Y6

R: Calculations

C: Concept of a fraction, decimal. Mixed numbers

E: Fractional parts of quantities

Lesson Plan 31

Activity ***Notes***

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- 31 is a prime number Factors: 1, 31
- 206 = 2 × 103 (nice) Factors: 1, 2, 103, 206
- 381 = 3 ×127 (nice) Factors: 1, 3, 127, 381
- 1031 is a prime number Factors: 1, 1031

  (As not exactly divisible by 2, 3, 5, 7, 11, 13, 17, 19, 23, 29 or 31 and 37 × 37 > 1031)

8 min

Individual work, monitored (or whole class activity)

BB: 31, 206, 381, 1031

Calculators allowed

Reasoning, agreement, self-correction, praising

e.g. $\begin{array}{r|l} 381 & 3 \\ 127 & 127 \\ 1 & \end{array}$

Elicit that a prime number has exactly 2 factors, itself and 1. (1 is not a prime number as it has only 1 factor, itself)

2

Revision of fractions

Let' fill in the missing numbers. Ps come to BB to write the numbers, explain reasoning and draw a diagram to show it. Class agrees/ disagrees. (Reasoning: e.g. 1 unit equals 2 halves, because when a unit is divided into 2 equal parts, each part is called 1 half)

BB:

a) 1 unit =	**2**	halves	b) 3 units =	**6**	halves	c) 1 half =	**2**	quarters
	3	thirds		**9**	thirds		**3**	sixths
	4	quarters		**12**	quarters		**4**	eighths
	5	fifths		**15**	fifths		**5**	tenths
	6	sixths		**18**	sixths		**6**	twelfths
	10	tenths		**30**	tenths			

What name do we give to fractions which hve the same value? (Equivalent fractions) Ask Ps to give additional examples.

13 min

Whole class activity

Written on BB or use enlarged copy master or OHP

Accept any valid diagram

Reasoning, agreement, praising

Feedback for T

BB: equivalent fractions

equal in value

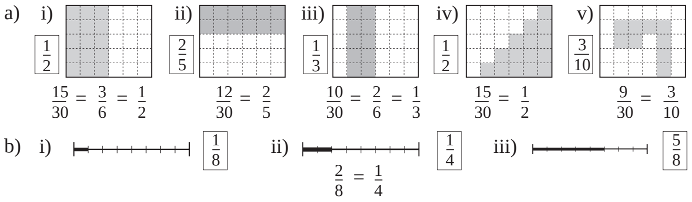
3

PbY6a, page 31

Q.1 Read: *Write in the boxes the part of the unit which has been shaded.*

Set a time limit. Review with whole class. Ps come to BB to write the fractions and explain reasoning, referring to the diagram. Who agrees? Who wrote something else? Elicit equivalent fractions where relevant. Mistakes discussed and corrected.

Solution:



What does 5 eighths really mean? (5 eighths means that the unit has been divided into 8 equal parts and 5 parts have been taken.)

Elicit (or remind Ps of) the names of the components of a fraction. (Denominator shows into how many equal parts the unit has been divided. Numerator shows how many of these parts have been taken. Fraction line separates the 2 numbers and means 'divide'.

18 min

Individual work, monitored (helped)

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Accept any equivalent fraction but also show the simplest form.

Whole class revision of the concept of a fraction.

BB:

$$\text{fraction line} \rightarrow \frac{5 \leftarrow \text{numerator}}{8 \leftarrow \text{denominator}}$$

Also, $\frac{5}{8} = \frac{1}{8} \times 5 = 5 \div 8$

Y6

Lesson Plan 31

Activity

4

Pb6a, page 31

Q.2 Read: *Answer with fractions in your exercise book.*

T asks Ps to write each answer as an equation like this. (BB)

Set a time limit or deal with one part at a time but first elicit the relationship between the two units of measure.

Review with whole class. Ps come to BB to write equations. Class agrees/disagrees. Mistakes discussed and corrected. Agree that if the numerator and denominator are reduced by the same number of times, the value of the fraction does not change.

Extension

In what other ways could we write the fractions? (As decimals, or as mixed numbers when the numerator is greater than the denominator.) Ps come to BB to write them or dictate to T.

Solution:

a) *What part of a metre is: 10 cm, 50 cm, 7 cm, 120 cm?*

$$10\text{ cm} = \frac{10}{100}\text{ m} = \frac{1}{10}\text{ m} \ (= 0.1\text{ m})$$

$$50\text{ cm} = \frac{50}{100}\text{ m} = \frac{5}{10}\text{ m} = \frac{1}{2}\text{ m} \ (= 0.5\text{ m} = 0.50\text{ m})$$

$$120\text{ cm} = \frac{120}{100}\text{ m} = \frac{12}{10}\text{ m} = \frac{6}{5}\text{ m} \ (= 1\frac{20}{100}\text{ m} = 1\frac{1}{5}\text{ m}$$

$$= 1.20\text{ m} = 1.2\text{ m})$$

b) *What part of an hour is: 1 min, 6 min, 30 min, 60 min, 120 min?*

$$1\text{ min} = \frac{1}{60}\text{ h}; \quad 6\text{ min} = \frac{6}{60}\text{ h} = \frac{1}{10}\text{ h} \ (= 0.1\text{ h})$$

$$30\text{ min} = \frac{30}{60}\text{ h} = \frac{1}{2}\text{ h} \ (= 0.5\text{ h})$$

$$60\text{ min} = \frac{60}{60}\text{ h} = 1\text{ h}; \quad 120\text{ min} = \frac{120}{60}\text{ h} = \frac{12}{6}\text{ h} = 2\text{ h}$$

c) *What part of a day is: 6 hours, 8 hours, 12 hours, 24 hours, 30 hours?*

$$6\text{ hours} = \frac{6}{24}\text{ day} = \frac{1}{4}\text{ day} \ (= 0.25\text{ day})$$

$$8\text{ hours} = \frac{8}{24}\text{ day} = \frac{1}{3}\text{ day} \ (= 0.333\ldots\text{ day} = 0.\dot{3}\text{ day})$$

$$12\text{ hours} = \frac{12}{24}\text{ day} = \frac{1}{2}\text{ day} \ (= 0.5\text{ day})$$

$$24\text{ hours} = \frac{24}{24}\text{ day} = 1\text{ day}$$

$$30\text{ hours} = \frac{30}{24}\text{ day} = 1\frac{6}{24}\text{ day} = \frac{5}{4}\text{ day} = 1\frac{1}{4}\text{ days}$$

$$= 1.25\text{ days}$$

24 min

Notes

Individual work, monitored (helped)

BB: $10\text{ cm} = \frac{?}{?}\text{ m}$

Differentiation by time limit

Discussion, reasoning, agreement, self-correction, praising

Revise the meaning of decimals and mixed numbers.

Elicit that:

- a decimal is a number in which the parts of a unit are written as tenths, hundredths, thousands, etc. and the decimal point separates the whole number from the parts of a unit;
- a mixed number is made up of a whole number and a fraction. e.g.

  BB: $1\frac{1}{4} = 1 + \frac{1}{4} = \frac{5}{4}$

Elicit (or remind Ps) that:

- the decimal form of a fraction can be calculated by dividing the numerator by the denominator.
- a decimal in which a digit (or set of digits) is repeated to infinity is called a

  BB: recurring decimal

$$\frac{1}{3} = 1 \div 3$$
$$= 0.333\ldots$$
$$= 0.\dot{3}$$

(read as 'zero point 3 recurring')

Y6

Lesson Plan 31

Activity

5

PbY6a, page 31, Q.3

T asks each part as a question (e.g. A line segment is 36 cm long. How many cm is 1 third of it?). Ps calculate mentally if they can, or in *Ex.Bks*, then show the amount on slates or scrap paper on command.

Ps answering correctly explain at BB to Ps who were wrong, drawing a digram where necessary and writing the calculation. Mistakes discussed and corrected.

Solution:

a) *How many cm are these parts of a 36 cm line segment?*

i) $\frac{1}{3}$ of 36 cm = 36 cm ÷ 3 = $\underline{\text{12 cm}}$

ii) $\frac{1}{6}$ of 36 cm = 36 cm ÷ 6 = $\underline{\text{6 cm}}$

iii) $\frac{5}{6}$ of 36 cm = 36 cm ÷ 6 × 5 = 6 cm × 5 = $\underline{\text{30 cm}}$

iv) $\frac{13}{12}$ of 36 cm = 36 cm ÷ 12 × 13 = 3 cm × 13 = $\underline{\text{39 cm}}$

v) $\frac{5}{9}$ of 36 cm = 36 cm ÷ 9 × 5 = 4 cm × 5 = $\underline{\text{20 cm}}$

b) *How long are these parts of a 4 m length of ribbon?*

i) $\frac{1}{8}$ of 4 m = $\frac{1}{8}$ of 400 cm = 400 cm ÷ 8 = $\underline{\text{50 cm}}$

ii) $\frac{1}{4}$ of 4 m = 4 m ÷ 4 = $\underline{\text{1 m}}$

iii) $\frac{3}{4}$ of 4 m = 4 m ÷ 4 × 3 = 1 m × 3 = $\underline{\text{3 m}}$

iv) $\frac{3}{2}$ of 4 m = 4 m ÷ 2 × 3 = 2 m × 3 = $\underline{\text{6 m}}$

v) $\frac{5}{8}$ of 4 m = 400 cm ÷ 8 × 5 = 50 cm × 5 = 250 cm = $\underline{\text{2.5 m}}$

vi) $\frac{8}{5}$ of 4 m = 400 cm ÷ 5 × 8 = 80 cm × 8 = 640 cm = $\underline{\text{6.4 m}}$

c) *How many apples are in these parts of a box of 48 apples?*

i) $\frac{1}{2}$ of 48 = 24 ÷ 2 = $\underline{12}$ (apples)

ii) $\frac{5}{16}$ of 48 = 48 ÷ 16 × 5 = 3 × 5 = $\underline{15}$ (apples)

iii) $\frac{5}{4}$ of 48 = 48 ÷ 4 × 5 = 12 × 5 = $\underline{60}$ (apples)

iv) $\frac{23}{24}$ of 48 = 48 ÷ 24 × 23 = 2 × 23 = $\underline{46}$ (apples)

v) $\frac{7}{48}$ of 48 = 48 ÷ 48 × 7 = 1 × 7 = $\underline{7}$ (apples)

vi) $\frac{2}{3}$ of 48 = 48 ÷ 3 × 2 = 16 × 2 = $\underline{32}$ (apples)

30 min

Notes

Whole class activity but individual calculation

(or individual work, monitored, helped, under a time limit or dealing with one part at a time, reviewed with whole class)

At a good pace

Responses shown in unison.

Reasoning, agreement, (self-correction), praising

(Convert m to cm first.)

(or 2 m 50 cm)

(or 6 m 40 cm)

Y6

Lesson Plan 31

Activity ***Notes***

6

PbY6a, page 31

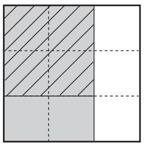
Q.4 a) Read: *Draw a 3 by 3 square in your exercise book.*

Colour $\frac{2}{3}$ *of its area in yellow, then colour* $\frac{2}{3}$ *of the yellow part in red.*

What part of the whole area is the red part?

Set a time limit. Review at BB with whole class. Ps show fraction on slates or scrap paper on command. P answering correctly explains and demonstrates on BB to Ps who were wrong. Who did the same? Who did it a different way? etc. Mistakes discussed and corrected.

Solution:



$$\frac{2}{3} \text{ of } \frac{2}{3} = \frac{2}{3} \div 3 \times 2 = \frac{2}{9} \times 2 = \boxed{\frac{4}{9}}$$

or 9 ÷ 3 × 2 = 3 × 2 = 6 (grid squares)

6 ÷ 3 × 2 = 2 × 2 = $\underline{4}$ → $\frac{4}{9}$ of square

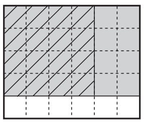
b) Read: *Draw a 6 by 5 rectangle in your exercise book.*

Colour $\frac{4}{5}$ *of its area in green, then shade* $\frac{2}{3}$ *of the green part in blue.*

What part of the whole area is the blue part?

Deal with part b) in a similar way to a).

Solution:



$$\frac{2}{3} \text{ of } \frac{4}{5} = \frac{4}{5} \div 3 \times 2 = \frac{4}{15} \times 2 = \boxed{\frac{8}{15}}$$

or 30 ÷ 5 × 4 = 6 × 4 = 24 (grid squares)

24 ÷ 3 × 2 = 8 × 2 = 16 → $\frac{16}{30} = \frac{8}{15}$ of the rectangle

35 min

Individual work, monitored, (helped)

Ps use squared *Ex. Bks* or more able Ps could measure in cm with rulers on plain paper.

Responses shown in unison.

Reasoning, agreement, self-correction, praising

Accept correct answers obtained by Ps counting the squares but also show the calculation on BB and ask such Ps to write it in *Ex. Bks*.

Elicit/remind Ps that to divide a fraction by a natural number:

- multiply the denominator by the number; or
- divide the numerator by the number.

Extra praise if Ps notice that the numerator (denominator) in the result is the product of the two numerators (denominators) of the fractions in the question.

If nobody notices, T draws Ps' attention to it.

7

PbY6a, page 31

Q.5 a) Read: *Convert these fractions to 24ths and write them in increasing order in your exercise book.*

What does convert mean? (Change to another form.)
How can we convert the fractions into 24ths? (Multiply the denominator by a number so that their product is 24, then multiply the numerator by the same number.) Elicit that increasing the numerator and denominator of a fraction by the same number of times does not change the value of the fraction.

Set a time limit. Review with whole class. Ps come to BB or dictate what T should write, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Let's show them on the number line. Ps come to BB to mark and label the fractions. Class points out errors.

Individual work, monitored (helped)

(or whole class activity)

Written on BB or SB or OHT

Initial whole class discussion to clarify the task.

Differentiation by time limit

Reasoning, agreement, self-correction, praising

Whole class activity

At a good pace. Involve several Ps. Praising

Y6

Lesson Plan 31

Activity | **Notes**

7

(Continued)

Q.5 a) *Solution:*

$\frac{1}{2}$	$\frac{3}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{7}{24}$	$\frac{16}{8}$	$\frac{5}{6}$	$1\frac{5}{12}$ (= $\frac{17}{12}$)
$\frac{12}{24}$	$\frac{36}{24}$	$\frac{16}{24}$	$\frac{18}{24}$	$\frac{30}{24}$	$\frac{32}{24}$	$\frac{7}{24}$	$\frac{48}{24}$	$\frac{20}{24}$	$\frac{34}{24}$

b) Read: *Convert each fraction to an equivalent fraction with numerator 12.*

Write them in increasing order in your exercise book.

What are equivalent fractions? (Fractions which have the same value.) How can we do the conversion? (Work out what number the numerator needs to be multiplied by to result in 12, then multiply the denominator by that same number.) Elicit that increasing (or reducing) the numerator and denominator of a fraction by the same number of times does not change the value of the fraction.

Set a time limit and continue as in a) but without drawing a number line and simply listing the fractions in order.

Solution:

$$\frac{3}{4},\ \frac{2}{11},\ \frac{6}{5},\ \frac{1}{3},\ \frac{6}{7},\ \frac{5}{10}\left(=\frac{1}{2}\right),\ \frac{9}{6}\left(=\frac{3}{2}\right),\ \frac{4}{5},\ \frac{4}{3},\ \frac{3}{2}$$

$$\frac{12}{16},\ \frac{12}{66},\ \frac{12}{10},\ \frac{12}{36},\ \frac{12}{14},\ \frac{12}{24},\ \frac{12}{8},\ \frac{12}{15},\ \frac{12}{9},\ \frac{12}{8}$$

In order:

$$\frac{12}{66} < \frac{12}{36} < \frac{12}{24} < \frac{12}{16} < \frac{12}{15} < \frac{12}{14} < \frac{12}{10} < \frac{12}{9} < \frac{12}{8} = \frac{12}{8}$$

If we are comparing two fractions, how can we decide which is greater? Ps say what they think and T repeats more clearly if necessary. e.g.

- Among positive fractions with equal denominators, the greater fraction has the greater numerator.
- Among positive fractions with equal numerators, the greater fraction has the smaller numerator.
- If fractions have unequal numerators and denominators, first change them to equivalent fractions which have equal numerators or denominators, then compare them.

Number line drawn on BB or use enlarged copy master or OHP

Elicit that $1\frac{5}{12}$ is a <u>mixed</u> number.

Individual work, monitored, helped (or whole class activity)

Written on BB or SB or OHT

Initial discussion to agree on the strategy for solution.

Differentiation by time limit

(If majority of Ps are stuck at what to do with $\frac{5}{10}$, T asks if anyone knows what to do, or gives a hint about changing to another equivalent fraction first.)

Reasoning, agreement, self-correction, praising

Whole class discussion about 'rules' for comparing fractions

Involve several Ps.

Praising, encouragement only

41 min

8

Inequalities

T has inequalities already written on BB. Show me a number which would make the inequality true. Ps show numbers on scrap paper or slates on command. Class decides which are valid and which are not. (If many Ps showed the same number, elicit other numbers too.)

BB: a) $\frac{3}{4} < \square < 1$ b) $1 < \square\ 1\frac{1}{2}$ c) $0 < \square < \frac{1}{4}$

e.g. $\square$: $\frac{4}{5}$, $\frac{7}{8}$, $\frac{9}{11}$ $\square$: $1\frac{3}{8}$, $1\frac{1}{4}$, $1\frac{2}{5}$ $\square$: $\frac{1}{5}$, $\frac{22}{100}$, $\frac{1}{20}$

Whole class activity

Written on BB or SB or OHT

Responses shown in unison.

Agreement, praising. Extra praise for unexpected numbers (e.g. decimals)

d) $1\frac{2}{3} < \square < 2\frac{1}{3}$

$\square$: $1\frac{8}{9}$, 2, $2\frac{1}{5}$, etc.

45 min

Y6

R: Fractions

C: Relationships betwen fractions. Fractions multiplied and divided by a natural number

E: Explaining the rules

Lesson Plan
32

Activity

Notes

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- $\underline{32} = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$ Factors: 1, 2, 4, 8, 16, 32
- $\underline{207} = 3 \times 3 \times 23 = 3^2 \times 23$ Factors: 1, 3, 9, 23, 69, 207
- $\underline{382} = 2 \times 191$ (nice) Factors: 1, 2, 191, 382
- $\underline{1032} = 2 \times 2 \times 2 \times 3 \times 43 = 2^3 \times 3 \times 43$

  Factors: 1, 2, 3, 4, 6, 8, 12, 24, ↓

  1032, 516, 344, 258, 172, 129, 86, 43

8 min

Individual work, monitored

(or whole class activity)

BB: 32, 207, 382, 1032

Calculators allowed

Reasoning, agreement, self-correction, praising

Whole class listing of the factors of 1032 (vertically as shown or Ps join factor pairs)

e.g.

207	3
69	3
23	23
1	

1032	2
516	2
258	2
129	3
43	43
1	

2

PbY6a, page 32

Q.1 Read: *a) Step along the number line by $\frac{1}{3}$ from – 2. Label the numbers that you land on.*

b) Step along the number line by $\frac{3}{5}$ from – 2. Label the numbers that you land on.

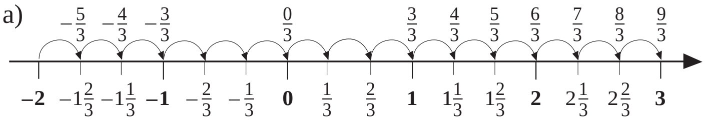
Deal with one part at a time. Set a time limit. Ps draw curved arrows and write fractions.

Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes corrected. Elicit different forms of the fractions where relevant.

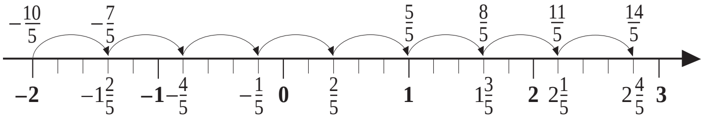
What do you notice? (Each positive fraction has an opposite negative fraction and vice versa.)

Solution:

a)



b)



13 min

Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

Ensure that Ps have sharp pencils.

Fractions should be small and neat.

Discussion, agreement, self-correction, praising

Feedback for T

Bold numbers were given.

Y6

Lesson Plan 32

Activity ***Notes***

3

PbY6a, page 32

Q.2 a) Read: *Multiply the numerator of* $\frac{1}{8}$ *by 2, 3, 4, 5 and 6 and write the fractions in your exercise book.*

Write a sentence about how the value of the fraction changes.

Do first multiplication with whole class on BB as a model for Ps to follow. Set a time limit. Ps write multiplications and sentence in *Ex. Bks*.

Reviewwith whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

T chooses 3 or 4 Ps to read out their sentences and class decides which is the clearest statement.

Solution:

i) $\frac{1\times 2}{8} = \frac{2}{8} = \frac{1}{8}\times 2 \;\; (= \frac{1}{4})$

ii) $\frac{1\times 3}{8} = \frac{3}{8} = \frac{1}{8}\times 3$

iii) $\frac{1\times 4}{8} = \frac{4}{8} = \frac{1}{8}\times 4 \;\; (= \frac{1}{2})$

iv) $\frac{1\times 5}{8} = \frac{5}{8} = \frac{1}{8}\times 5$ v) $\frac{1\times 6}{8} = \frac{6}{8} = \frac{1}{8}\times 6$

e.g. 'When the numerator of a fraction is multiplied by a natural number, the value of the <u>whole</u> fraction has been multiplied by that number.'

b) Read: *Multiply the numerator of* $\frac{1}{5}$ *by 2, 3, 4, 5 and 6 and write the fractions in your exercise book.*

Write a sentence about how the value of the fraction changes.

Set a time limit and review in the same way as a).

Solution:

i) $\frac{1\times 2}{5} = \frac{2}{5} = \frac{1}{5}\times 2$ ii) $\frac{1\times 3}{5} = \frac{3}{5} = \frac{1}{5}\times 3$

iii) $\frac{1\times 4}{5} = \frac{4}{5} = \frac{1}{5}\times 4$ iv) $\frac{1\times 5}{5} = \frac{5}{5} = \frac{1}{5}\times 5$

v) $\frac{1\times 6}{5} = \frac{6}{5} = \frac{1}{5}\times 6 \;\; (= 1\frac{1}{5})$

e.g. 'When the numerator of a fraction is increased by a certain number of times, the value of the <u>whole</u> fraction has been increased by that number of times.'

18 min

Individual work, monitored

P comes to BB to do the multiplication, then T elicits (or points out) that the result is the same as if the whole fraction had been <u>multiplied</u>.

Discussion, reasoning, agreement, self-correction, praising

Accept any valid sentence.

(Demonstrate with a model or draw a digram if necessary.)

Ps who did not write a sentence or who prefer the agreed sentence write it in *Ex. Bks*.

$(= \frac{3}{4})$

$(= 1)$

or 'When you multiply the numerator of a fraction, you are mutliplying the whole fraction.'

Y6

Lesson Plan 32

Activity ***Notes***

4

PbY6a, page 32

Q.3 Let's see how many of these multiplications you can do in 3 minutes! Start . . . now! . . . Stop!

Review with whole class. Ps come to BB or dictate to T, explaining reasoning and also simplifying fractions where relevant. Class agrees/disagrees. Mistakes discussed/corrected.

Solution:

a) $\frac{1}{8} \times 7 = \frac{7}{8}$

b) $\frac{1}{5} \times 8 = \frac{8}{5} = 1\frac{3}{5}$

c) $\frac{1}{5} \times 13 = \frac{13}{5} = 2\frac{3}{5}$

d) $\frac{3}{8} \times 2 = \frac{6}{8} = \frac{3}{4}$

e) $\frac{4}{5} \times 3 = \frac{12}{5} = 2\frac{2}{5}$

f) $\frac{5}{6} \times 7 = \frac{35}{6} = 5\frac{5}{6}$

g) $\frac{7}{10} \times 4 = \frac{28}{10} = 2\frac{8}{10} = 2\frac{4}{5}$

h) $\frac{3}{20} \times 3 = \frac{9}{20}$

i) $4\frac{2}{5} \times 3 = 4 \times 3 + \frac{2}{5} \times 3 = 12 + \frac{6}{5} = 12 + 1 + \frac{1}{5} = 13\frac{1}{5}$

j) $5\frac{1}{2} \times 2 = 10 + \frac{2}{2} = 10 + 1 = 11$

k) $3\frac{3}{4} \times 7 = 21 + \frac{21}{4} = 21 + 5 + \frac{1}{4} = 26\frac{1}{4}$

Who can explain how to multiply a fraction by a whole number?

'*Multiply the numerator but do not change the denominator.*'

Individual work, monitored, helped

Written on BB or SB or OHT

Reasoning, agreement, self-correction, praising

(Elicit that simplifying a fraction means changing it to its simplest form.)

Use a model or draw diagrams if necessary.

(or $\frac{22}{5} \times 3 = \frac{66}{5} = 13\frac{1}{5}$)

(or $\frac{11}{2} \times 2 = \frac{22}{2} = 11$)

(or $\frac{15}{4} \times 7 = \frac{105}{4} = 26\frac{1}{4}$)

26 min

5

PbY6a, page 32

Q.4 a) Read: *Divide the numerator of $\frac{6}{8}$ by 2, 3, and 6 in your exercise book. Write a sentence about how the value of the fraction changes.*

Do first division with whole class on BB as a model for Ps to follow. Set a time limit. Ps write divisions and a sentence in *Ex. Bks*.

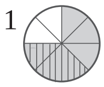
Review with whole class. Ps come to BB or dictate to T, explaining reasoning and drawing a digram on BB. Class agrees/disagrees. Mistakes discussed and corrected.

T chooses 3 or 4 Ps to read out their sentences and class decides which is the clearest statement.

Solution:

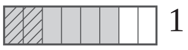
i) $\frac{6 \div 2}{8} = \frac{3}{8} = \frac{6}{8} \div 2$

e.g. BB:



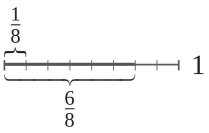
ii) $\frac{6 \div 3}{8} = \frac{2}{8} = \frac{6}{8} \div 3$

BB:



iii) $\frac{6 \div 6}{8} = \frac{1}{8} = \frac{6}{8} \div 6$

BB:



Individual work, monitored

P comes to BB to do the division, then T elicits (or points out that) the result is the same as if the whole fraction had been <u>divided</u>.

Discussion, reasoning, agreement, self-correction, praising

Accept any valid sentence and type of diagram.

Ps who did not write a sentence or who prefer the agreed sentence write it in *Ex. Bks*.

e.g.

'When the numerator of a fraction is divided by a natural number, the value of the whole fraction has been divided by that number.'

Y6

Lesson Plan 32

Activity

Notes

5

(Continued)

b) Read: *Divide the numerator of* $\frac{12}{25}$ *by 2, 3, 6 and 12 in your exercise book.*

Write a sentence about how the value of the fraction changes.

Set a time limit and review with the whole class as in a).

Solution:

i) $\frac{12 \div 2}{25} = \frac{6}{25} = \frac{12}{25} \div 2$

ii) $\frac{12 \div 3}{25} = \frac{4}{25} = \frac{12}{25} \div 3$

iii) $\frac{12 \div 6}{25} = \frac{2}{25} = \frac{12}{25} \div 6$

iv) $\frac{12 \div 12}{25} = \frac{1}{25} = \frac{12}{25} \div 12$

e.g. 'When the numerator of a fraction is decreased by a certain number of times, the value of the whole fraction has been decreased by that number of times.'

Individual work, monitored

Differentiation by time limit

Discussion, reasoning, agreement, self-correction, praising

Demonstrate with models or draw diagrams if there are problems or disagreement.

Ps who did not write a sentence or who prefer the agreed sentence write it in *Ex. Bks*.

34 min

6

PbY6a, page 32

Q.5 Let's see if you can do these divisions in 2 minutes!
Start . . . now! . . . Stop!

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected. Use models or draw diagrams if necessary.

Solution:

a) $\frac{6}{7} \div 2 = \frac{3}{7}$ b) $\frac{9}{10} \div 3 = \frac{3}{10}$ c) $\frac{8}{9} \div 4 = \frac{2}{9}$

d) $\frac{21}{8} \div 7 = \frac{3}{8}$ e) $\frac{32}{35} \div 8 = \frac{4}{32}$ f) $\frac{18}{7} \div 9 = \frac{2}{7}$

Who can explain how to divide a fraction by a whole number? e.g.

'*If the numerator is a multiple of the divisor, we can divide the numerator and leave the denominator unchanged.*'

Individual work, monitored, helped

Written on BB or SB or OHT

Discussion, reasoning, agreement, self-correction, praising

Ask several Ps what they think. Agree that this method is difficult to use if the numerator is <u>not</u> a multiple of the divisor.

38 min

Y6

Lesson Plan 32

Activity **Notes**

7

PbY6a, page 32

Q.6 a) Read: *Multiply the denominator of* $\frac{1}{2}$ *by 2, 3, 4, 5 and 6 in your exercise book.*

Write a sentence about how the value of the fraction changes.

If necessary, do first division with whole class on BB. Set a time limit. Ps write divisions and a sentence in *Ex. Bks*.

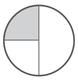
Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Classagrees/disagrees. Mistakes discussed and corrected. T helps Ps to show some divisions by using models or by drawing diagrams on BB.

T chooses 3 or 4 Ps to read out their sentences and class decides which is the clearest statement.

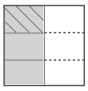
Solution:

i) $\frac{1}{2 \times 2} = \frac{1}{4} = \frac{1}{2} \div 2$ ii) $\frac{1}{2 \times 3} = \frac{1}{6} = \frac{1}{2} \div 3$

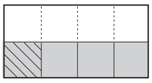
e.g. BB:



BB:



iii) $\frac{1}{2 \times 4} = \frac{1}{8} = \frac{1}{2} \div 4$ BB:



iv) $\frac{1}{2 \times 5} = \frac{1}{10} = \frac{1}{2} \div 5$ v) $\frac{1}{2 \times 6} = \frac{1}{12} = \frac{1}{2} \div 6$

e.g. 'When the denominator of a fraction is multiplied by a natural number, the value of the whole fraction has been <u>divided</u> by that number.'

b) and c)

Set a time limit of 2 minutes. Ps write quotients in *Pbs*.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

b) $\frac{1}{2} \div 2 = \frac{1}{4}$; $\frac{1}{2} \div 3 = \frac{1}{6}$; $\frac{1}{2} \div 4 = \frac{1}{8}$;

$\frac{1}{2} \div 5 = \frac{1}{10}$; $\frac{1}{2} \div 6 = \frac{1}{12}$

c) $\frac{3}{4} \div 2 = \frac{3}{8}$; $\frac{2}{3} \div 3 = \frac{2}{9}$; $\frac{4}{7} \div 3 = \frac{4}{21}$;

$\frac{4}{5} \div 5 = \frac{4}{25}$; $\frac{1}{6} \div 4 = \frac{1}{24}$

Compare these divisions with those in Q.5. What do you notice?

(In these divisions, the numerator is <u>not</u> a multiple of the divisor.)

So who can explain a 2nd way to divide a fraction by a whole number?

'*If the numerator is **not** a multiple of the divisor, we can multiply the denominator and leave the numerator unchanged.*'

45 min

Individual work, monitored

P comes to BB to do the multiplication, then T elicits (or points out) that the result is the same as if the whole fraction had been <u>divided.</u>

Discussion, reasoning, agreement, self-correction, praising

Accept any valid sentence and type of diagram.

Ps who did not write a sentence or who prefer the agreed sentence write it in *Ex. Bks*.

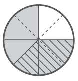
Differentiation by time limit

Reasoning, agreement, self-correction, praising

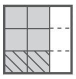
Use models or draw diagrams on BB if problems or disagreement.

e.g. BB:

c) $\frac{3}{4} \div 2 = \frac{3}{8}$



$\frac{2}{3} \div 3 = \frac{2}{9}$



Praising only

T could have the 2 rules for dividing fractions written on SB or OHT and Ps say then in unison and/or copy in *Ex. Bks*.

Y6

R: Concept of a fraction. Reducing, enlarging fractions

C: Relationships among fractions. Multiplication and division of fractions by a natural number

E: Problems. Laws

Lesson Plan
33

Activity

Notes

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- <u>33</u> = 3 × 11 (nice) Factors: 1, 3, 11, 33
- <u>208</u> = $2 \times 2 \times 2 \times 2 \times 13 = 2^4 \times 13$
  Factors: 1, 2, 4, 8, 13, 16, 26, 52, 104, 208
- <u>383</u> is a prime number Factors: 1, 383
  (as not exactly divisible by 2, 3, 5, 7, 11, 13, 17 and 19 and 23 × 23 > 383)
- <u>1033</u> is a prime number Factors: 1, 1033
  (as not exactly divisible by 2, 3, 5, 7, 11, 13, 17, 19, 23, 29 and 31 and 37 × 37 > 1033)

Individual work, monitored (or whole class activity)

BB: 33, 208, 383, 1033

Calculators allowed

Reasoning, agreement, self-correction, praising

Whole class listing of the factors of 208.

e.g.

208	2
104	2
52	2
26	2
13	13
1	

8 min

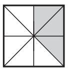
2

Concept of a fraction

Who can explain what 3 eighths means?

Ps say what they know and if necessary T promps or asks questions to elicit other meanings too. e.g.

- $\frac{3}{8}$ means that 1 unit has been divided into 8 equal parts and we have taken 3 of the parts.

BB: 1 

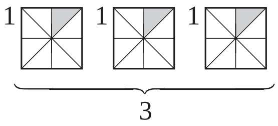
- $\frac{3}{8}$ is $\frac{1}{8}$ of 3 units. We have 3 units and have divided each of them into 8 equal parts, then we have taken 1 part from each unit.
- $\frac{3}{8}$ = 3 times $\frac{1}{8}$; or $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{1}{8} \times 3$; or $\frac{3}{8} = 3 \div 8$

Whole class activity

Involve several Ps.

Reasoning, agreement, praising only

Feedback for T

BB: 

Extra praise for unexpected but correct definitions.

11 min

3

PbY6a, page 33

Q.1 Deal with one row at a time. Ps write calculations in *Ex. Bks.* if they need more space. Set a short time limit for each row.

Review with whole class. Ps come to BB to write calculations, explaining reasoning and drawing diagrams if problems or disagreement. Class agrees/disagrees.

Extra praise if Ps notice that a fraction can be simplified or changed to a mixed number. If no P notices, T asks if the fraction could be shown in a simpler form. Mistakes discussed and corrected.

Ps say what they did to calculate each row.

Solution:

a) i) $\frac{1}{6} \times 5 = \frac{5}{6}$ ii) $\frac{1}{6} \times 3 = \frac{3}{6}$ $\left(= \frac{1}{2}\right)$

iii) $\frac{1}{6} \times 11 = \frac{11}{6} = 1\frac{5}{6}$ iv) $\frac{5}{6} \times 2 = \frac{10}{6} = \frac{5}{3} = 1\frac{2}{3}$

e.g. To multiply a fraction by a natural number, multiply the numerator but leave the denominator unchanged.

Individul work, monitored, helped

Written on BB or use enlarged copy master or OHP

Discussion, reasoning (with model or diagrams if needed), agreement, self-correction, praising

T helps with wording if necessary.

Y6

Lesson Plan 33

Activity

Notes

3

(Continued)

b) i) $\left(3 + \frac{2}{5}\right) \times 4 = 3 \times 4 + \frac{2}{5} \times 4 = 12 + \frac{8}{5}$

$= 12 + 1 + \frac{3}{5} = 13\frac{3}{5}$

[or use method in ii)]

ii) $3\frac{2}{5} \times 4 = \frac{17}{5} \times 4 = \frac{68}{5} = 13\frac{3}{5}$ [same as i)]

[or use method in i)]

iii) $12\frac{3}{4} \times 5 = 60 + \frac{15}{4} = 60 + 3 + \frac{3}{4} = 63\frac{3}{4}$

To multiply a mixed number by a natural number:

- multiply the whole number first, then multiply the fraction, then add the two results together; or
- change the mixed number to a fraction, multiply the fraction, then change back to a mixed number.

T asks Ps which method they like best.

(First method is usually easier.)

c) i) $\frac{6}{8} \div 2 = \frac{3}{8}$ ii) $\frac{6}{8} \div 3 = \frac{2}{8} = \frac{1}{4}$

iii) $\frac{14}{15} \div 7 = \frac{2}{15}$ iv) $\frac{24}{5} \div 4 = \frac{6}{5} = 1\frac{1}{5}$

To divide a fraction by a natural number which is a factor of its numerator, divide the numerator by that number.

d) i) $\frac{1}{3} \div 2 = \frac{1}{6}$ ii) $\frac{3}{5} \div 2 = \frac{3}{10}$

iii) $\frac{4}{9} \div 5 = \frac{4}{45}$ iv) $\frac{25}{4} \div 3 = \frac{25}{12} = 2\frac{1}{12}$

To divide a fraction by a natural number which is <u>not</u> a factor of its numerator, multiply the denominator by that number.

Which of the two methods of division can be used at <u>any</u> time? (d)

18 min

4

PbY6a, page 33

Q.2 a) Read: *Divide the denominator of $\frac{1}{6}$ by 2 and by 3 in your exercise book.*

Draw a diagram to show each division.

Write a sentence about how the value of the fraction changed as its denominator decreased.

Deal with one step at a time or set a time limit, (or do as a whole class activity if Ps are not very able, with Ps working on BB with help and prompts from T, while rest of Ps work in *Ex. Bks*.)

Review with whole class. Ps come to BB to write divisons and explain reasoning by drawing diagrams. Ps say what they noticed. Who thought the same thing? Who drew a different diagram? Deal with all cases. Class agrees/ disagrees. Mistakes discussed and corrected.

Agree that dividing the denominator by 2 or by 3 has the same result as if the whole fraction had been <u>multiplied</u> by 2 or by 3.

Individual work, monitored, helped in drawing diagrams

[or whole class activity for a)]

T could ask Ps what they think will happen to the value of the fractions <u>before</u> they do the divisions.

Who thinks the value of each fraction will increase (decrease, stay the same)?

Discussion, reasoning, agreeement, self-correction, praising

Extra praise for unexpected but correct diagrams

Ps who did not write a sentence,write it now in *Ex. Bks* after the outcome has been discussed and agreed.

Activity ***Notes***

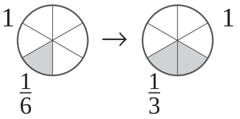
4 (Continued)

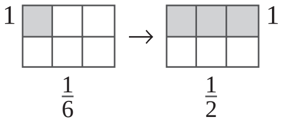
Solution:

a) i) $\frac{1}{6 \div 2} = \frac{1}{3}$ (= $\frac{1}{6} \times 2$)

ii) $\frac{1}{6 \div 3} = \frac{1}{2}$ (= $\frac{1}{6} \times 3$)

e.g.





e.g. If the denominator of a fraction is <u>reduced</u> by 2 or by 3 times, the value of the whole fraction <u>increases</u> by 2 or by 3 times.

Agreement, praising

b) Let's see if the same thing occurs with other natural numbers.

Set a time limt. Ps read question themselves, write calculations and draw suitable diagrams in *Ex. Bks*.

Review as for a) and agree that the same thing happens with <u>any</u> natural number. Ps formulate a general statement, with T's help if necessary, and write it in *Ex. Bks*.

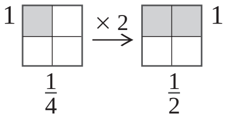
Individual work, monitored, helped

Differentiation by time limit

Discussion, reasoning, agreement, self-correction, praising

Solution:

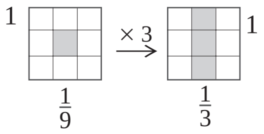
i) $\frac{1}{4 \div 2} = \frac{1}{2}$ (= $\frac{1}{4} \times 2$)



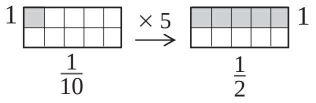
ii) $\frac{1}{9 \div 3} = \frac{1}{3}$ (= $\frac{1}{9} \times 3$)

ii) $\frac{1}{10 \div 5} = \frac{1}{2}$ (= $\frac{1}{10} \times 5$)

ii)



iii)



<u>General rule or law</u> e.g.

If the denominator of a fraction is divided by any natural number, the value of the whole fraction is multiplied by that number.

24 min

5 ***PbY6a, page 33***

Q.3 Deal with one row at a time or set a time limit. Ps do calculations mentally, write results in *Pbs* and write sentences for c) in *Ex. Bks*.

Individual work, monitored helped

Written on BB or SB or OHT

(If Ps are unsure, do b) i) on BBwith whole class first)

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Who did the same? Who calculated in a different way? etc. If problems or disagreement, draw diagrams on BB or write as an addition. Mistakes discussed and corrected.

T asks 2 or 3 Ps to read out their sentences. Who agrees? Who wrote something different? T repeats more clearly if necessary.

Discussion, reasoning by stating the 'law', self-correction, praising

Accept any correct method of calculation.

Ps who did not write any sentences do so after the discussion and agreement.

Solution:

a) $\frac{2}{5} \times 5 = \frac{2 \times 5}{5} = \frac{10}{5} = \underline{2}$ or $\frac{2}{5} \times 5 = \frac{2}{5 \div 5} = \frac{2}{1} = \underline{2}$

or $\frac{2}{5} \times 5 = \frac{2}{5} + \frac{2}{5} + \frac{2}{5} + \frac{2}{5} + \frac{2}{5} = \frac{10}{5} = \underline{2}$

Similarly for: $\frac{1}{6} \times 3 = \frac{1}{2}$, $\frac{3}{4} \times 2 = \frac{3}{2} = 1\frac{1}{2}$,

$\frac{9}{10} \times 5 = \frac{9}{2} = 4\frac{1}{2}$, $\frac{7}{12} \times 6 = \frac{7}{2} = 3\frac{1}{2}$

Y6

Lesson Plan 33

Activity ***Notes***

5

(Continued)

b) i) $1\frac{1}{2}\times 2 = 2+\frac{2}{2} = 2+1 = \underline{3}$, or $1\frac{1}{2}+1\frac{1}{2} = 2+1 = \underline{3}$

or $1\frac{1}{2}\times 2 = \frac{3}{2}\times 2 = \frac{6}{2} = \underline{3}$,

or $1\frac{1}{2}\times 2 = \frac{3}{2}\times 2 = \frac{3}{2\div 2} = \frac{3}{1} = \underline{3}$

ii) $3\frac{5}{8}\times 4 = 12+\frac{5}{2} = 12+2\frac{1}{2} = 14\frac{1}{2}$,

or $= 12+\frac{20}{8} = 12+2\frac{4}{8} = 14+\frac{1}{2} = 14\frac{1}{2}$

iii) $2\frac{2}{3}\times 2 = 4+\frac{4}{3} = 4+1\frac{1}{3} = 5\frac{1}{3}$

c) i) If the denominator of a fraction is multiplied by a natural number, the value of the fraction is divided by that number.

ii) If the denominator of a fraction is divided by a natural number, the value of the fraction is multiplied by that number.

Extra praise if a P notices that in iii) the denominator is <u>not</u> a multiple of the divisor, so the method of dividing the denominator by the multiplier cannot be used.

30 min

6

PbY6a, page 33

Individual work, monitored

Q.4 a) Read: *Multiply the numerator and denominator of* $\frac{2}{3}$ *by 2, 3 and 5. How did the value of the fraction change? Draw diagrams to show it.*

Deal with one step at a time or set a time limit.

Review with whole class. Ps come to BB to write multiplications and explain reasoning. Ps say what they noticed. Who thought the same thing? Who can draw a diagram to show it? Ps come to BB and T helps where necessary. Class points out any errrors.

Agree that increasing the numerator and denominator by the same number of times does not change the value of the fraction.

Discussion, reasoning, agreement, self-correction, praising

T: When we multiply the numerator and denominator of a fraction by the same natural number, we say that we are <u>expanding</u> the fraction.

BB: <u>expanding</u>

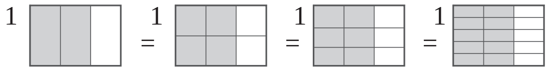
$$\frac{2}{3} = \frac{6}{9} = \frac{8}{12} = \frac{20}{30}\text{, etc.}$$

Ps give other examples of expanding 2 thirds orally.

Solution:

$$\frac{2}{3} = \frac{2\times 2}{3\times 2} = \frac{4}{6} = \frac{2\times 3}{3\times 3} = \frac{6}{9} = \frac{2\times 5}{3\times 5} = \frac{10}{15}$$

e.g.



Y6

Lesson Plan 33

Activity ***Notes***

6 (Continued)

b) Read: *Divide the numerator and the denominator of* $\frac{12}{30}$ *by 2, 3 and 6. How did the value of the fraction change?*

Draw diagrams to show it.

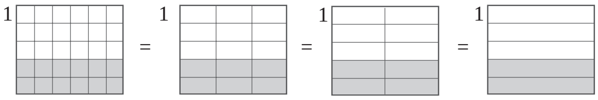
Deal with b) in a similar way to a) but this time T helps Ps to draw the diagrams on BB with the whole class. Agree that reducing the numerator and denominator by the same number of times does not change the value of the fraction.

T: When we divide the numerator and denominator of a fraction by the same natural number, we say that we are simplifying the fraction.

Solution:

$$\frac{12}{30} = \frac{12 \div 2}{30 \div 2} = \frac{6}{15};\quad \frac{12 \div 3}{30 \div 3} = \frac{4}{10};\quad \frac{12 \div 6}{30 \div 6} = \frac{2}{5}$$

e.g.



Who can put both our findings into one sentence? Ps suggest sentences and T repeats in a clearer way if necessary.) e.g.

If the numerator and denominator of a fraction are increased or reduced by the same number of times, the value of the fraction does not change.

Discussion, reasoning, agreement, self-correction, praising

BB: simplifying

$$\frac{12}{30} = \frac{6}{15} = \frac{4}{10} = \frac{2}{5}$$

Ps give examples of simplifying other fractions.

e.g. $\frac{4}{8} = \frac{2}{4} = \frac{1}{2}$

Elicit that fractions which have equal value are called equivalent fractions.

Ps could write the sentence in *Ex. Bks.*

35 min

7 **Expanding and reducing decimals**

a) Let's write 4.3 as a fraction in tenths, hundredths and thousandths.

Ps come to BB to write the fractions or dictate to T. Class agrees/disagrees. Elicit that 430 hundredths as a decimal is written as 4.30 and 4300 thousandths as a decimal is written as 4.300.

BB: $4.3 = \frac{43}{10} = \frac{430}{100} = \frac{4300}{1000}$

(= 4.30) (= 4.300)

Agree that all these forms are equal in value.

T: When we write additional zeros at the RHS of a decimal, we say that we are expanding the decimal but its value stays the same.

b) Let's write 2.700 as a fraction in thousandths, hundredths and tenths.

Ps come to BB to write the fractions. Class agrees/disagrees.

Who could write the 10ths and 1000ths as decimals?

BB: $2.700 = \frac{2700}{1000} = \frac{270}{100} = \frac{27}{10}$

(= 2.70) (= 2.7)

Agree that all these forms are equal in value.

T: When we leave off the zeros at the RHS of a decimal, we say that we are simplifying the decimal but its value stays the same.

Whole class activity

At a good pace

Agreement, praising

Allow Ps to try to explain the 'rule' in their own words before T states the 'rule' in a clear way.

Ps suggest their own examples of expanding or simplifying decimals.

39 min

Y6

Lesson Plan 33

Activity

8

PbY6a, page 33

Q.5 Read: *Fill in the missing digits.*

What can you say about the fractions and decimals in each row? (They are equal because there is an 'equals' sign between each pair.) What name do we give to fractions which have the same value? (<u>Equivalent</u> fractions.)

Deal with one row at a time. Set a time limit.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning by saying what has been done to the original fraction to form the equivalent fraction. Class agrees or disagrees. Mistakes discussed and corrected.

Stress that when the <u>fraction</u> in a mixed number is expanded or simplified, the whole number is not affected.

Solution:

a) $\frac{3}{4} = \frac{\boxed{6}}{8} = \frac{12}{\boxed{16}} = \frac{15}{\boxed{20}} = \frac{\boxed{21}}{28} = \frac{48}{\boxed{64}} = \frac{30}{\boxed{40}} = \frac{\boxed{75}}{100} = \frac{750}{\boxed{1000}} = 0.\boxed{7}\boxed{5}$

b) $\frac{4}{7} = \frac{8}{\boxed{14}} = \frac{\boxed{40}}{70} = \frac{16}{\boxed{28}} = \frac{\boxed{32}}{56} = \frac{20}{\boxed{35}} = \frac{\boxed{28}}{49} = \frac{\boxed{120}}{210}$

c) $\frac{3}{10} = 0.\boxed{3} = \frac{\boxed{30}}{100} = \frac{300}{\boxed{1000}} = \frac{\boxed{3000}}{10\,000} = 0.\boxed{3}\boxed{0} = 0.\boxed{3}\boxed{0}\boxed{0}$

d) $2\frac{4}{5} = 2\frac{\boxed{8}}{10} = 2.\boxed{8} = \boxed{2}\,\frac{12}{15} = \boxed{2}\,\frac{24}{30} = 2\,\frac{28}{\boxed{35}}$

T points to pairs of fractions and asks what has been done to the first fraction to form the 2nd equivalent fraction.

Who can explain the rules for expanding and simplifying fractions? T asks several Ps to explain in their own words, then T states the 'laws' in a clear way and Ps repeat them in unison.

<u>Expanding fractions</u>

If both the numerator and the denominator of a fraction are <u>multiplied</u> by the same non-zero number, then the value of the fraction does not change.

<u>Simplifying fractions</u>

If both the numerator and the denominator of a fraction are <u>divided</u> by the same non-zero number, then the value of the fraction does not change.

Notes

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

BB: <u>equivalent fractions</u>
(fractions with equal value)

Differentiation by time limit

Discussion, reasoning, agreement, self-correction, praising

Feedback for T

e.g. $\underset{\times 4}{\overset{\times 4}{\frac{12}{16} = \frac{48}{64}}}$ $\quad$ $\underset{\div 2}{\overset{\div 2}{\frac{40}{70} = \frac{20}{35}}}$

<u>expansion</u> <u>simplification</u>

Use different forms of words (nouns, verbs, particles) to familiarise Ps with the two concepts.

45 min

Y6

R: Simplifying and expanding fractions

C: Addition and subtraction of fracions

E: Involving decimals, mixed numbers and negative fractions

Lesson Plan 34

Activity ***Notes***

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- $\underline{34} = 2 \times 17$ (nice) Factors: 1, 2, 17, 34
- $\underline{209} = 11 \times 19$ (nice) Factors: 1, 11, 19, 209
- $\underline{384} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^7 \times 3$

  Factors: 1, 2, 3, 4, 6, 8, 12, 16, ↓

  384, 192, 128, 96, 64, 48, 32, 24
- $\underline{1034} = 2 \times 11 \times 47$ Factors: 1, 2, 11, 22, 47, 94, 517, 1034

$$\begin{array}{r|l} 384 & 2 \\ 192 & 2 \\ 96 & 2 \\ 48 & 2 \\ 24 & 2 \\ 12 & 2 \\ 6 & 2 \\ 3 & 3 \\ 1 & \end{array}$$

8 min

Individual work, monitored (or whole class activity)

BB: 34, 209, 384, 1034

Calculators allowed

Reasoning, agreement, self-correction, praising

Whole class listing of the factors of 384, either paired vertically as shown or joining up the factor pairs.

e.g. $\begin{array}{r|l} 209 & 11 \\ 19 & 19 \\ 1 & \end{array}$ $\begin{array}{r|l} 1034 & 2 \\ 517 & 11 \\ 47 & 47 \\ 1 & \end{array}$

2

Equivalent fractions

T aks a question about equivalent fractions. Ps say the answer. T asks Ps to write an equation on the BB Classagree/sdisagrees. If problems or disagreement, show it with a model (e.g. using multilink cubes) or by drawing a diagram on BB.

a) How many halves form a whole unit (5 units, 7 units)? [2, 10, 14]

BB: $1 = \frac{2}{2}$, $5 = \frac{10}{2}$, $7 = \frac{14}{2}$

b) How mny thirds are in 1 (2, 5, 7)? [3, 6, 15, 21]

BB: $1 = \frac{3}{3}$, $2 = \frac{6}{3}$, $5 = \frac{15}{3}$, $7 = \frac{21}{3}$

c) How many fifths are in 1 (2, 6, 1 and 3 fifths)? [5, 10, 30, 8]

BB: $1 = \frac{5}{5}$, $2 = \frac{10}{5}$, $6 = \frac{30}{5}$, $1\frac{3}{5} = \frac{8}{5}$

d) How many eighths do you need to make 1 and a half? [12]

e.g. BB: $1\frac{1}{2} = \frac{8}{8} + \frac{4}{8} = \frac{12}{8}$, or $1\frac{1}{2} = \frac{3}{2} = \frac{12}{8}$

e) How many twelfths are in 1 unit (a quarter, a third)? [12, 3, 4]

BB: $1 = \frac{12}{12}$, $\frac{1}{4} = \frac{3}{12}$, $\frac{1}{3} = \frac{4}{12}$

f) How many fifteenths are in 1 fifth (3 fifths, 7 fifths)? [3, 9, 21]

BB: $\frac{1}{5} = \frac{3}{15}$, $\frac{3}{5} = \frac{9}{15}$, $\frac{7}{5} = \frac{21}{15}$

g) How many tenths are in 2 (5, 3 fifths)? [20, 50, 6]

BB: $2 = \frac{20}{10}$, $5 = \frac{50}{10}$, $\frac{3}{5} = \frac{6}{10}$ (= 0.6)

h) How many hundredths are in 4 tenths (2 and 5 tenths)? [40, 250]

BB: $\frac{4}{10} = \frac{40}{100}$, $2\frac{5}{10} = \frac{25}{10} = \frac{250}{100}$

(= 0.4 = 0.40) (= 2.5 = 2.50)

18 min

Whole class activity

Involve all Ps.

T chooses Ps at random

At a good pace.

In good humour.

Differentiation by question.

Agreement, praising

In e), T asks Ps who could write a division to answer the first part of the question.

If no P can do it, T shows it and asks if it is correct.

Ps could write divisions for the next two parts with T's help.

BB: $1 \div \frac{1}{12} = \underline{12}$,

$\frac{1}{4} \div \frac{1}{12} = \underline{3}$, $\frac{1}{3} \div \frac{1}{12} = \underline{4}$

In f), T asks who could write a multiplication about it. e.g.

BB: $3 \times \frac{1}{15} = \frac{3}{15} = \frac{1}{5}$

In g) and h) T asks Ps to give the fractions as a decimals.

Y6

Lesson Plan 34

Activity

3

PbY6a, page 34

Q.1 Read: *a) Circle the numbers which are less than 1.*
Tick the numbers which equal 1.
b) Convert the numbers greater than 1 to mixed numbers in your exercise book.

What does convert mean? (Change to another form.) Set a time limit of 3 minutes.

Review with whole class. Ps come to BB to circle and tick, explaining reasoning and writing relevant fractions as a mixed number. Class agrees/disagrees. Mistakes discussed/corrected.

Elicit that a fraction where the numerator is:

- less than the denominator is less than 1,
- the same as the denominator is equal to 1,
- greater than the denominator is greater than 1 and can be written as a mixed number.

Solution:

a) $\enclose{circle}{\frac{3}{4}} \quad \frac{32}{5} \quad \enclose{circle}{\frac{12}{37}} \quad \frac{92}{59} \quad \overset{\checkmark}{\frac{7}{7}} \quad \frac{9}{2} \quad \enclose{circle}{\frac{116}{120}} \quad \overset{\checkmark}{\frac{16}{16}} \quad \frac{9}{8}$

b) $\frac{32}{5} = 6\frac{2}{5}, \quad \frac{92}{59} = 1\frac{33}{59}, \quad \frac{9}{2} = 4\frac{1}{2}, \quad \frac{9}{8} = 1\frac{1}{8}$

Notes

Individual work, monitored (helped)

Written on BB or SB or OHT

Reasoning, agreement, self-correction, praising

Feedback for T

Can you see any equivalent fractions among them?

$\left(\frac{7}{7} = \frac{16}{16}\right)$

22 min

4

PbY6a, page 34

Q.2 Read: *Fill in the missing digits.*

What kind of fractions are in each row? (equivalent fractions)

Deal with one row at a time. Set a time limit.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning by saying what has been done to the original fraction to form the eqivalent fraction. Class agrees/disagrees. (If problems or disagreement, show with a model or by drawing a diagram on BB.) Mistakes discussed and corrected.

Solution:

a) $\frac{2}{5} = \frac{\boxed{4}}{10} = \frac{20}{\boxed{50}} = \frac{6}{\boxed{15}} = \frac{\boxed{8}}{20} = \frac{\boxed{14}}{35} = \frac{18}{\boxed{45}} = \frac{\boxed{40}}{100} = \frac{\boxed{30}}{75} = \frac{\boxed{400}}{1000}$

b) $\frac{14}{10} = \frac{7}{\boxed{5}} = \boxed{1}\,.\boxed{4} = \frac{\boxed{42}}{30} = \boxed{1}\,\frac{2}{\boxed{5}} = 1\frac{\boxed{40}}{100} = \frac{\boxed{70}}{50} = \frac{70}{\boxed{50}} = \boxed{1}\,\frac{40}{\boxed{100}}$

c) $2.03 = 2.\boxed{0}\boxed{3}\boxed{0} = 2.\boxed{0}\boxed{3}\boxed{0}\boxed{0} = \frac{\boxed{203}}{100} = \boxed{2}\,\frac{\boxed{3}}{100} = \frac{2030}{\boxed{1000}}$

d) $\frac{60}{72} = \frac{\boxed{30}}{36} = \frac{\boxed{20}}{24} = \frac{\boxed{15}}{18} = \frac{\boxed{10}}{12} = \frac{\boxed{7.5}}{9} = \frac{\boxed{5}}{6}$

Notes

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Feedback for T

Extension

What is the simplest form of the number in each row?

a) $\frac{2}{5}$ b) $1\frac{2}{5}$ c) $2\frac{3}{100}$ d) $\frac{5}{6}$

In d), what steps could we take to get from the 1st fraction to its simplest form? Ps come to BB to show them. (See above.)

How could we do it in just <u>one</u> step? (Divide numerator and denominator by 12.) T shows it on BB.

Notes

Whole class activity

Discussion, reasoning, agreement, praising

BB: $\frac{60}{72} \overset{\div 12}{\underset{\div 12}{=}} \frac{5}{6}$

27 min

Y6

Lesson Plan 34

Activity

5

PbY6a, page 34

Q.3 Read: *Calculate the sums and differences in your exercise book.*

Ask Ps to <u>simplify</u> their results as far as possible.

Set a time limit for each row. Review with whole class. Ps could show each sum or difference on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

Do the first addition in row c) with the whole class. What is different about the fractions in this addition? (They have different denominators.) We cannot add the two fractions in these forms, so what could we do? (Change the half to 2 quarters.)

BB: $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

Ps come to BB or dictate what T should write. Class agrees/ disagrees.

T: We say that we have changed the 2 different denominators to a <u>common denominator</u>. In this case, one of the denominators (4) is a multiple of the other (2), so the <u>lowest common denominator</u> is the same as the lowest common multiple of 2 and 4, which is 4.

Ps do each of the other calculations one at a time in *Ex. Bks*, then show result on scrap paper or slates on command. Ps with different answers come to BB to explain reasoning. Class decides who is correct. Mistakes discussed and corrected.

Solution:

a) i) $\frac{1}{8} + \frac{5}{8} = \frac{6}{8} = \frac{3}{4}$ ii) $\frac{2}{10} + \frac{7}{10} + \frac{3}{10} = \frac{12}{10} = \frac{6}{5} = 1\frac{1}{5}$

iii) $\frac{6}{7} - \frac{2}{7} = \frac{4}{7}$ iv) $\frac{4}{5} + \frac{7}{5} - \frac{9}{5} = \frac{2}{5}$

b) i) $1\frac{4}{5} + 2\frac{1}{5} + 8\frac{3}{5} = 11 + \frac{8}{5} = 11 + 1\frac{3}{5} = 12\frac{3}{5}$

ii) $3 - \frac{7}{12} = 2\frac{5}{12}$

iii) $2\frac{4}{9} + \frac{2}{9} - 1\frac{5}{9} = 1 + \frac{4 + 2 - 5}{9} = 1 + \frac{1}{9} = 1\frac{1}{9}$

iv) $5\frac{3}{8} - 3\frac{5}{8} = 2 + \frac{3 - 5}{8} = 2 - \frac{2}{8} = 1\frac{6}{8} = 1\frac{3}{4}$

or $5\frac{3}{8} - 3\frac{5}{8} = 4\frac{11}{8} - 3\frac{5}{8} = 1\frac{6}{8} = 1\frac{3}{4}$

c) i) $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

ii) $\frac{5}{6} + \frac{4}{3} = \frac{5}{6} + \frac{8}{6} = \frac{13}{6} = 2\frac{1}{6}$

iii) $\frac{11}{12} + \frac{2}{3} - \frac{3}{4} = \frac{11}{12} + \frac{8}{12} - \frac{9}{12} = \frac{10}{12} = \frac{5}{6}$

iv) $1\frac{3}{10} + \frac{4}{5} - \frac{3}{2} = 1\frac{3}{10} + \frac{8}{10} - 1\frac{5}{10} = \frac{6}{10} = \frac{3}{5}$

Notes

Individual work for a) and b) (one row at a time), monitored

Written on BB or SB or OHT

Responses shown in unison.

Reasoning, agreement, self-correction, praising

If problems or disagreement, draw diagrams on BB.

Whole class discussion

Allow Ps to suggest what to do if they can, otherwise T prompts.

Agreement, praising

BB: <u>common denominator</u>

↓

common multiple of the denominators

Individual trial, monitored

Responses shown in unison.

Reasoning, agreement, self-correction, praisng

Elicit or show Ps that:

- to add or subtract mixed numbers, add or subtract the whole numbers first, then the fractions;
- instead of writing the common denominator lots of times, we can write the denominator once below the fraction line and write the numerators and operation signs above it.
  (Ps could use this notation for the remaining calculations if they wish.)
- in b) iv), there are two methods of subtracting mixed numbers where the fractional part of the subtrahend is smaller than that of the reductant;
- in each part of c), one of the two denominators is a multiple of the other, so that multiple is the lowest common denominator

35 min

Y6

Lesson Plan 34

Activity

Notes

6

PbY6a, page 34

Q.4 Read: *Convert the fractions to a common denominator, then do the calculation.*

Deal with one at a time to start with. Ps try each calculation in *Ex. Bks* then show result on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

(If T notes that the majority of Ps are calculating correctly, set a time limit for the remaining calculations in each row, then review as normal.)

Individual work, monitored closely, helped

(one at a time until most Ps understand what to do)

Responses shown in unison.

Discussion, reasoning, agreement, self-correction, praising

Extension

Which calculations can easily be written in decimal form? Ps come to BB or dictate to T. Class agrees/disagrees. (See below.)

Whole class activity

Solution:

a) i) $\frac{13}{5} + \frac{3}{2} = \frac{26}{10} + \frac{15}{10} = \frac{41}{10} = 4\frac{1}{10}$

(or $= 2.6 + 1.5 = \underline{4.1}$)

ii) $\frac{1}{2} - \frac{4}{5} = \frac{5}{10} - \frac{8}{10} = -\frac{3}{10}$

(or $= 0.5 - 0.8 = \underline{-0.3}$)

iii) $1\frac{2}{3} + \frac{7}{8} = 1\frac{16}{24} + \frac{21}{24} = 1\frac{37}{24} = 2\frac{13}{24}$

iv) $\frac{1}{7} - \frac{1}{8} = \frac{8}{56} - \frac{7}{56} = \frac{1}{56}$

v) $3\frac{7}{9} - 2\frac{1}{2} = 1\frac{14}{18} - \frac{9}{18} = 1\frac{5}{18}$

(or $= 1 + \frac{14 - 9}{18} = 1 + \frac{5}{18} = 1\frac{5}{18}$)

b) i) $\frac{3}{4} + \frac{5}{6} = \frac{9}{12} + \frac{10}{12} = \frac{19}{12} = 1\frac{7}{12}$

ii) $\frac{7}{10} - \frac{1}{4} = \frac{14}{20} - \frac{5}{20} = \frac{9}{20}$

iii) $2\frac{1}{6} + 1\frac{3}{8} = 3 + \frac{4 + 9}{24} = 3 + \frac{13}{24} = 3\frac{13}{24}$

iv) $4\frac{5}{20} - 1\frac{5}{12} = 3 + \frac{15 - 25}{60} = 3 - \frac{10}{60} = 3 - \frac{1}{6} = 2\frac{5}{6}$

Elicit (or point out) that in:

a) the 2 denominators in each part are <u>relative primes</u>, i.e. they have only one common factor, 1; so their lowest common multiple (and thus the lowest common denominator of the 2 fractions) is their product;

b) the two denominators are <u>not</u> relative primes and neither denominator is a multiple of the other, so their <u>lowest</u> common multiple is taken as the common denominator of the two fractions.

Would it be wrong to use as the common denominator a common mutltiple which was <u>not</u> the smallest possible?

e.g.

BB: $\frac{7}{10} - \frac{1}{4} = \frac{28 - 10}{40}$

$= \frac{18}{40} = \frac{9}{20}$

(Not wrong, but uses greater numbers in the calculation than are necessary and the result needs to be simplified.)

41 min

Y6

Lesson Plan 34

Activity

7

PbY6a, page 34

Q.5 Read: *Write a plan, do the calculation and write the answer in your exercise book.*

Set a time limit. Ps read problems themselves and solve them.

Review with whole class. Ps could show results on scrap paper or slates in unison. Ps answering correctly explain at BB to Ps who were wrong, saying why they chose that common denominator. Class agrees/disagrees. Mistakes discussed and corrected.

T chooses a P to say the answer in a sentence.

Solutions:

a) *Yesterday I bought 3 quarters of a kg of potatoes and today I bought half a kg of potatoes. How many kg of potatoes did I buy altogether?*

Plan: $\frac{3}{4} + \frac{1}{2} = \frac{3}{4} + \frac{2}{4} = \frac{5}{4} = 1\frac{1}{4}$ (kg)

[4 is a multiple of 2, so 4 is the lowest common denominator]

Answer: I bought 1 and a quarter kg of potatoes altogether.

b) *A family took 3 quarters of a kg of grapes on a picnic. How many kg of grapes did they bring home if they ate 3 fifths of a kg during the picnic?*

Plan: $\frac{3}{4} - \frac{3}{5} = \frac{15}{20} - \frac{12}{20} = \frac{3}{20}$ (kg)

[4 and 5 are relative primes, so lowest common denominator is their product.]

Answer: They brought home 3 twentieths of a kg of grapes.

c) *Two friends decide to walk to the beach which is 2 and 3 quarter kilometres from their camp site. They walk 1 and 5 sixths kilometeres, then have a rest.*

How far do they still have to go?

Plan: $2\frac{3}{4} - 1\frac{5}{6} = 1 + \frac{9 - 10}{12} = 1 - \frac{1}{12} = \frac{11}{12}$ (km)

or $= 1\frac{7}{4} - 1\frac{5}{6} = \frac{7}{4} - \frac{5}{6} = \frac{21}{12} - \frac{10}{12} = \frac{11}{12}$ (km)

[4 and 6 are not relative primes and neither is a multiple of the other, so the lowest common denominator of the two fractions is the lowest common multiple of 4 and 6, i.e. 12]

Answer: They still have to walk 11 twelfths of a kilometre.

45 min

Notes

Individual work, monitored, helped

Differentiation by time limit.

Responses shown in unison.

Discussion, reasoning, agreement, self-correction, praising

Extra praise if Ps use the short notation correctly:

e.g. $\frac{3}{4} + \frac{1}{2} = \frac{3 + 2}{4} = \frac{5}{4}$

T repeats explanations more clearly if necessary.

Feedback for T

Y6

Lesson Plan *35*

Activity

Factorising 35, 210, 385 and 1035. Revision, activities, consolidation

PbY6a, page 305

Solutions:

Q.1 a) $\frac{4}{5} < \square < 1$ e.g. $\square$: $\frac{9}{10}, \frac{13}{15}, \frac{14}{15}$, etc.

b) $2 < \square < 2\frac{1}{3}$ e.g. $\square$: $2\frac{1}{4}, 2\frac{1}{6}, 2\frac{2}{9}$, etc.

c) $1\frac{3}{4} < \square < 2\frac{1}{4}$ e.g. $\square$: $1\frac{7}{8}, 2, 2\frac{1}{8}$, etc.

Q.2 a) $\frac{1}{9} \times 9 = 1$ b) $\frac{1}{6} \times 1 = \frac{1}{6}$ c) $\frac{1}{11} \times 5 = \frac{5}{11}$

d) $\frac{4}{7} \times 7 = 4$ e) $\frac{3}{4} \times 2 = \frac{3}{2} = 1\frac{1}{2}$

f) $\frac{7}{8} \times 4 = \frac{7}{2} = 3\frac{1}{2}$ g) $\frac{5}{12} \times 3 = \frac{5}{4} = 1\frac{1}{4}$

h) $\frac{7}{20} \times 10 = \frac{7}{2} = 3\frac{1}{2}$ i) $3\frac{1}{4} \times 3 = 9\frac{3}{4}$

j) $6\frac{1}{3} \times 6 = 36 + \frac{6}{3} = 36 + 2 = 38$

k) $8\frac{1}{2} \times 9 = 72 + 4\frac{1}{2} = 76\frac{1}{2}$ l) $\frac{13}{10} \times 3 = \frac{39}{10} = 3\frac{9}{10}$

m) $\frac{3}{8} \div 3 = \frac{1}{8}$ n) $\frac{2}{13} \div 2 = \frac{1}{13}$ o) $\frac{13}{20} \div 4 = \frac{13}{80}$

p) $\frac{3}{5} \div 6 = \frac{3}{30} = \frac{1}{10}$ q) $\frac{21}{20} \div 7 = \frac{3}{20}$

r) $\frac{21}{20} \div 4 = \frac{21}{80}$ s) $\frac{17}{33} \div 11 = \frac{17}{363}$ t) $\frac{28}{35} \div 7 = \frac{4}{35}$

Q.3 a) i) $9.3 = \frac{930}{100} = \frac{9300}{1000}$ ii) $4.75 = \frac{475}{100} = \frac{4750}{1000}$

iii) $0.3 = \frac{30}{100} = \frac{300}{1000}$ iv) $0.05 = \frac{5}{100} = \frac{50}{1000}$

v) $1.0 = \frac{100}{100} = \frac{1000}{1000}$

b) i) $\frac{136}{10} = 13.6$ ii) $5\frac{31}{100} = 5.31$ iii) $10\frac{1}{100} = 10.01$

iv) $\frac{583}{1000} = 0.583$ v) $\frac{27}{1000} = 0.027$

Notes

<u>35</u> = 5 × 7

Factors: 1, 5, 7, 35

<u>210</u> = 2 × 3 × 5 × 7

Factors: 1, 2, 3, 5, 6, 7, 10, 14, 15, 21, 30, 35, 42, 70, 105, 210

<u>385</u> = 5 × 7 × 11

Factors: 1, 5, 7, 11, 35, 55, 77, 385

<u>1035</u> = $3^2 \times 5 \times 23$

Factors: 1, 3, 5, 9, 15, 23, 45, 69, 115, 207, 345, 1035

(or set factorising as homework at the end of *Lesson 34* and review at the start of *Lesson 35)*

Activity

Q.4

a) $\frac{4}{5} = \frac{\boxed{8}}{10} = \frac{12}{\boxed{15}} = \frac{20}{\boxed{25}} = \frac{\boxed{48}}{60} = \frac{60}{\boxed{75}} = \frac{88}{\boxed{110}} = \frac{\boxed{800}}{1000} = \frac{80}{\boxed{100}} = \boxed{0.8}$

b) $\frac{7}{4} = \frac{14}{\boxed{8}} = \frac{\boxed{35}}{20} = \frac{49}{\boxed{28}} = \frac{\boxed{147}}{84} = \frac{210}{\boxed{120}} = \frac{\boxed{175}}{100} = \frac{\boxed{1750}}{1000} = \boxed{1.75}$

c) $8.16 = 8.\boxed{1}\boxed{6}\boxed{0} = 8.\boxed{1}\boxed{6}\boxed{0}\boxed{0} = \frac{\boxed{816}}{100} = \boxed{8}\,\frac{\boxed{16}}{100} = \frac{816}{\boxed{100}}$

Q.5 Part written on M, T and W:

$$\frac{1}{3} + \frac{2}{8} + \frac{1}{6} = \frac{1}{3} + \frac{1}{4} + \frac{1}{6} = \frac{4+3+2}{12} = \frac{9}{12} = \frac{3}{4}$$

Part remaining: $1 - \frac{3}{4} = \frac{1}{4} \rightarrow 27$ cards

$$\frac{4}{4} \rightarrow 27 \times 4 = \underline{108}\text{ (cards)}$$

Answer: I sent 108 Christmas cards.

Notes

or $1 - \left(\frac{1}{3} + \frac{1}{4} + \frac{1}{6}\right) \rightarrow 27$

$1 - \frac{4+3+2}{12} \rightarrow 27$

$1 - \frac{9}{12} \rightarrow 27$

$\frac{3}{12} \rightarrow 27$

$\frac{1}{12} \rightarrow 9$

$\frac{12}{12} \rightarrow \underline{108}$

Y6

R: Concept of a fraction and a decimal

C: Addition and subtraction of fractions and decimals

E: Problems. Rational numbers

Lesson Plan 36

Activity | *Notes*

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- $\underline{36} = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2 = (2 \times 3) \times (2 \times 3) = 6^2$
  Factors: 1, 2, 3, 4, 6, 9, 12, 18, 36 (square number)
- $\underline{211}$ is a prime number Factors: 1, 211
  (as not exactly divisible by 2, 3, 5, 7, 11 and 13, and $17 \times 17 > 211$)
- $\underline{386} = 2 \times 193$ (nice) Factors: 1, 2, 193, 386
  (193 is not exactly divisible by 2, 3, 5, 7, 11, 13; $17 \times 17 > 193$)
- $\underline{1036} = 2 \times 2 \times 7 \times 37 = 2^2 \times 7 \times 37$
  Factors: 1, 2, 4, 7, 14, 28, 37, 74, 148, 259, 518, 1036

Individual work, monitored (or whole class activity)

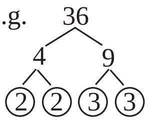
BB: 36, 211, 386, 1036

Calculators allowed (for larger numbers).

Reasoning, agreement, self-correction, praising

Whole class listing of the factors of 1036.

e.g.



386	2
193	193
1	

1036	2
518	2
259	7
37	37
1	

6 min

2

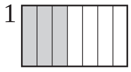
Concept of a fraction

T asks a question. Ps come to BB or dictate what T should write or draw. Class agrees/disagrees or suggests alternatives. T helps or prompts when necessary.

a) Who can explain what 3 sevenths means? e.g.

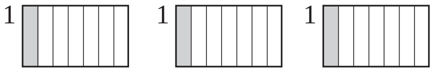
- 1 unit is divided into 7 equal parts and we take 3 of the parts.

  BB: $\dfrac{3}{7} = 1 \div 7 \times 3$



- 3 units are each divided into 7 equal parts, and we take 1 part from each unit.

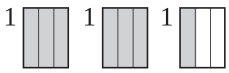
  BB: $\dfrac{3}{7} = 3 \div 7$



b) Who can explain what 7 thirds means? e.g.

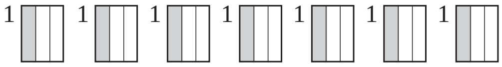
- 1 unit is divided into 3 equal parts and we take 7 of the parts.

  BB: $\dfrac{7}{3} = 1 \div 3 \times 7$



- 7 units are each divided into 3 equal parts, and we take 1 part from each unit.

  BB: $\dfrac{7}{3} = 7 \div 3$



c) Let's expand these fractions to tenths, then write in decimal form.

BB: i) $\dfrac{1}{2} = \left(\dfrac{5}{10} = 0.5\right)$ ii) $\dfrac{3}{5} = \left(\dfrac{6}{10} = 0.6\right)$

iii) $1\dfrac{3}{4}$ = (does not expand to tenths; 10 is not a multiple of 4)

Whole class activity

Involve several Ps.

Discussion, reasoning, agreement

Praising, encouragement only

(Consolidation of concepts and laws.)

Feedback for T

or $\dfrac{3}{7} = \dfrac{1}{7} \times 3$

Elicit that: $\dfrac{7}{3} = 2\dfrac{1}{3}$

or $\dfrac{7}{3} = \dfrac{1}{3} \times 7$

Written on BB or SB or OHT.

Extra praise if a P suggests expanding the 3 quarters to 75 hundredths, so the decimal form is 1.75.

Y6

Lesson Plan 36

Activity

Notes

2 (Continued)

d) Let's expand these fractions to hundredths, then write in decimal form.

BB: i) $\dfrac{31}{50} = \left(\dfrac{62}{100} = 0.62\right)$ iii) $\dfrac{13}{4} = \left(\dfrac{325}{100} = 3.25\right)$

iii) $\dfrac{17}{20} = \left(\dfrac{85}{100} = 0.85\right)$ iv) $\dfrac{3}{7}$ = [Impossible, as 100 is not a multiple of 7)

BB:
$$\begin{array}{r} 2\,5 \\ \times\ 1\,3 \\ \hline 7\,5 \\ +\ 2\,5\,0 \\ \hline 3\,2\,5 \\ {\scriptstyle 1}\quad\ \ \end{array}$$

e) How could we work out the decimal form of 11 sixteenths?

(Divide the numerator by the denominator.)

BB: $\dfrac{11}{16} = 11 \div 16 = \underline{0.6875}$ or $\underset{\times 625}{\overset{\times 625}{\dfrac{11}{16} = \dfrac{6875}{10\,000}}} = 0.6875$

(Ps do division on BB or use a calculator.)

BB:
$$\begin{array}{r|l} & 0.6\,8\,7\,5 \\ \hline 1\,6 & 1\,1.0\,0\,0\,0 \\ & -\ 9\,6 \\ \hline & 1\,4\,0 \\ & -\ 1\,2\,8 \\ \hline & 1\,2\,0 \\ & -\ 1\,1\,2 \\ \hline & 8\,0 \\ & -\ 8\,0 \\ \hline & 0 \end{array}$$

f) Let's write each of these numbers as a fraction in different forms.

BB: $3 = \left(\dfrac{3}{1} = \dfrac{6}{2} = \dfrac{18}{6} = \dfrac{9}{3} = \dfrac{-\ 15}{-\ 5} = \ldots\right)$

$-\dfrac{5}{2} = \left(-\dfrac{10}{4} = \dfrac{-15}{6} = \dfrac{20}{-8} = -2\dfrac{1}{2} = \ldots\right)$

$0 = \left(\dfrac{0}{1} = \dfrac{0}{2} = \dfrac{0}{10} = \dfrac{0}{-5} = \ldots\right)$

T writes fractions with negative numerators and/or denominators if Ps do not suggest them and asks Ps if they are correct.

Elicit that they are <u>equivalent</u> fractions, i.e. have equal value.

T: *Any number which can be written as a fraction using 2 whole numbers, and where the demoninator of the fraction is <u>not</u> zero, is called a <u>rational numbe</u>r*. (BB)

So all fractions are rational numbers but note that equivalent fractions are different forms of the <u>same</u> rational number.

BB: <u>rational numbers</u>

e.g. $\dfrac{3}{4} = \dfrac{6}{8}$

g) Do you think that 5 is a rational number? (Yes, as it can be written in fraction form.)

T: 5 can also be written as a decimal number. (BB) So are decimal numbers also rational numbers? (Yes, if they can be written in fraction form)

What about zero (1 and 3 quarters, – 3 fifths)? Ps dictate what T should write. We say that these are <u>finite</u> decimals, as they have a definite end point. Agree that finite decimals are rational numbers.

$$\left.\begin{aligned} 5 &= \frac{5}{1} = 5.0 \\ 0 &= \frac{0}{1} = 0.00 \\ 1\frac{3}{4} &= \frac{7}{4} = 1.75 \\ -\frac{3}{5} &= -0.6 \end{aligned}\right\}\ \underline{\text{Finite decimals}}$$

What about <u>recurring</u> decimals? T elicits the meaning and shows an example on BB. Ps could suggest others that they know.

Elicit that recurring decimals have no definite endpoint and digits or groups of digits are repeated to indefinitely.

Agree that recurring decimals can be written in fraction form using two whole numbers, so are also <u>rational</u> numbers.

<u>Recurring decimals</u> e.g.

T: $\dfrac{8}{11} = 8 \div 11 = 0.727272\ldots = 0.\dot{7}\dot{2}$

Ps: e.g. $0.\dot{3} = \dfrac{1}{3}$, $0.\dot{1} = \dfrac{1}{9}$

If necessary, remind Ps how to write recurring decimals. (For a single recurring digit, a dot is written above it. For a group of recurring digits, i.e. in a <u>cyclic</u> recurring decimal, a dot is written above the first and the last digit in the repeating group, or a bar is drawn above the repeating cycle of digits.)

T writes this recurring decimal if no P suggests it and asks Ps what it is in fraction form.

BB: $0.\dot{1}4285\dot{7} = \left(\dfrac{1}{7}\right)$

or $0.\overline{142857}$

So what kind of numbers are rational numbers? (whole numbers, mixed numbers, fractions, finite and some recurring decimals; <u>any</u> number which can be written as a fraction where the numerator and denominator are whole numbers and the denominator is not zero.)

Praising only

16 min

Y6

Lesson Plan 36

Activity ***Notes***

3

PbY6a, page 36

Q.1 Read: ***Simplify*** *these fractions and mark them on the number line.*

What does simplify mean? (Reduce the numerator and denominator by the same number of times so that the fraction is in its simplest form.)

Deal with one at a time or set a time limit. Ps calculate in steps in *Ex. Bks* if they wish, write simplfied fraction in *Pbs* and mark with a dot and label it (or join fraction to corresponding point) on the number line.

Review with whole class. Ps come to BB to explain reasoning. Who did the same? Who did it another way? etc. Mistakes discussed and corrected.

Solution:

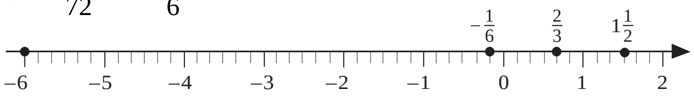
a) e.g. $\frac{160}{240} = \frac{16}{24} = \frac{4}{6} = \frac{2}{3}$ or $\frac{160}{240} \underset{\div 80}{\overset{\div 80}{=}} \frac{2}{3}$

T: We say that as 160 = 2 × <u>80</u> and 240 = 3 × <u>80</u>, the <u>greatest</u> <u>common factor</u> of 160 and 240 is 80.

b) e.g. $\frac{240}{160} = \frac{24}{16} = \frac{3}{2}$ $(= 1\frac{1}{2})$ or $\frac{240}{160} \underset{\div 80}{\overset{\div 80}{=}} \frac{3}{2}$

c) e.g. $-\frac{72}{12} = -\frac{36}{6} = -\frac{6}{1} = -6$ or $-\frac{72}{12} \underset{\div 12}{\overset{\div 12}{=}} -\frac{6}{1}$

d) $-\frac{12}{72} = -\frac{1}{6}$



20 min

Individual work, monitored, (helped)

Number line drawn on BB or use enlarged copy master/OHP

Ensure that Ps know what 'simplify' means.

Ps decide which method of marking they use.

Discussion, reasoning, agreement, self-correction, praising

Elicit/show the simplification in 1 step on BB if no P did it.

BB: <u>Greatest common factor</u>

(as greatest common factor of 240 and 160 is 80)

(as greatest common factor of 72 and 12 is 12)

(as greatest common factor of 12 and 72 is 12)

4

PbY6a, page 36

Q.2 Read: *Write a plan, do the calculation, check the result and write the answer in a sentence.*

Deal with one at a time. Set a time limit. Ps read question themselves and solve it in *Ex. Bks*.

Review with whole class. Ps show results on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Who agrees? Who did it a different way? etc. Mistakes discussed and corrected.

Solutions:

a) A farmer had 3 beehives. He collected 2 and 4 fitfths kg of honey from one of the beehives and 3.2 kg of honey from another. If he collected 9 and 2 fifths kg of honey altogether, how much honey did he collect from the 3rd beehive?

Plan: $9\frac{2}{5} - (2\frac{4}{5} + 3.2) = 9.4 - (2.8 + 3.2) = 9.4 - 6$

$= \underline{3.4}$ (kg)

Answer: He collected 3.4 kg of honey from the 3rd beehive.

Individual work, monitored, (helped)

Responses shown in unison.

Discussion, reasoning, agreeement self-correction, praising

Feedback for T

or $9\frac{2}{5} - (2\frac{4}{5} + 3\frac{2}{10})$

$= 9\frac{2}{5} - (5 + \frac{4}{5} + \frac{1}{5})$

$= 9\frac{2}{5} - 6 = 3\frac{2}{5}$ kg

Check: 2.8 + 3.2 + 3.4 = 9.4 ✔

Y6

Lesson Plan 36

Activity

4

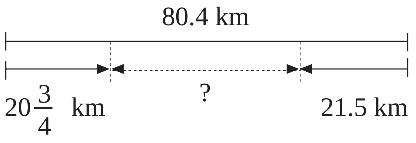
(Continued)

b) *Two cyclists started at the same time from either end of an 80.4 km journey and cycled towards each other. They both had a rest break at the same time.*

By then, one cyclist had covered 20 and 3 quarters km and the other had covered 21.5 km.

How far apart were they when they stopped to rest?

Diagram:



Plan: $80.4 - (20\frac{3}{4} + 21.5) = 80.4 - (20.75 + 21.5)$

$= 80.4 - 42.25 = \underline{38.15}$ (km)

Check: 38.15 km + 20.75 km + 21.5 km = 80.4 km ✔

Answer: The two cyclists were 38.15 km apart when they stopped to rest.

c) *Mum bought 1200 g of grapes. Andy ate 1 fifth of them, Betty ate 1 quarter of them and Charlie ate 1 third of them. Dad ate the rest.*

What amount of grapes did each of them eat?

e.g. A: 1200 g ÷ 5 = <u>240 g</u>

B: 1200 g ÷ 4 = <u>300 g</u>

C: 1200 g ÷ 3 = <u>400 g</u>

D: 1200 – (240 + 300 + 400) = 1200 – 940 = <u>260</u> (g)

Check: 260 g + 400 g + 300 g + 240 g = 1200 g ✔

Answer: Andy ate 240 g, Betty ate 300 g, Charlie ate 400 g and Dad ate 260 g of grapes.

Erratum

In *Pbs*:

'strawberies' should be 'strawberries'

d) *Kate gathered 45.6 kg of strawberries in 12 hours.*

Julie worked for 10 hours but collected 18 and 4 fifths of a kg less than Kate.

What amount of strawberries did Julie gather?

Plan: J: $45.6\text{ kg} - 18\frac{4}{5}\text{ kg} = 45.6\text{ kg} - 18.8\text{ kg} = \underline{26.8\text{ kg}}$

Check: $45.6\text{ kg} - 26.8\text{ kg} = 18.8\text{ kg} = 18\frac{8}{10}\text{ kg} = 18\frac{4}{5}\text{ kg}$ ✔

Answer: Julie gathered 26.8 kg of strawberries.

35 min

Notes

T suggests drawing a diagram if Ps do not.

or $80\frac{4}{10} - 20\frac{3}{4} - 21\frac{1}{2}$

$= 39 + \dfrac{8 - 15 - 10}{20}$

$= 39 - \dfrac{17}{20} = 38\dfrac{3}{20}$ (km)

[20 is the LCM of 10, 4 and 2]

In this question it is easier <u>not</u> to use fractions but if no P did so, T might ask the class to calulate what <u>part</u> Dad ate using fractions. Ps come to BB or dictate what T should write. e.g.

BB: <u>Part</u> eaten by Dad:

$1 - \left(\dfrac{1}{5} + \dfrac{1}{4} + \dfrac{1}{3}\right)$

$= 1 - \dfrac{12 + 15 + 20}{60}$

$= 1 - \dfrac{47}{60} = \underline{\dfrac{13}{60}}$

[5, 4 and 3 are <u>relative primes</u>, i.e. they have only 1 common factor, 1, so their LCM is their product.]

Elicit that the times worked are not needed for the answer.

BB:

$$\begin{array}{rrr} & {}^{10} & {}^{10} \\ & 4 & 5\,.\,6 \\ - & 1_1 & 8_1.\,8 \\ \hline & 2 & 6\,.\,8 \end{array}$$

Check:

$$\begin{array}{rrr} & {}^{10} & {}^{10} \\ & 4 & 5\,.\,6 \\ - & 2_1 & 6_1.\,8 \\ \hline & 1 & 8\,.\,8 \end{array}$$

Y6

Lesson Plan 36

Activity ***Notes***

5

PbY6a, page 36

Q.3 Read: *Practise addition and subtraction in your exercise book.*

Deal with one row at a time. Set a time limit.

Review with whole class. Ps come to BB to write and explain the calculations. Who did the same? Who did it a different way? etc. Mistakes discussed and corrected.

Solution:

a) $\frac{1}{2}-\left(\frac{1}{8}+\frac{1}{4}\right) = \frac{4}{8}-\left(\frac{1}{8}+\frac{2}{8}\right) = \frac{4}{8}-\frac{3}{8} = \frac{1}{8}$

b) $\frac{2}{5}-\left(\frac{1}{10}-\frac{1}{20}\right) = \frac{8-(2-1)}{20} = \frac{8-1}{20} = \frac{7}{20}$

c) $2\frac{5}{6}-\left(1\frac{1}{2}-\frac{2}{3}\right) = 2\frac{5}{6}-\left(1\frac{3}{6}-\frac{4}{6}\right) = 2\frac{5}{6}-\frac{5}{6} = \underline{2}$

d) $3.16-(1.2+0.5) = 3.16-1.7 = \underline{1.46}$

e) $4.03-(2.1-0.8) = 4.03-1.3 = \underline{2.73}$

f) $3.18-(0.6-1.2) = 3.18-(-0.6) = 3.18+0.6 = \underline{3.78}$

g) $\frac{3}{2}+\left(-\frac{5}{2}\right) = \frac{3}{2}-\frac{5}{2} = -\frac{2}{2} = \underline{-1}$

h) $\frac{5}{8}-\left(-\frac{1}{4}\right) = \frac{5}{8}+\frac{1}{4} = \frac{5}{8}+\frac{2}{8} = \frac{7}{8}$

i) $-\frac{4}{9}-\left(-\frac{2}{3}\right) = -\frac{4}{9}+\frac{2}{3} = -\frac{4}{9}+\frac{6}{9} = \frac{2}{9}$

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

Differentiation by time limit.

Reasoning, agreement, self-correction, praising

or

a) $\frac{1}{2}-\left(\frac{1}{8}+\frac{1}{4}\right)$

$= \frac{4-(1+2)}{8}$

$= \frac{4-3}{8} = \frac{1}{8}$

Elicit that:

- subtracting a negative number is the same as adding its opposite positive number;
- adding a negative number is the same as subtracting its opposite positive number.

Feedback for T

40 min

6

PbY6a, page 36

Q.4 Read: *Write a plan, do the calculation and write the answer in your exercise book.*

Deal with one question at a time. Set a time limit.

Review with whole class. Ps show result on scrap paper or slates on command. Ps responding correctly explain at BB to Ps who were wrong. Who did the same? Who did it another way? etc. Mistakes discussed and corrected.

Solution:.

a) *One side of a rectangle is* $\frac{3}{4}$ *m long and the other side is* $\frac{2}{3}$ *m long. What length is its perimeter?*

$P = \left(\frac{3}{4}+\frac{2}{3}\right)\times 2 = \frac{9+8}{12}\times 2 = \frac{17}{12}\times 2 = \frac{17}{6} = 2\frac{5}{6}$ (m)

Answer: The length of the perimeter is 2 and 5 sixths metres.

b) *The side of a square is 4* $\frac{3}{5}$ *cm long. What length is its perimeter?*

$P = 4\frac{3}{5}\times 4 = 16+\frac{12}{5} = 16+2\frac{2}{5} = 18\frac{2}{5}$ (cm)

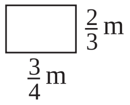
Answer: The length of the perimeter is 18 and 2 fifths centimetres.

Individual calculation but class kept together on questions, monitored, helped

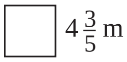
Discussion, reasoning, agreement, self-correction, praising

Extra praise for Ps who first drew a diagram

BB:



BB:



45 min

Y6

R: Ordering decimals and fractions

C: Fractions and decimals in calculations: addition, subtraction

E: Rational numbers. Problems

Lesson Plan 37

Activity / *Notes*

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- <u>37</u> is a prime number — Factors: 1, 37
- <u>212</u> = 2 × 2 × 53 = $2^2 \times 53$ — Factors: 1, 2, 4, 53, 106, 212
- <u>387</u> = 3 × 3 × 43 = $3^2 \times 43$ — Factors: 1, 3, 9, 43, 129, 387
- <u>1037</u> = 17 × 61 (nice) — Factors: 1, 17, 61, 1037

Individual work, monitored

(or whole class activity)

BB: 37, 212, 387, 1037

Calculators allowed for 1037.

Reasoning, agreement, self-correction, praising

e.g.

$$\begin{array}{r|l} 212 & 2 \\ 106 & 2 \\ 53 & 53 \\ 1 & \end{array} \qquad \begin{array}{r|l} 387 & 3 \\ 129 & 3 \\ 43 & 43 \\ 1 & \end{array} \qquad \begin{array}{r|l} 1037 & 17 \\ 61 & 61 \\ 1 & \end{array}$$

6 min

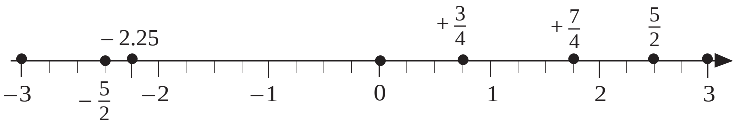
2

Fractions and decimals

a) Let's mark these <u>rational</u> numbers on the number line.

Ps come to BB to draw dots and label them. Class points out errors.

BB: + 3, 0, – 2.25, $\frac{5}{2}$, – 3, + $\frac{7}{4}$, – $\frac{5}{2}$, + $\frac{3}{4}$



Let's list them in increasing order. Ps dictate to T.

BB: $-3 < -\frac{5}{2} < -2.25 < 0 < +\frac{3}{4} < +\frac{7}{4} < \frac{5}{2} < +3$

Which numbers form <u>opposite</u> pairs? (– 3 and + 3, – $\frac{5}{2}$ and $\frac{5}{2}$)

Agree that every positive number (integer, fraction and decimal) has an opposite negative number which is the same distance from zero. What do we call the distance of a number from zero? (its <u>absolute value</u>) Who remembers how to write it mathematically? Ps come to BB or T reminds Ps if necessary.

b) Let's mark $\frac{5}{9}$ and $\frac{6}{9}$ on the number line. Ps come to BB to draw dots and label them. Class agrees/disagrees.

Let's think of a rational number which is greater than $\frac{5}{9}$ but less than $\frac{6}{9}$. **A** makes a suggestion (e.g. $\frac{11}{18}$) and class agrees.

Who can write an inequality about **A**'s number? T helps P to write and explain his or her reasoning. Who can think of other numbers?

BB: e.g. $\frac{5}{9} = \frac{15}{27} < \frac{17}{27} < \frac{18}{27} = \frac{6}{9}$ (or $\frac{16}{27}$ or $\frac{23}{36}$, or . . .)

or $\frac{5}{9} = 0.\dot{5} < \boxed{0.56 < 0.57 < 0.63 < 0.634} < 0.\dot{6}$, etc.

Agree that the decimals could be increased to the next and next greater place value so the number of possible numbers which are greater than 5 ninths and less than 6 ninths is endless or <u>infinite</u>.

Whole class activity

Written/drawn on BB or use enlarged copy master or OHP

First elicit what a <u>rational</u> number is.

(A number which can be written as a fraction using 2 whole numbers, but with a non-zero number as the denominator.)

Agreement, praising

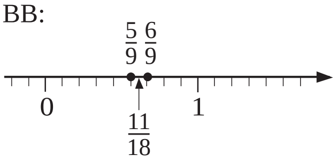
Discussion, agreement, praising

BB: <u>absolute value</u>

$$\left|-\frac{5}{2}\right| = \left|+\frac{5}{2}\right| = \frac{5}{2}$$

$$|-3| = |+3| = 3$$

BB:



$$\frac{5}{9} = \frac{10}{18} < \frac{11}{18} < \frac{12}{18} = \frac{6}{9}$$

T suggests the decimal form if Ps do not and elicits Ps' help incalculating the decimals and writing the inequality:

BB: $5 \div 9 = 0.555... = 0.\dot{5}$

$6 \div 9 = 0.666... = 0.\dot{6}$

Activity

Notes

2

(Continued

T: There is an infinite number of rational numbers between <u>any</u> two different rational numbers, so the number of rational numbers on the whole number line is also infinite.

There is also an infinite number of numbers which are <u>not</u> rational numbers. We call them <u>irrational</u> numbers.

This number (T writes on BB) is irrational, as there is no fraction which has a whole number as its numerator and a whole non-zero number as its demoninator which is equal to it.

What do you notice about it? (It has no definite endpoint so is not a finite decimal and no single digit or group of digits is repeated in order so it is not a recurring decimal either.) So there are infinite decimals which are <u>not</u> rational numbers.

T explains and Ps listen.

BB: <u>irrational number</u>

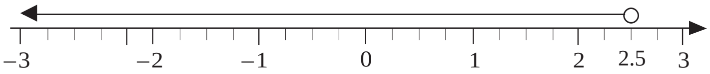
cannot be written as a fraction

e.g. 3.12122122212222 . . .

Agreement, praising

c) How can we show <u>all</u> the rational numbers less than 2.5 on the number line? Ps come to BB to show and explain if they can.

BB:



Elicit (or remind Ps) what the notation means:

- all the numbers below the arrow line are included in the set;
- the numbers in the set extend to infinity in the direction of the arrowhead;
- an open (white) circle above a number means that the number is <u>not</u> included in the set;
- a closed (black) circle means that the number <u>is</u> included.

Number line drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, praising

Extra praise for Ps who remember and can explain

Who can write an inequality about it?

BB: $x < 2.5$

Ps suggest values for *x*.. e.g.

$2,\ \frac{3}{7},\ 0,\ -0.2,\ -2\frac{1}{5},$ etc.

16 min

3

PbY6a, page 37

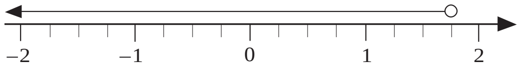
Q.1 Read: *Show the solution to each inequality on the number line.*

Set a time limit. Ps use rulers to draw the arrows.

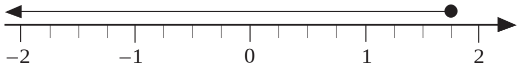
Review with whole class. Ps come to BB to say the inequality and to draw circles and arrows, explaining the difference between the 2 sets of numbers. Class agrees/ disagrees. Mistakes discussed and corrected.

Solution:

a) $x < 1\frac{3}{4}$



b) $x \le 1\frac{3}{4}$



Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Elicit that in set a) $1\frac{3}{4}$ is <u>not</u> included but in set b) it is.

Feedback for T

20 min

Y6

Lesson Plan 37

Activity

Notes

4

PbY6a, page 37

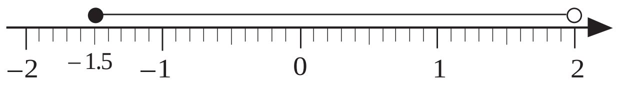
Q.2 Read: *Show the solution to each inequality on the number line.*

Set a time limit. Ask Ps to write a) as an inequality first.

Review with whole class. Ps come to BB to say the inequality and to draw circles and arrows (or dots for b)), explaining reasoning. Class agrees/ disagrees. Mistakes discussed and corrected.

Solution:

a) *Numbers which are less than + 2 but are not less than (– 1.5).*

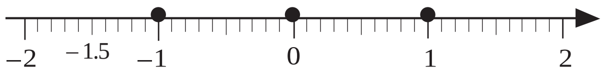


Are these numbers solutions to the inequality? T dictates.

– 1.4 (Yes), – 1.5 (Yes), – 1.6 (No), 0.2 (Yes), $-\frac{4}{5}$ (Yes),

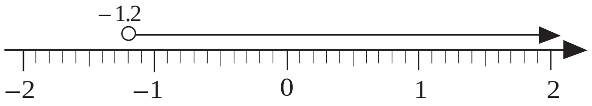
1 (Yes), 1.999 (Yes), 2 (No), 2.00001 (No)

b) *– 1.5 ≤ x < 2 and x is a whole number.*



Ps say statements about the inequality and class decides whether they are true or false.

c) $-x < 1.2$



Who could write the inequality in another way? ($x > -1.2$)

Individual work, monitored helped

Number lines drawn on BB or use enlarged copy master or OHP

Differentiation by time limit

Reasoning, areement, self-correcting praising

Feedback for T

BB: $-1.5 \le x < 2$

Ps shout Yes or No in unison.

Ps with opposing views explain at BB and class decides who is correct.

Agree that dots should be used here, not arrows and circles.

Accept reasoning using example and counter example: e.g.

– 2 is no good, as
$-(-2) = 2$, and $2 > 1.2$

– 1 is o.k. as
$-(-1) =$, and $1 < 1.2$, etc.

26 min

5

PbY6a, page 37

Q.3 Read: *Practise addition and subtraction in your exercise book.*

Deal with one row at a time. Set a time limit. Ask Ps to simplify their results where possible and ask more able Ps to give the results in decimal (fraction) form too where they can.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) i) $\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$ (= 1.4)

ii) $\frac{7}{15} - \frac{3}{15} = \frac{4}{15}$ (= $0.2\dot{6}$)

iii) $\frac{4}{9} + \frac{11}{9} - \frac{20}{9} = -\frac{5}{9}$ (= $-0.\dot{5}$)

iv) $3\frac{3}{6} + 2\frac{2}{6} - 4\frac{1}{6} = 1 + \frac{3+2-1}{6} = 1\frac{4}{6} = 1\frac{2}{3}$ (= $1.\dot{6}$)

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

(Allow Ps to use calculators for the decimals.)

Reasoning, agreement, self-correction, praising

Ps who make a mistake mark the error in red and write the calculation again correctly.

Feedback for T

Activity

Notes

5

(Continued)

b) i) $\frac{2}{5} + \frac{4}{15} = \frac{6}{15} + \frac{4}{15} = \frac{10}{15} = \frac{2}{3}$ (= $0.\dot{6}$)

ii) $\frac{5}{28} + \frac{2}{7} - \frac{3}{14} = \frac{5+8-6}{28} = \frac{7}{28} = \frac{1}{4}$ (= 0.25)

iii) $3\frac{5}{8} - \frac{7}{4} = 3\frac{5}{8} - 1\frac{3}{4} = 2 + \frac{5-6}{8} = 2 - \frac{1}{8} = 1\frac{7}{8}$

or $= 1 + \frac{13}{8} - \frac{6}{8} = 1 + \frac{7}{8} = 1\frac{7}{8}$

iv) $4 - 2\frac{5}{9} = 2 - \frac{5}{9} = 1\frac{4}{9}$ (= $1.\dot{4}$)

c) i) 13.4 – (10.25 – 5.6) = 13.4 – 4.65 = <u>8.75</u> (= $8\frac{3}{4}$)

ii) 13.4 – 10.25 + 5.6 = 19 – 10.25 = = <u>8.75</u>

d) i) – 5.6 – (+ 3.1) + (– 4.5) – (– 2.7) = – 5.6 – 3.1 – 4.5 + 2.7

= – 13.2 + 2.7 = <u>– 10.5</u>

ii) – 5.6 – 3.1 – 4.5 + 2.7 = <u>– 10.5</u>

Accept any valid method of calculation.

(= 1.875)

In c) and d), both parts are the same calculation written in 2 different ways.

(= $-10\frac{1}{2}$)

38 min

6

PbY6a, page 37

Q.4 Read: *Write a plan, calculate, check and write the answer as a sentence in your exercise book.*

Set a time limit or deal with one question at a time.

Review with whole class. Ps could show results on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Who did the same? Who did it another way? etc. Mistakes discussed and corrected. T chooses a P to say the answer in a sentence.

Solution:

a) *Tommy Tortoise took 1 hour to move* $65\frac{3}{4}$ *metres.*

This was $6\frac{5}{6}$ *metres more than the distance covered by Timmy Tortoise in the same time.*

What distance did Timmy Tortoise move in an hour?

Solution: e.g.

Plan: $65\frac{3}{4} - 6\frac{5}{6} = 59 + \frac{9-10}{12} = 59 - \frac{1}{12} = 58\frac{11}{12}$ (m)

or $= 59\frac{9}{12} - \frac{10}{12} = 58\frac{21}{12} - \frac{10}{12} = 58\frac{11}{12}$ (m)

Answer: *Timmy Tortoise* moved 58 and 11 twelfths metres in 1 hour.

Individual work, monitored, helped

Differentiation by time limit.

Responses shown in unison.

Discussion, reasoning, agreement, self-correction, praising

Extra praise for correct answer to c)

Feedback for T

Check:

$58\frac{11}{12} + 6\frac{5}{6} = 64\ \frac{11}{12} + \frac{10}{12}$

$= 64\frac{21}{12} = 65\frac{9}{12} = 65\frac{3}{4}$ ✓

Y6

Lesson Plan 37

Activity ***Notes***

6 (Continued)

b) *Jenny cut 3 pieces from a 20.8 m length of ribbon.*

The lengths of the 3 pieces were $5\frac{1}{2}$ *m, 7.2 m and* $2\frac{2}{5}$ *m.*

Could Jenny cut another piece 6.5 m long from the ribbon that is left?

Plan: $20.8 - (5\frac{1}{2} + 7.2 + 2\frac{2}{5}) = 20.8 - (5.5 + 7.2 + 2.4)$

$= 20.8 - 15.1 = \underline{5.7}$ (m)

5.7 m < 6.5 m

Answer: No, Jenny could <u>not</u> cut another piece 6.5 m long, as there is not enough ribbon left.

c) *The sum of two fractions is* $\frac{5}{8}$. *One fraction is 1 greater than the other fraction. What are the two fractions?*

Let the smaller fraction be *x*, so the larger fraction is *x* + 1.

Plan: $x + (x + 1) = \frac{5}{8}$

$$2 \times x + 1 = \frac{5}{8}$$

$$2 \times x = \frac{5}{8} - 1 = -\frac{3}{8}$$

$$x = -\frac{3}{8} \div 2 = \underline{-\frac{3}{16}}$$ (smaller fraction)

So greater fraction is $-\frac{3}{16} + 1 = \underline{\frac{13}{16}}$

Check: $-\frac{3}{16} + \frac{13}{16} = \frac{10}{16} = \frac{5}{8}$ ✔

Answer: The two fractions are $-\frac{3}{16}$ and $\frac{13}{16}$.

(Part c) could be done as a whole class activity, with T directing Ps' thinking if necessary, or could be set as homework to challenge the more able Ps and reviewed before the start of *Lesson 38*)

45 min

Y6

R: Calculations

C: Recognising equivalence betweem decimal and fraction forms

E: Rational numbers. Problems

Lesson Plan 38

Activity

Notes

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- <u>38</u> = 2 × 19 (nice) Factors: 1, 2, 19, 38
- <u>213</u> = 3 × 71 Factors: 1, 3, 71, 213
- <u>388</u> = 2 × 2 × 97 = $2^2 \times 97$ Factors: 1, 2, 4, 97, 194, 388
- <u>1038</u> = 2 × 3 × 173
  Factors: 1, 2, 3, 6, 173, 346, 519, 1038

Individual work, monitored (or whole class activity)

BB: 38, 213, 388, 1038

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.

388	2
194	2
97	97
1	

1038	2
519	3
173	173
1	

8 min

2

Fractions and decimals

a) T says a decimal and chooses a P to write it as a fraction or mixed number on BB while rest of class write it in *Ex. Bks*. Ps point out any errors made on BB or when a fraction could be simplified.

BB:

$$0.1 = \frac{1}{10},\quad 0.31 = \frac{31}{100},\quad 0.6 = \frac{6}{10} = \frac{3}{5},\quad 0.48 = \frac{48}{100} = \frac{12}{25},$$

$$15.3 = 15\frac{3}{10}\ \left(= \frac{153}{10}\right),\quad 3.419 = 3\frac{419}{1000}\ \left(= \frac{3419}{10\,000}\right),$$

$$-4.96 = -4\frac{96}{100} = -4\frac{24}{25}\ \left(= -\frac{496}{100} = -\frac{124}{25}\right)$$

$$0.33333\ldots = 0.\dot{3} = \frac{1}{3},\quad 0.\dot{6} = \frac{2}{3}$$

b) T says a fraction and chooses a P to write it (doing a division on BB or changing to a suitable equivalent fraction if they do not know it) as a decimal number while rest of class writes it in *Ex. Bks*. Ps point out errors made on BB or help Ps who are stuck.

BB:

$$\frac{1}{2} = 0.5,\quad \frac{2}{2} = 1.0\ (= 1) \qquad \frac{3}{2} = 1\frac{1}{2} = 1\frac{5}{10} = 1.5$$

$$\frac{13}{20} = \frac{65}{100} = 0.65 \qquad 10\frac{3}{4} = 10\frac{75}{100} = 10.75$$

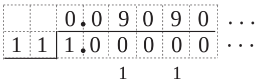
$$\frac{31}{25} = \frac{124}{100} = 1.24 \qquad \frac{11}{16} = 11 \div 16 = 0.6875$$

$$\frac{1}{3} = 1 \div 3 = 0.333\ldots = 0.\dot{3} \qquad \frac{2}{3} = 0.\dot{6}\ \ (= 2 \div 3 = 0.666\ldots)$$

$$\frac{4}{3} = 1\frac{1}{3} = 1.\dot{3} \qquad \frac{1}{9} = 1 \div 9 = 0.1111\ldots = 0.\dot{1}$$

$$\frac{2}{9} = 0.\dot{2},\qquad \frac{4}{9} = 0.\dot{4},\qquad \frac{5}{9} = 0.\dot{5}$$

$$\frac{5}{18} = 5 \div 18 = 0.2\dot{7} \qquad \frac{1}{11} = 1 \div 11 = 0.\dot{0}\dot{9} \text{ or } 0.\overline{09}$$



Whole class activity

Involve a different P at BB for each decimal.

Ps at BB explain reasoning to class.

At a good pace

Reasoning, agreement, praising

Elicit that 0.3333. . . is a <u>recurring</u> decimal where the digit below the dot is endlessly repeated.

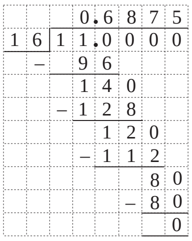
Reasoning, agreement, praising

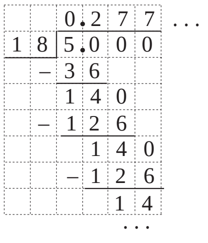
Agree on the general 'rule' for fractions:

BB: $\frac{a}{b} = a \div b$

or 3 ÷ 2 = 1.5

BB:





20 min

Y6

Lesson Plan 38

Activity ***Notes***

3

PbY6a, page 38

Q.1 Read: *Convert the decimals to fractions. Simplify where possible.*

Set a time limit or deal with parts a), b) and c) one at a time.
(Simplification can be done in easy steps if necessary.)

Review at BB with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) i) $0.27 = \frac{27}{100}$ ii) $0.46 = \frac{46}{100} = \frac{23}{50}$

iii) $10.35 = 10\frac{35}{100} = 10\frac{7}{20}$ iv) $103.5 = 103\frac{1}{2}$

b) i) $0.25 = \frac{25}{100} = \frac{1}{4}$ ii) $0.50 = \frac{50}{100} = \frac{1}{2}$

iii) $0.75 = \frac{75}{100} = \frac{3}{4}$ iv) $7.25 = 7\frac{25}{100} = 7\frac{1}{4}$

c) i) $0.125 = \frac{125}{1000} = \frac{25}{200} = \frac{5}{40} = \frac{1}{8}$

ii) $0.375 = \frac{375}{1000} = \frac{75}{200} = \frac{15}{40} = \frac{3}{8}$

iii) $0.625 = \frac{625}{1000} = \frac{125}{200} = \frac{25}{40} = \frac{5}{8}$

iv) $0.875 = \frac{875}{1000} = \frac{175}{200} = \frac{35}{40} = \frac{7}{8}$

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Extra praise if Ps know the equivalent fraction form without needing to calculate.

Encourage all Ps to try to learn by heart the decimal forms of simple fractions as it will save them time in future calculations.

T asks Ps to explain how to convert adecimal to a fraction in their own words.

e.g. 'Write the fraction as 10ths, 100th or 1000ths and then reduce the fraction to its simplest form.'

Feedback for T

26 min

4

PbY6a. page 38

Q.2 Read: *Convert the fractions to decimals.*

Set a time limit or deal with one row at a time.
(Ps can do necessary calculations in *Ex. Bks* or on scrap paper.)

Review at BB with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) $\frac{1}{2} = \underline{0.5}$, $\frac{2}{2} = \underline{1}$, $\frac{3}{2} = \underline{1.5}$, $5\frac{1}{2} = \underline{5.5}$, $-16\frac{1}{2} = \underline{-16.5}$

b) $\frac{1}{4} = \underline{0.25}$, $\frac{2}{4} = \frac{1}{2} = \underline{0.5}$, $\frac{3}{4} = \underline{0.75}$, $\frac{4}{4} = \underline{1}$,

$\frac{135}{4} = 33\frac{3}{4} = \underline{33.75}$

c) $\frac{1}{8} = \underline{0.125}$, $\frac{3}{8} = \underline{0.375}$, $\frac{5}{8} = \underline{0.625}$, $\frac{6}{8} = \frac{3}{4} = \underline{0.75}$,

$\frac{7}{8} = \underline{0.875}$

d) $\frac{1}{5} = \underline{0.2}$, $\frac{2}{5} = \underline{0.4}$, $\frac{3}{5} = \underline{0.6}$, $\frac{4}{5} = \underline{0.8}$, $\frac{9}{5} = 1\frac{4}{5} = \underline{1.8}$

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

Differentiation by time limit

Reasoning, agreement, self-correction, praising

Accept any correct method.

e.g. $\frac{3}{8} = 3 \div 8 = 0.375$

or $\frac{3}{8} = \frac{1}{8} \times 3$

$= 0.125 \times 3 = \underline{0.375}$

Elicit that to convert a fraction to a decimal, change to 10ths, 100ths, etc. where possible, or divide the numerator by the denominator. Show divisions in detail on BB if problems or disagreement.

Feedback for T

Y6

Lesson Plan 38

Activity ***Notes***

4

(Continued)

e) $\frac{1}{3} = 0.\dot{3}$, $\frac{2}{3} = 0.\dot{6}$, $\frac{3}{3} = \underline{1}$, $\frac{4}{3} = 1\frac{1}{3} = 1.\dot{3}$, $2\frac{1}{3} = 2.\dot{3}$

f) $\frac{1}{6} = 0.1\dot{6}$, $\frac{2}{6} = \frac{1}{3} = 0.\dot{3}$, $\frac{3}{6} = \frac{1}{2} = 0.5$,

$\frac{4}{6} = \frac{2}{3} = 0.\dot{6}$, $\frac{5}{6} = 0.8\dot{3}$

d) $\frac{1}{9} = 0.\dot{1}$, $\frac{2}{9} = 0.\dot{2}$, $\frac{4}{9} = 0.\dot{4}$, $\frac{5}{9} = 0.\dot{5}$, $\frac{7}{9} = 0.\dot{7}$

Extension

What about $\frac{8}{9}$ and $\frac{9}{9}$?

Elicit that: $\frac{8}{9} = 0.\dot{8}$ but $\frac{9}{9} = 1$, not $0.\dot{9}$.

Whole class activity or extra questions for quicker Ps.

35 min

5

PbY6a, page 38

Q.3 Read: *Do the calculations in your exercise book.*

Deal with one part at a time. Set a short time limit of 1 minute.

Review with whole class. Ps who have an answer show result on scrap paper or slates on command. Ps with different answers explain reasoning on BB. Class decides who is correct. Who had the correct answer but did it a different way?

Give extra praise to Ps who realised that it is easier to simplify each fraction before calculating.

Ps who did not obtain an answer or were wrong, write the calculation correctly in *Ex. Bks*.

Solution:

a) $\frac{63}{84} + \frac{45}{75} - \frac{72}{90} = \frac{3}{4} + \frac{3}{5} - \frac{4}{5} = \frac{15 + 12 - 16}{20} = \frac{11}{20}$

(or $\frac{63}{84} = 63 \div 84 = 9 \div 12 = 3 \div 4 = 0.75$

$\frac{45}{75} = 45 \div 75 = 9 \div 15 = 3 \div 5 = 0.6$

$\frac{72}{90} = 72 \div 90 = 8 \div 10 = 4 \div 5 = 0.8$

$0.75 + 0.6 - 0.8 = 1.35 - 0.8 = \underline{0.55}$)

b) $\frac{45}{35} + \frac{20}{16} - \frac{15}{35} + \frac{20}{28} = \frac{9}{7} + \frac{5}{4} - \frac{3}{7} + \frac{5}{7} = \frac{11}{7} + \frac{5}{4}$

$= 1\frac{4}{7} + 1\frac{1}{4} = 2 + \frac{16 + 7}{28} = 2\frac{23}{28}$

Individual trial first, monitored

(or whole class activity, with Ps suggesting what to do)

Written on BB or SB or OHT

Responses shown in unison.

Discussion, reasoning, agreement, self-correction, praising

Agree that it is very difficult to do the calculation without simplifying first!

as $\frac{63}{84} = \frac{9}{12} = \frac{3}{4}$

$\frac{45}{75} = \frac{9}{15} = \frac{3}{5}$

$\frac{72}{90} = \frac{8}{10} = \frac{4}{5}$

[T might show conversion to decimals in a), or a P might have used it, but agree that it is only useful if the fractions form <u>finite</u> decimals, which is not the case in b) where sevenths form recurring decimals. Agree that simplification first is best.]

40 min

Y6

Lesson Plan 38

Activity

6

PbY6a, page 38

Q.4 Read: *Solve the problems and equations in your exercise book.*

Deal with one at a time. Set a time limit.

Review with whole class. Ps who have an answer show results on scrap paper or slates on command. Ps answering correctly explain reasoning at BB. Who agrees? Who did it another way? etc. Mistakes discussed and corrected.

Ps who could not solve a question write solution in *Ex. Bks*.

Solution:

a) *If I add 1 to a number, the sum is* $\frac{27}{48}$. *What is the number?*

Plan: $x + 1 = \frac{27}{48} = \frac{9}{16}$, so $x = \frac{9}{16} - 1 = \underline{-\frac{7}{16}}$

Check: $-\frac{7}{16} + 1 = \frac{9}{16} = \frac{27}{48}$ ✔

Answer: The number is $-\frac{7}{16}$.

b) *If I subtract 3 from a number, the result is* $1\frac{1}{8}$.

What is the number?

Plan: $x - 3 = 1\frac{1}{8}$, so $x = 1\frac{1}{8} + 3 = 4\frac{1}{8}$

Check: $4\frac{1}{8} - 3 = 1\frac{1}{8}$ ✔

Answer: The number is $4\frac{1}{8}$.

c) $$\frac{x}{75} + \frac{11}{15} = \frac{18}{25}$$
$$\frac{x}{75} = \frac{18}{25} - \frac{11}{15}$$
$$= \frac{54}{75} - \frac{55}{75}$$
$$= -\frac{1}{75}$$
$$\underline{x = -1}$$

d) $$\frac{25}{14} - \frac{d}{70} = \frac{21}{10}$$
$$\frac{d}{70} = \frac{25}{14} - \frac{21}{10}$$
$$= \frac{125}{70} - \frac{147}{70}$$
$$= -\frac{22}{70}$$
$$\underline{d = -22}$$

- $25 = \underline{5} \times 5$, and $15 = 3 \times \underline{5}$, so lowest common multiple of 25 and 15 is $3 \times 5 \times 5 = 75$.
- $14 = \underline{2} \times 7$, and $10 = \underline{2} \times 5$, so lowest common multiple of 14 and 10 is $2 \times 5 \times 7 = 70$.

45 min

Notes

Individual work, monitored helped

(or whole class activity if time is short, with Ps scoming to BB or dictating what T should write)

Responses shown unison.

Discussion, reasoning, agreement, self-correction, praising

Accept any correct method but T should also show the methods opposite if no P used them.

Ps who could solve c) and d) without help from T should be given a round of applause!

c) *Check:*

$$-\frac{1}{75} + \frac{11}{15} = -\frac{1}{75} + \frac{55}{75}$$
$$= \frac{54}{75} = \frac{18}{25} \text{ ✔}$$

d) *Check:*

$$\frac{25}{14} - \left(-\frac{22}{70}\right) = \frac{25}{14} + \frac{22}{70}$$
$$= \frac{125}{70} + \frac{22}{70} = \frac{147}{70} = \frac{21}{10}$$
✔

(Underlined numbers are common factors, so are used once in forming the multiple)

Y6

R: Calculations with fractions and integers

C: Using fractions and decimals as 'operators'

E: Direct proportion. Problems

Lesson Plan 39

Activity ***Notes***

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- $\underline{39} = 3 \times 13$ (nice) Factors: 1, 3, 13, 39
- $\underline{214} = 2 \times 107$ (nice) Factors: 1, 2, 107, 214
- $\underline{389}$ is a prime number Factors: 1, 389

  (as not exactly divisible by 2, 3, 5, 7, 11, 13, 17 and 19, and $23 \times 23 > 389$)
- $\underline{1039}$ is a prime number Factors: 1, 1039

  (as not exactly divisible by 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, and $37 \times 37 > 1039$)

Individual work, monitored (or whole class activity)

BB: 39, 214, 389, 1039

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.

$$\begin{array}{r|l} 214 & 2 \\ 107 & 107 \\ 1 & \end{array}$$

6 min

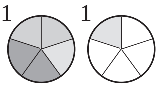
2

Multiplication of fractions

a) What does $\frac{2}{5} \times 3$ mean? Ps say what they know. e.g.

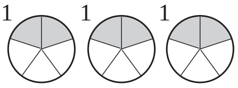
BB: $\boxed{\frac{2}{5} \times 3}$ $\frac{2}{5} + \frac{2}{5} + \frac{2}{5} = \frac{6}{5} = \underline{1\frac{1}{5}}$

or $\frac{2}{5}$ multiplied by 3



Let's calculate $\frac{2}{5}$ of 3 units. How could we do it?

Ps come to BB or dictate to T. e.g.



BB: $\boxed{\frac{2}{5} \text{ of } 3}$ $3 \div 5 \times 2 = \frac{15}{5} \div 5 \times 2$

$= \frac{3}{5} \times 2 = \frac{6}{5} = \underline{1\frac{1}{5}}$

b) Let's calculate $\left(-\frac{7}{12}\right) \times 4$. Ps come to BB or dictate to T.

BB: $\left(-\frac{7}{12}\right) \times 4 = -\frac{28}{12} = -2\frac{4}{12} = \underline{-2\frac{1}{3}}$

or $= -\frac{7}{3} = -2\frac{1}{3}$

Who can explain how to multiply a fraction by a natural number?

'Multiply the numerator or, where possible, divide the denominator.'

c) Let's continue the pattern. Ps come to BB or dictate to T.

BB: $\frac{3}{16} \times -1 = (-\frac{3}{16})$, $\frac{3}{16} \times -2 = (-\frac{3}{8})$, $\frac{3}{16} \times -4 = (-\frac{3}{4})$,

$[\frac{3}{16} \times -8 = -\frac{3}{2} = -1\frac{1}{2}$, $\frac{3}{16} \times -16 = -3$,

$\frac{3}{16} \times -32 = -6$, $\frac{3}{16} \times -64 = -12, \ldots]$

Whole class activity

Reasoning, agreement, praising

T helps with drawing diagrams.

What do you notice?

BB: $\frac{2}{5}$ of $3 = \frac{2}{5} \times 3$

Reasoning, agreement, praising

First 3 operations written on BB. Ps write results then continue the pattern.

What do you notice?

(Sequence is being multiplied by 2 but it is <u>decreasing</u>.)

Show on the number line.

Activity

Notes

2

(Continued)

d) Let's continue this pattern. Ps come to BB or dictate to T.

BB: $-\frac{3}{16}\times 3 = (-\frac{9}{16})$, $-\frac{3}{16}\times 2 = (-\frac{3}{8})$, $-\frac{3}{16}\times 1 = (-\frac{3}{16})$,

[$-\frac{3}{16}\times 0 = 0$, $-\frac{3}{16}\times -1 = \frac{3}{16}$, $-\frac{3}{16}\times -2 = \frac{6}{16} = \frac{3}{8}$,

$-\frac{3}{16}\times -3 = \frac{9}{16}$, . . .]

Who can explain what happens when a number is multiplied by – 1?
(Multiplying by – 1 results in the opposite number.)

What do you notice about the sequence?

(It is increasing, but the multiplier is decreasing.)

Show on the number line.

11 min

3

PbY6a, page 39

Q.1 Read: *In your exercise book, calculate each product in two ways.*

Deal with part a) first, then part b). Set a time limit. Ps write the whole equation in *Ex. Bks*. and underline the result.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected. (Ask able Ps for the decimal form too.)

Solution:

a) i) $\frac{5}{8}\times 4 = \frac{5\times 4}{8} = \frac{20}{8} = \frac{5}{2} = 2\frac{1}{2}$ (= 2.5)

ii) $\frac{7}{10}\times 2 = \frac{7\times 2}{10} = \frac{14}{10} = \frac{7}{5} = 1\frac{2}{5}$ (= 1.4)

iii) $\left(-\frac{3}{28}\right)\times 7 = -\frac{3\times 7}{28} = -\frac{21}{28} = -\frac{3}{4}$ (= – 0.75)

iv) $\frac{6}{35}\times(-5) = -\frac{6\times 5}{35} = -\frac{30}{35} = -\frac{6}{7}$ $(= -0.\dot{8}5714\dot{2})$

v) $\left(-\frac{5}{8}\right)\times(-2) = \frac{5\times 2}{8} = \frac{10}{8} = \frac{5}{4} = 1\frac{1}{4}$ (= 1.25)

What do you notice about these fractions? (In each case, the denominator is a multiple of the multiplier.)

How could we write the 'rule' in a general way? Ps explain in own words then T helps Ps to write the algebraic formula.

Agree that in such cases, dividing the denominator by the multiplier is quicker and easier.

Let's use just the division method for part b). Set a time limit and review as in a). What do you notice? (In each case, the denominator is the same as the multiplier. Elicit the general rule.

Solution:

b) i) $\frac{2}{3}\times 3 = \frac{2}{1} = 2$ ii) $\frac{3}{8}\times 8 = \frac{3}{1} = 3$

iii) $\frac{5}{13}\times 13 = \frac{5}{1} = 5$ iv) $-\frac{7}{9}\times 9 = -\frac{7}{1} = -7$

v) $-\frac{3}{25}\times(-25) = \frac{3}{1} = 3$ vi) $\left(-\frac{8}{17}\right)\times(-17) = 8$

Individual work, monitored, (helped)

Written on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

Elicit the general rules.

or $= \frac{5}{8\div 4} = \frac{5}{2} = 2\frac{1}{2}$

or $= \frac{7}{10\div 2} = \frac{7}{5} = 1\frac{2}{5}$

or $= -\frac{3}{28\div 7} = -\frac{3}{4}$

or $= -\frac{6}{35\div 5} = -\frac{6}{7}$

or $= \frac{5}{8\div 2} = \frac{5}{4} = 1\frac{1}{4}$

General rule

$\frac{a}{b}\times c = \frac{a\times c}{b} = \frac{a}{b\div c}$

where b and c are not zero

i.e. $b \neq 0$, $c \neq 0$

General rule

$\frac{a}{b}\times b = a \quad (b \neq 0)$

Review that:

(+) × (+) → (+)

(+) × (–) → (–)

(–) × (+) → (–)

(–) × (–) → (+)

24 min

Y6

Lesson Plan 39

Activity

Notes

4

PbY6a, page 39

Q.2 *Read: a) Calculate 3 sevenths of the area of a 1 unit by 2 unit rectangle.*

b) Calculate: i) $\frac{5}{4}$ ***of*** *3* *ii)* $\frac{5}{4}$ ***times*** *3.*

Set a time limit. Ps colour the diagram in *Pbs.* appropriately then write operations in *Ex. Bks.*

Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees. Mistakes discussed and corrected.

Agree that a fraction <u>of</u> a number or quantity is the same as multiplying that number or quantity by the fraction.

Solution:

a) $\frac{3}{7}$ of 2 $= 2 \div 7 \times 3 = \frac{2}{7} \times 3 = \frac{6}{7}$ (sq. units) $\left(= \frac{3}{7} \times 2\right)$

b) i) $\frac{5}{4}$ of 3 $= 3 \div 4 \times 5 = \frac{3}{4} \times 5 = \frac{15}{4} = 3\frac{3}{4}$

ii) $\frac{5}{4}$ times 3 $= \frac{5}{4} \times 3 = \frac{15}{4} = 3\frac{3}{4}$

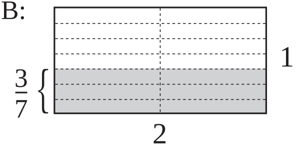
Individual work, monitored (helped)

Diagram drawn on BB or SB or OHT

Discussion, reasoning, agreement, self-correction, praising

A = 2 square units

BB:



BB: $\frac{5}{4}$ <u>of</u> 3 ⓔ $\frac{5}{4}$ <u>times</u> 3

29 min

5

PbY6a, page 39

Q.3 Read: *Calculate in your exercise book.*

Set a time limit. Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

T shows a quicker way of writing the calculation of the multiplication, by crossing out the numbers which can be reduced and writing the result instead.

T: We say that we are <u>cancelling down</u> these numbers.

Solution:

a) i) $\frac{5}{3}$ of 60 $= 60 \div 3 \times 5 = 20 \times 5 = \underline{100}$

ii) $60 \times \frac{5}{3} = \frac{\overset{20}{\cancel{60}} \times 5}{\cancel{3}_1} = 20 \times 5 = 100$

b) i) $\frac{11}{18}$ of 6 $= 6 \div 18 \times 11 = \frac{6}{18} \times 11 = \frac{66}{18} = \frac{11}{3} = 3\frac{2}{3}$

ii) $6 \times \frac{11}{18} = \frac{66}{18} = \frac{11}{3} = 3\frac{2}{3}$

c) i) $\frac{7}{3}$ of 8 $= 8 \div 3 \times 7 = \frac{8}{3} \times 7 = \frac{56}{3} = 18\frac{2}{3}$

ii) $8 \times \frac{7}{3} = \frac{56}{3} = 18\frac{2}{3}$

d) i) $\frac{17}{5}$ of 15 $= 15 \div 5 \times 17 = 3 \times 17 = \underline{51}$

ii) $15 \times \frac{17}{5} = \frac{\overset{3}{\cancel{15}} \times 17}{\cancel{5}_1} = 3 \times 17 = \underline{51}$

Individual work, monitored (helped)

Written on BB or SB or OHT

Differentiation by time limit

Reasoning, agreement, self-correction, praising

Agree that in each part, i) = ii)

T: 'A fraction <u>of</u> a number is the same as multiplying that number by the fraction.'

or $\overset{20}{\cancel{60}} \times \frac{5}{\underset{1}{\cancel{3}}} = 100$

or $\overset{1}{\cancel{6}} \times \frac{11}{\underset{3}{\cancel{18}}} = \frac{11}{3} = 3\frac{2}{3}$

or $\overset{3}{\cancel{15}} \times \frac{17}{\underset{1}{\cancel{5}}} = 51$

34 min

Activity ***Notes***

6 ***PbY6a, page 39***

Q.3 Read: *Solve these problems in your exercise book.*

Deal with one question at a time. Ps read question themselves, write a plan, do the calcualtion and write the answer in a sentence

Review with whole class. Ps show results on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Who did the same? Who did it another way? etc. Mistakes discussed and corrected. T chooses a P to say the answer in a sentence.

Solutions: e.g.

a) *Henry Hedgehog ate* $\frac{4}{13}$ *of his 39 apples. How many apples did he have left?*

Apples eaten: $\frac{4}{13}$ of 39 = 39 ÷ 13 × 4 = 3 × 4 = 12

Apples left: 39 – 12 = $\underline{27}$

or Part left: $1 - \frac{4}{13} = \frac{9}{13}$;

$\frac{9}{13}$ of 39 = 39 ÷ 13 × 9 = 3 × 9 = $\underline{27}$ (apples)

Answer: Henry Hedgehog had 27 apples left.

b) *Paul had £150. He spent* $\frac{1}{3}$ *of £150, then* $\frac{2}{5}$ *of £150.*

i) *How much did Paul spend?*

Spent: $\frac{1}{3}$ of £150 + $\frac{2}{5}$ of £150

£30

= £150 ÷ 3 + £150 ÷ 5 × 2

= £50 + £60 = $\underline{£110}$

Answer: Paul spent £110.

ii) How much money did he have left?

Plan: £150 – £110 = $\underline{£40}$

Answer: Paul had £40 left.

c) *Liz had £150. Then she was given some money by her grandparents so she now has* $\frac{4}{3}$ *of her original amount.*

If she spends $\frac{1}{4}$ *of her money, how much will she have left?*

Now has: $\frac{4}{3}$ of £150 = £150 ÷ 3 × 4 = £50 × 4 = £200

Spends: $\frac{1}{4}$ of £200 = £200 ÷ 4 = £50

Has left: £200 – £50 = $\underline{£150}$

Answer: Liz has £150 left.

Individual work, monitored, helped

Responses shown in unison.

Discussion, reasoning, agreement, self-correction, praising

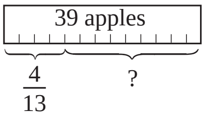
Accept any correct method of solution but deal with all methods used by Ps.

Draw diagrams on BB if necessary.

Feedback for T

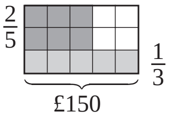
BB:

e.g.



BB:

e.g.



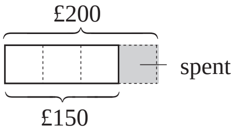
or Part spent altogether:

$\frac{1}{3} + \frac{2}{5} = \frac{5+6}{15} = \frac{11}{15}$

$\frac{11}{15}$ of £150 = £150 ÷ 15 × 11

= £10 × 11 = $\underline{£110}$

BB:



or has left: $\frac{3}{4}$ of $\frac{4}{3}$ of £150

= £150

Y6

Lesson Plan 39

Activity

6

(Continued)

d) *How much money do I have if* $\frac{5}{3}$ *of* $\frac{3}{5}$ *of it is £480?*

$\frac{5}{3}$ of $\frac{3}{5}$ $\rightarrow$ £480

$\frac{1}{3}$ of $\frac{3}{5}$ $\rightarrow$ £480 ÷ 5 = £96

$\frac{3}{3}$ of $\frac{3}{5}$ = $\frac{3}{5}$ $\rightarrow$ £96 × 3 = £288

$\frac{1}{5}$ $\rightarrow$ £288 ÷ 3 = £96

$\frac{5}{5}$ $\rightarrow$ £96 × 5 = $\underline{£480}$

Answer: I have £480.

e) *One side of a rectangle is 32 cm long and its adjacent side is* $\frac{3}{4}$ *of its length.*

i) *How long is the other side?*

$\frac{3}{4}$ of 32 cm = $\frac{3}{{}_{1}\cancel{4}} \times \overset{8}{\cancel{32}}$ cm = 3 × 8 cm = $\underline{24 \text{ cm}}$

Answer: The adjacent side is 24 cm long.

ii) How long is its perimeter?

P = 2 × (24 cm + 32 cm) = 2 × 56 cm = $\underline{112 \text{ cm}}$

Answer: Its perimeter is 112 cm.

iv) What is the area of the rectangle?

A = 32 cm × 24 cm = 64 cm × 12 cm = 128 cm × 6 cm = $\underline{768 \text{ cm}^2}$)

Answer: The area of the rectangle is 768 cm^2.

45 min

Notes

or (£480 ÷ 5 × 3) ÷ 3 × 5

= (£96 × 3) ÷ 3 × 5

= £288 ÷ 3 × 5

= £96 × 5 = $\underline{£480}$

or T might show:

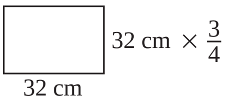
$(\overset{96}{\cancel{480}} \times \frac{3}{\cancel{5}_1}) \times \frac{5}{3}$

$= \overset{96}{\cancel{288}} \times \frac{5}{\cancel{3}_1} = \underline{480}$

Agree that:

$\frac{5}{3}$ of $\frac{3}{5}$ = $\frac{5}{3} \times \frac{3}{5}$ = 1

BB:



or

		3	2
	×	2	4
	1	2	8
+	6	4	0
	7	6	8

(cm^2)

Y6

Lesson Plan *40*

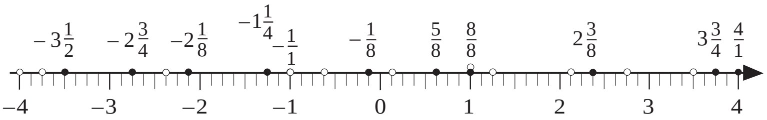
Activity

Factorising 40, 215, 390 and 1040. Revision, activities, consolidation

PbY6a, page 305

Solutions:

Q.1 a) and b)



c) – 4.0, – 3.75, – 3.5, – 2.75, – 2.375, – 2.125, – 1.25, – 1.0, – 0.625, – 0.125, 0.125, 0.625, 1.0, 1.25, 2.125, 2.375, 2.75, 3.5, 3.75, 4.0

d) Sum is <u>zero</u>, as every number and its opposite add up to zero.

Q.2 a) i) $\frac{4}{9} + \frac{2}{9} = \frac{6}{9} = \frac{2}{3}$ ii) $\frac{11}{12} - \frac{5}{12} = \frac{6}{12} = \frac{1}{2}$

iii) $\frac{13}{20} + \frac{3}{10} - \frac{21}{20} = \frac{13 + 6 - 21}{20} = -\frac{2}{20} = -\frac{1}{10}$

iv) $8\frac{2}{5} - 7\frac{3}{10} + 2\frac{1}{2} = 3 + \frac{4 - 3 + 5}{10} = 3\frac{6}{10} = 3\frac{2}{5}$

b) i) $\frac{3}{4} + \frac{9}{16} = \frac{12}{16} + \frac{9}{16} = \frac{21}{16} = 1\frac{5}{16}$

ii) $\frac{3}{100} + \frac{1}{4} - \frac{1}{5} = \frac{3 + 25 - 20}{100} = \frac{8}{100} = \frac{2}{25}$

iii) $11\frac{5}{13} - \frac{29}{26} = 11\frac{5}{13} - 1\frac{3}{26} = 10 + \frac{10 - 3}{26} = 10\frac{7}{26}$

iv) $8 - 3\frac{5}{7} = 5 - \frac{5}{7} = 4\frac{2}{7}$

c) i) 139 – (20.7 – 5.8) = 139 – 14.9 = <u>134.1</u>

ii) 45.33 – 8.03 + 9.1 = 37.3 + 9.1 = <u>46.4</u>

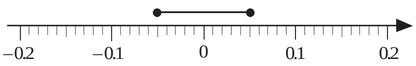
d) i) – 4.4 – (+ 5.5) + (– 3.3) – (– 2.2)

= – 4.4 – 5.5 – 3.3 + 2.2 = – 13.2 + 2.2 = <u>– 11.0</u>

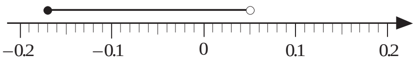
ii) – 100 – 54.35 – 17.98 + 20.6 = – 172.33 + 20.6

= <u>– 151.73</u>

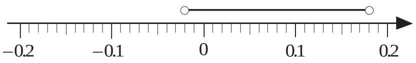
Q.3 a) $-0.05 \leq x \leq 0.05$



b) $-0.17 \leq x < 0.05$



c) $-0.02 < x < 0.18$



Notes

<u>40</u> = $2^3 \times 5$

Factors: 1, 2, 4, 5, 8, 10, 20, 40

<u>215</u> = 5×43

Factors: 1, 5, 43, 215

<u>390</u> = $2 \times 3 \times 5 \times 13$

Factors: 1, 2, 3, 5, 6, 10, 13, 15, 26, 30, 39, 65, 78, 130, 195 390

<u>1040</u> = $2^4 \times 5 \times 13$

Factors: 1, 2, 4, 5, 8, 10, 13, 16, 20, 26, 40, 52, 65, 80, 104, 130, 208, 260, 520, 1040

(or set factorising as homework at the end of *Lesson 39* and review at the start of *Lesson 40)*

Y6

Lesson Plan 40

Activity

Q.4 a) 1 quarter of a year = <u>3</u> months

1st month: Saved: £50
Spent: £50 ÷ 10 = £5
Left in savings: £50 – £5 = £45

2nd month: Saved: £45 + £50 = £95
Spent: £95 ÷ 10 = £9.50
Left in savings: £95 – £9.50 = £85.50

3rd month: Saved: £85.50 + £50 - £135.50
Spent: £135.50 ÷ 10 = £13.55
Left in savings: £135.50 – £13.55 = <u>£121.95</u>

Answer: Emma had saved £121.95 by the end of the quarter.

b) $\frac{3}{8}$ of $\frac{2}{3}$ → 12 000 g = 12 kg

$\frac{1}{8}$ of $\frac{2}{3}$ → 12 kg ÷ 3 = 4 kg

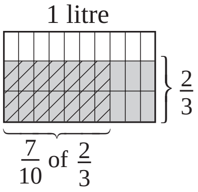
$\frac{8}{8}$ of $\frac{2}{3}$ = $\frac{2}{3}$ → 4 kg × 8 = 32 kg

$\frac{3}{3}$ → 32 kg ÷ 2 × 3 = 16 kg × 3 = <u>48 kg</u>

Answer: I weigh 48 kg.

c) B: $\frac{7}{10}$ of $\frac{2}{3}$ of 1 litre;

BB:



S: $\frac{3}{10}$ of $\frac{2}{3}$ of 1 litre

$\frac{1}{10}$ of $\frac{2}{3}$ = $\frac{2}{3}$ ÷ 10 = $\frac{2}{30}$ = $\frac{1}{15}$

$\frac{3}{10}$ of $\frac{2}{3}$ = $\frac{1}{15}$ × 3 = $\frac{1}{5}$; $\frac{1}{5}$ of 1000 cl = <u>20 cl</u>

Answer: Steve drank 20 cl.

d) 1st jump: 2.7 m

2nd jump: 2.7 m + $\frac{1}{9}$ of 2.7 m = 2.7 m + 0.3 m = 3.0 m

3rd jump: 3.0 m – $\frac{1}{6}$ of 3.0 m = 3.0 m – 0.5 m = 2.5 m

4th jump: $\frac{4}{5}$ of 2.5 m = 2.5 m ÷ 5 × 4 = 2.0 m

Total distance: 2.7 m + 3.0 m + 2.5 m + 2.0 m = <u>10.2 m</u>

Answer: The two bushes were 10.2 m apart.

Notes

or
50 – 50 ÷ 10 = 50 – 5 = <u>45</u>

(45 + 50) – (95 ÷ 10)
= 95 – 9.50 = <u>85.50</u>

(85.50 + 50) – (135.50 ÷ 10)
= 135.50 – 13.55 = <u>121.95</u>

or $\frac{3}{10}$ of $\frac{2}{3}$ = $\frac{2}{3}$ of $\frac{3}{10}$

$\frac{3}{10}$ of 1 litre = 30 cl

$\frac{2}{3}$ of 30 cl = 30 cl ÷ 3 × 2
= 10 cl × 2 = <u>20 cl</u>

Y6

R: Calculations

C: Revision: Solid shapes. Spatial elements

E: Describing and visualising properties of solid shapes

Lesson Plan *41*

Activity

Notes

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- 41 is a prime number Factors: 1, 41
- 216 = $2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^3 \times 3^3 = 6^3$ (cubic number)
  Factors: 1, 2, 3, 4, 6, 8, 9, 12,
  216, 108, 72, 54, 36, 27, 24, 18 ↓
- 391 = 17×23 Factors: 1, 17, 23, 391
- 1041 = 3×347 Factors: 1, 3, 347, 1041

8 min

Individual work, monitored (or whole class activity)

BB: 41, 216, 391, 1041

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.

$$\begin{array}{r|l} 216 & 2 \\ 108 & 2 \\ 54 & 2 \\ 27 & 3 \\ 9 & 3 \\ 3 & 3 \\ 1 & \end{array} \qquad \begin{array}{r|l} 391 & 17 \\ 23 & 23 \\ 1 & \end{array} \qquad \begin{array}{r|l} 1041 & 3 \\ 347 & 347 \\ 1 & \end{array}$$

2

Shapes

a) T points to an object in the classroom and asks Ps to say what they can about it. (e.g. colour, material, size, shape, what it is used for, plane (flat) or curved surface, etc.)

T and Ps choose other objects in the classroom, then real things outside the classroom and describe them in a similar way.

T: If we forget about colour, material, size, use and other such features, and just concentrate on the form or shape of an object, we talk about a geometric solid.

b) T has a variety of geometric solids on desk (see c) for examples) and some matching axonometric diagrams stuck (drawn) on BB.

T points to certain diagrams and Ps identify the matching solid. Ps point out the matching faces, edges and vertices on the model and on the diagram as a check.

c) T asks Ps to come to front of class and show the solids which are:

cubes (cuboids, prisms, spheres, cylinders, cones, semi-spheres, pyramids, etc.) Class agrees/disagrees or points out missed solids.

d) T holds up a solid and asks Ps to name it and say what they know about it. (e.g. triangular prism: 5 faces – 2 congruent, parallel triangles and 3 congruent rectangles; 6 vertices, 9 edges)

15 min

Whole class activity

At a good pace

In good humour!

Discussion, agreement, praising

[e.g. book, desk, ball, pencil, matchbox, apple, house, tree, boat, bus, mountain, living cell, monument, etc.]

BB: Geometric solid

face edge vertex
(vertices)

Agreement, praising

N.B. Use only solids which Ps have already learned about.

Ask Ps to write the name of the solid on BB. Class points out missed features. Praising only

Y6

Lesson Plan 41

Activity

Notes

3

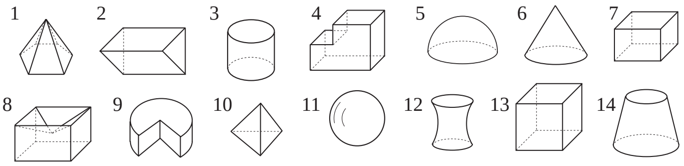
PbY6a, page 41

Q.1 Read: *Which description fits which solids? Write the numbers of the matching solids.*

Set a time limit of 5 minutes.

Review with whole class. Ps come to BB or dictate to T. Class agrees/disagrees or points out missed solids. Mistakes and omissions corrected.

Solution:



a) *It has only plane faces.* 1, 2, 4, 7, 8, 10, 13

b) *It has at least one plane face.* 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14

c) *It has at least 2 plane faces.* 1, 2, 3, 4, 7, 8, 9, 10, 12, 13, 14

d) *It has perpendicular faces.* 2, (3), 4, 7, 8, (9), 13

e) *It has at least one triangular face.* 1, 2, 8, 10

f) *It has only rectangular faces.* 7, 13

g) *It has at least 2 parallel edges.* 1, 2, (3), 4, 7, 8, 9, (12), 13, (14)

h) *It has perpendicular edges.* 2, 4, 7, 8, 9, 13

Individual work, monitored, helped

Drawn on BB o use enlarged copy master or OHP

(If possible, T also has models for demonstration.)

Differentiation by time limit.

Discussion, agreement, self-correction, praising

Accept the numbers in brackets too.

Extension

1. Ps name the solids that they know and tell class about their main properties. T reminds Ps of names of solids that they have learned but forgotten.

   1 : hexagon-based pyramid, 2 : triangular prism, 3 : cylinder,
   4 : octahedron or 8-sided polyhedron, 5 : hemisphere, 6 : cone,
   7: cuboid, 8: nonahedron or 9-sided polyhedron,
   10 : triangular pyramid, 11 : sphere, 13 : cube (12, 14 not learned)

2. T (Ps) give the numbers of certain shapes and Ps say what they have in common.

   (e.g. 2, 3, 9, 12, 14: exactly two faces which are parallel)

25 min

4

PbY6a, page 41

Q.2 Read: *Count the faces, edges and vertices of the above solids which have* ***only*** *plane faces. Complete the table.*

Set a time limit of 3 minutes. Review with whole class. Ps come to BB to write numbers in the table, explaining reasoning by referring to diagrams (or if possible to models). Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

Solid	1	2	4	7	8	10	13	
Number of faces	7	5	8	6	9	4	6	
Number of edges	12	9	18	12	16	6	12	
Number of vertices	7	6	12	8	9	4	8	

Do you notice a connection among the number of faces, edges and vertices? T gives a hint or points it out if Ps do not notice.

BB: $f + v = e + 2$ or $f + v - e = 2$

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Ps first identify the relevant solids (diagrams or models)

Reasoning, agreement, self-correction, praising

Elicit/remind Ps that a solid which has many plane faces is called a polyhedron.

To Ts only:

[Euler's polyhedron theorem]

30 min

Y6

Lesson Plan 41

Activity

Notes

5

PbY6a, page 41**, **Q.3

Read: *Complete the sentences.*

Deal with one part at a time. T chooses a P to read out the sentence, saying 'something' instead of the missing word.

Ps write the word they think is missing on scrap paper or slates and show on command. Ps with different words explain reasoning to class. Class decides who is correct. Draw diagrams on BB if necessary.

T writes agreed word on BB and Ps write it in *Pbs*. Class reads out the completed sentence, emphasising the word which was missed out.

Solution:

a) When we divide up a surface, the surface pieces are bounded by lines.

b) A line can be curved or straight.

c) When we divide up a line, the segments start and end with points.

d) *A point on a straight line divides the line into two half lines or rays.*

(Elicit that the two rays are endless in opposite directions.)

e) The part of a straight line between two different points is called a segment.

f) A straight line in a plane divides that plane into two half planes.

g) Two different parallel lines divide their plane into three parts.

h) Two intersecting lines divide their plane into four parts.

Elicit that any part of a plane not bounded by a line extends to infinity.

Extension

i) A plane divides space into two half spaces. (Half spaces are equal.)

j) Two planes can be parallel or intersecting. (Demonstrate with sheets of card.)

Whole class activity

Written on BB or use enlarged copy master or OHP

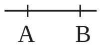
(with two extra questions – see Extension)

Responses shown in unison.

Discussion, reasoning, agreement, praising

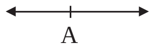
BB: e.g.

c)



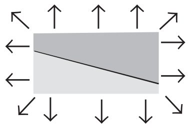
AB is a line segment.

d)



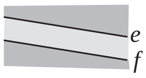
2 half lines or rays are equal.

f)

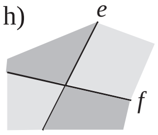


2 half planes are equal.

g)



h)



39 min

6

PbY6a, page 41

Q.4 Set a time limit of 3 minutes. Ps read questions themselves and choose from the points already labelled in the diagram.

Review with whole class. Ps come to BB or dictate to T. Who agrees? Who chose a different point? Mistakes discussed/corrected.

Solution:

a) Colour red a point on the plane P. (A, B, C or D)

*b) Colour green a point which is **not** on the plane P.* (E, F, G or H)

c) Colour yellow an edge which is in the plane P. (AB, BC, CD or DA)

*d) Colour blue an edge which is **not** in the plane P.* (EF, FG, GH or HE have no points n plane *P*)

Extension

T (or Ps) asks additional questions about the diagram. e.g.

e) Tell me an edge which intersects plane *P.* (AE, BF, CG or DH)

f) Tell me a face which is perpendicular to plane *P.* (ABFE, BCGF, CGHD or ADHE)

g) Tell me a face which is parallel to plane *P.* (EFGH)

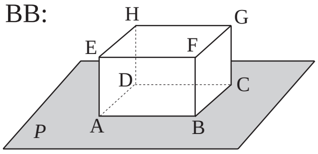
h) Tell me two edges which do not intersect each other and are not parallel. (e.g. edges: EH and CG)

i) Tell me two faces which have no common point. (e.g. ABFE and HGDC, i.e. parallel faces)

Individual work, monitored (or whole class activity)

Drawn on BB or use enlarged copy master or OHP

BB:



(Use a model too if possible.)

Agreement, self-correction, praising

(Also accept correct points which are not already labelled.)

Whole class activity

At a good pace, in good humour!

Extra praise for creativity!

45 min

Y6

R: Calculation

C: Plane shapes. Circles, polygons. Classifying triangles, quadrilaterals. Angles

E: Parts of circles

Lesson Plan 42

Activity ***Notes***

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- $42 = 2 \times 3 \times 7$ Factors: 1, 2, 3, 6, 7, 14, 21, 42
- $217 = 7 \times 31$ Factors: 1, 7, 31, 217
- $392 = 2 \times 2 \times 2 \times 7 \times 7 = 2^3 \times 7^2$
  Factors: 1, 2, 4, 7, 8, 14, 28, 49, 56, 98, 196, 392
- $1042 = 2 \times 521$ Factors: 1, 2, 521, 1042
  (521 is not exactly divisible by 2, 3, 5, 7, 11, 13, 17 or 19 and $23 \times 23 = 529 > 521$)

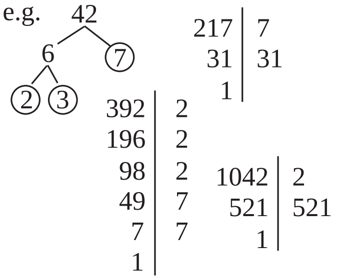
Individual work, monitored (or whole class activity)

BB: 42, 217, 392, 1042

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.



8 min

2

Revision: the components of a circle

Ps have plain sheets of paper, rulers, compasses and 4 straws on desks.

a) Mark a point with a cross in the middle of your sheet and label it C. Colour *red* all the points which are exactly 3 cm from C.

P comes to BB to use BB compasses (with T's help) or draws on an OHT (or T has diagram prepared). Elicit that they form a circle.

b) Colour *blue* those points which are less than 3 cm from C.
P comes to BB or OHT to show it (or T has it already prepared).
What is the the shape coloured *red*? (a circle)
What is the name of the shape coloured *red* or *blue*? (a circle)

T tells class that the set of *red* points form a line but the set of points coloured *red* or *blue* form a plane shape. Both are called circles. If we are dealing with the circle as a plane shape, what do we call the line enclosing it? (the circumference)

c) Place your 4 straws on your sheet of paper so that they are parallel and are 1 cm, 2 cm, 3 cm and 4 cm from C. T demonstrates on BB.

Lay your ruler along against each straw, remove the straw and draw a line instead. Label the lines *a*, *b*, *c* and *d*, with line *a* nearest C. What can you say about the 4 lines? (Parallel, equal distance apart.)

How many points does each line have in common with the circumference of the circle? (*a*: 2, *b*: 2, *c*: 1, *d*: 0)

T: We call lines such as *a* and *b* intersectors of the circle. Intersectors of a circle cross the circumference at 2 points.

We call a line such as *c* a tangent to the circle. A tangent meets the circumference of a circle at just 1 point.

d) Mark two different points on the circumference of your circle and label them E and F. Join E and F to C.

What do we call the line segements CE and CF?
(Each is a radius of the circle, or both are radii of the circle.)
Who can explain what a radius of a circle is? (A straight line joining the centre of a circle to a point on the circumference)

e) What does the broken line ECF form? (2 angles at centre of circle)

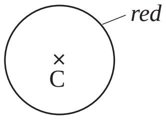
f) What do we call the plane shape ECF? (sector of a circle)

Whole class activity, but individual drawing and writing, monitored

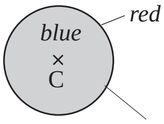
T helps Ps to use compasses.

BB:

circle

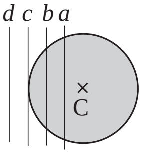


plane shape



circumference

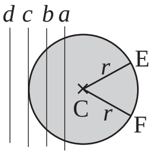
T quickly checks positions of straws before Ps draw the lines.



Ps come to BB to show them.

a and *b*: itersectors

c: tangent



Elicit that CE = CF = *r*

CE: radius, CE and CF: radii

(written as $\angle$ECF or $E\hat{C}F$)

(enclosed by 2 radii and arc EF)

16 min

Y6

Lesson Plan 42

Activity

3

PbY6a, page 42*, *Q.1

Read: *Complete the sentences about circles.*

T chooses a P to read each sentence. Ps show the word they think is missing on scrap paper or slates on command. After discussion and references to the relevant diagram drawn on BB, class agrees on correct word (or T reminds them if necessary). T writes agreed word on BB and Ps write it in *Pbs*.

Solution:

a) *The line segment joining the* ***centre*** *of a circle (C) and a point (D) on its* ***circumference*** *is called the* *radius.*

Elicit the names of the radii in the diagram (CD, CB, CA) and that they are of equal length, r. (Ps could draw others.)

b) *A section between two* ***points*** *on the circumference is called an* *arc.*

Elicit the names of some arcs in diagram. (AE, EF, FB, BD, DA, etc.)

If we join up two points on the circumference with a straight line, what do we call the line segment? (a chord of the circle, e.g. EF, AB)

c) *A* ***chord*** *which lies on the centre of the circle is called the* *diameter.*

Elicit that the diameter in the diagram is AB and its length is d.

d) *Two points on the circumference divide it into* *two* ***arcs****.* (AB, BA)

e) *Two* ***radii*** *of a circle divide the circle into* *two* ***sector****s.*

Ps come to BB to show the two sectors. Elicit that a sector is part of the circle plane bounded by 2 radii and an arc.

f) *A chord divides the circle into* *two* *segments.*

P comes to BB to draw a chord on the diagram (e.g. AB, or any 2 points on circumference.

g) *Line f is an* *intersector* *and line t is a* *tangent* *of the circle.*

Elicit that an intersector **crosses** the circumference at two points but a tangent **touches** the circle at just one point.

What other information does the diagram show us? (r is the radius; r and t have one common point, T, and are perpendicular)

Do you think any radius and any tangent with a common point on the circumference of the circle will be perpendicular? Ps try it in on BB or on scrap paper or in *Ex. Bks*.

Agree that a tangent is always perpendicular to the radius which meets it at a common point on the circumference.

24 min

Erratum
In *Pbs*:
'betwen'
should be
'between'

Erratum
In g):
'a'
should be
'an'

Notes

Whole class activity

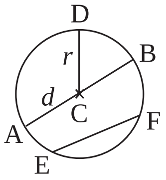
Drawn/written on BB or use enlarged copy masters or OHP

Responses shown in unison.

Discussion, agreement, praising

Elicit or tell additional details where appropriate.

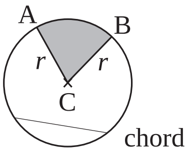
BB:



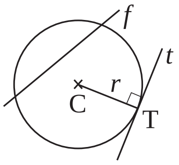
(A diameter is also a chord.)

T explains that in diagrams of circles, we usually call the length of the radius r and the length of the diameter d.
Elicit that $d = 2 \times r$

BB:



BB:



$r \perp t$

Y6

Lesson Plan 42

Activity

Notes

4

PbY6a, page 42

Q.2 Read: *Fill in the missing items about* ***angles.***

Talk about angles first. Ps say what they know with prompting from T if necessary. [Angles formed when 2 half lines or rays meet or when they are turned around a centre point as on a clock face. Angles are measured with protractors (T could show one to class) in degrees. An angle is identified with an arc to show the turn and is often labelled with a Greek letter. etc.]

Let's see if we can fill in what is missing.

Deal with one part at a time, Ps come to BB or dictate to T, referring to the diagram where necessary. e.g. In a), C is the centre of a circle and *e* and *f* are 2 half lines (or rays) extending to infinity.)

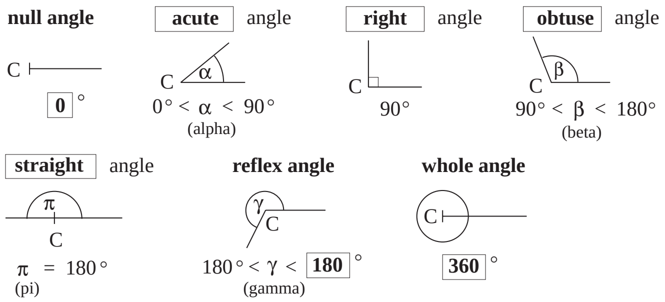
Who agrees? Who thinks something else? Teacher promps or guides as necessary. After agreement, Ps write missing word or number in *Pbs*.

Solution:

a) *The two half lines (e and f) form two* *<u>angles</u>.*

b) *C is the <u>vertex</u> and e and f are the <u>arms</u> of the angle* α.

c)



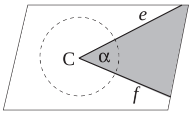
32 min

Whole class activity (or individual trial first)

Drawn/written on BB or use enlarged copy master or OHP

Discussion, agreement, (self-correction), praising

BB:



Ask Ps to give examples of specific angles for the inequalities.

T helps with pronunciation of Greek letters and Ps repeat in unison.

Elicit that:

- a <u>null</u> angle is no turn at all
- a <u>right</u> angle is a quarter of a turn
- a <u>straight</u> angle is half a turn. (i.e. 2 right angles)
- a <u>whole</u> angle is a complete turn (i.e. 4 right angles)

Feedback for T

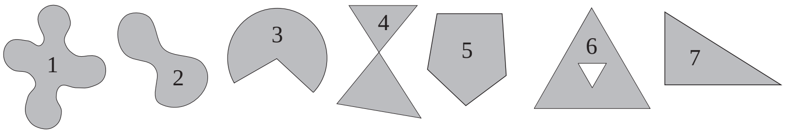
5

Plane shapes

What do these shapes have in common? (They are all plane shapes.)

Let's put them into sets in different ways. I will describe a set and you must tell me the numbers of the shapes which match the description.

BB:



a) It is enclosed by a single line. (1, 2, 3, 4, 5, 7)
b) It is enclosed by a single curved line. (1, 2)
c) It is enclosed only by straight lines (4, 5, 6, 7)

Who can think of other ways to put them into sets? Ps make suggestions and choose other Ps to list the set. e.g.

d) It is a polygon. (5, 7)
e) It is concave. (1, 2, 3, 4, 6)
f) It is enclosed by exactly 3 lines. (3, 7), etc.

37 min

Whole class activity

Drawn (stuck) on BB or use enlarged copy master or OHP

Ps come to BB or dictate list to T. Class agrees/disagrees.

At a good pace

Agreement, praising

Feedback for T

Extra praise for unexpected criteria

Y6

Lesson Plan 42

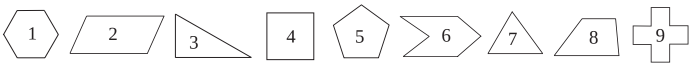
Activity | ***Notes***

6

PbY6a, page 42

Q.3 Read: *Which description fits which polygons? Write the numbers of the matching polygons.*

BB:



What is a polygon? (A plane shape enclosed by many straight sides but with only 2 sides meeting at a vertex.) Set a time limit.

Review with whole class. T chooses a P to read each description, then Ps come to BB to write list and point out the relevant shapes and criteria. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

a) *It has only* ***acute*** *angles.* (7)

b) *It has no angle greater than* 90°. (3, 4, 7)

Elicit that it has acute angles and/or right angles.

c) *It has more than 3* ***diagonals***. (1, 5, 6, 9)

Elicit that a diagonal is a straight line joining one vertex to another vertex which is not adjacent to it.

d) *It can be divided into more than 2 parts by* ***one*** *straight cut.* (6, 9)

Elicit that these are concave polygons.

Extension

T points to each polygon in turn and chooses Ps to say what they know about it. (e.g. name, parallel/perpendicular/equal sides, concave/convex, symmetry, types of angles, regular/irregular, etc.)

Individual work, monitored, (less able Ps helped)

Drawn (stuck) on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, self-correction, praising

Feedback for T

Extension

1: hexagon (regular, convex)
2: parallelogram
3: triangle (right-angled, scalene)
4: square
5: pentagon (regular, convex)
6: hexagon (irregular, concave)
7. triangle (equilateral)
8: trapezium (convex)
9: duodecagon (regular, concave) (12-sided polygon)

41 min

7

Drawing polygons

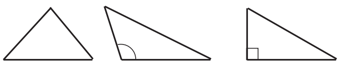
Ps have rulers, protractors and compasses on desks.

Deal with one part at a time. T dictates the names of polygons and Ps draw them in *Ex. Bks*. T monitors closely, correcting where necessary.

Review the important properties of each polygon with the whole class.

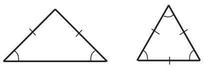
a) Draw an acute-angle, an obtuse-angled and a right-angled triangle.

BB: e.g.



b) Draw an isosceles triangle and an equilateral triangle.

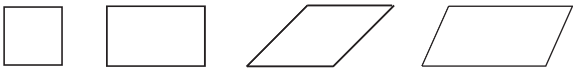
BB: e.g.



(Elicit that a triangle with no equal sides is a scalene triangle.)

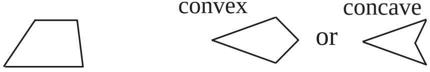
c) Draw a square, a rectangle which is not a square, a rhombus which is not a square, and a parallelogram which is not special.

BB: e.g.



d) Draw a trapezium which is not a parallelogram and a deltoid which is not a rhombus.

BB: e.g.



Individual drawing but class kept together on each task.

T monitors, helps, corrects

If time is short, Ps can just draw rough sketches and mark the important criteria.

T could have polygons already prepared on BB or SB or OHT. Elicit/remind Ps how to mark equal sides and angles, parallel and perpendicular sides.

Quick discussion on properties, agreement, self-correction, praising only

Feedback for T

45 min

Y6

R: Calculations

C: Triangles, quadrilaterals. Visualising 3–D from 2-D shapes. Nets

E: Drawing shapes wih increasing accuracy

Lesson Plan *43*

Activity ***Notes***

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 5 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- 43 is a prime number Factors: 1, 43
- 218 = 2 × 109 Factors: 1, 2, 109, 208
- 393 = 3 × 131 Factors: 1, 3, 131, 393
- 1043 = 7 × 149 Factors: 1, 7, 149, 1043

6 min

Individual work, monitored (or whole class activity)

BB: 43, 218, 393, 1043

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.

1043	7
149	149
1	

2

Lines

T gives instructions and Ps follow the steps in *Ex. Bks*, while an able P works on BB with BB instruments. Encourage Ps to work neatly and accurately.

a) Curved line

Draw a curved line in your *Ex. Bks*. Let me see it! Ps hold up *Bks*. Elicit that it is possible for a curved line to meet itself eventually to form a closed line.

b) Straight line

Draw a straight line in your *Ex. Bks* using your ruler. Label it *e*. How far does *e* extend? (To the edges of the page in our *Ex. Bks* but to infinity in both directions in our imagination) Elicit that it will never meet itself, however far it is extended.

c) Ray (half line)

Mark a point A in your *Ex. Bks*. and draw a ray with A as its starting point. Label the ray *a*.

How far does *a* extend? (From point A to the edge of the page in reality but from point A to infinity in our imagination.)

What part of a line is a ray? (half a line)

d) Line segment

Draw a line segment in your *Ex. Bks*. with A as its starting point and B as its end point. Label the line segment *a*.

How far does it extend? (From point A to point B)

Measure its length as accurately as you can and write an equation about it. T asks some Ps to write their equations on BB.

e) Perpendicular Lines

Draw a line *e*. Mark any point A on it. Draw ray *f* perpendicular to line *e* from point A. Who remembers how to do it? Ps come to BB if they do, or T demonstrates each step and Ps follow.

(Lay ruler along line *e*. Place bottom edge of set square against top edge of ruler with its vertical edge on point A. Draw a line from A along the vertical edge of the set square.)

What kind of angle have we drawn? (right angle) How do we mark it? (with a square) What is the relationship between lines *e* and *f*?

Ps have sharp pencils, rulers and set squares (or 2 rulers), on desks.

Whole class activity but individual drawing

T leads brief discussion after each drawing.

Praising, encouragement only

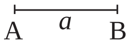
BB: e.g.

a)

b)

c)

d)

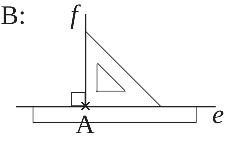


e.g. a = 3.4 cm

or AB = 3.4 cm

e) T could have steps already prepared on OHTs (or use a computer simulation)

BB:



$f \perp e$

(*f* is perpendicular to *e*)

Y6

Lesson Plan 43

Activity | **Notes**

2

(Continued)

f) Perpendicular distance

Draw another line *e*. Mark any point P which is not on the line. Draw line *f* perpendicular to line *e* and passing through point P.

(Similar to i) but with vertical edge of set square against point P.)

How far is point P from line *e*? Ps measure as accurately as they can and write it below their diagram.

T: When we want to find the distance between a point and a line, we always measure the perpendicular distance between them.

g) Intersecting lines

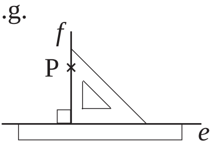
Draw 2 lines *e* and *f* which cross one another. Label the point where they cross A. T: We say that lines *e* and *f* intersect at point A.

How many angles do they form? (4) What do you notice about them? (Opposite angles are equal.) How do we mark it? (T reminds Ps if necessary.) Let's mark them and label one pair α and the other pair β.

What can we say about all the angles? (The 4 angles form a whole turn, or whole angle of 360°.) Who could write an equation about it?

P comes to BB and class writes equation below diagram in *Ex. Bks*.

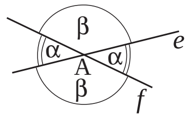
BB: e.g.



Perpendicular distance of P from *e* is 2.8 cm.

Elicit that this is the shortest distance.

Notation for equal angles:
1 arc for 1st equal pair;
2 arcs for 2nd equal pair, etc.



$$2 \times \alpha + 2 \times \beta = 360°$$

$$\text{or } 2 \times (\alpha + \beta) = 360°$$

16 min

3

PbY6a, page 43

Q.1 Read: *In your exercise book, draw:*

i) a triangle, ii) a quadrilateral, iii) a pentagon.

Complete the sentences.

Ps draw the shapes first and T quickly checks that they are correct. T chooses Ps to draw their shapes on BB.

What name can we give to all 3 shapes? (polygons)

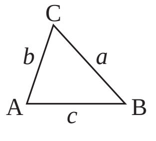
Discuss the usual way of labelling polygons. (Upper case letters for vertices, starting with A at bottom LH vertex and going in an anti-clockwise direction; lower case letters for sides: in triangles, *a* is opposite vertex A but in other polygons, *a* is adjacent to vertex A (and on RHS). Ps label their shapes.

Ps read each sentence themselves and write the missing words. Review with whole class. Ps could show words on scrap paper or slates on command. Ps with different words explain reasoning and class decides whether they are valid.

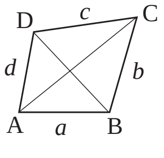
How many diagonals does each shape have? Elicit that a diagonal is a straight line joining vertices which are not adjacent. (triangle: 0, quadrilateral: 2, pentagon: 5)

Solution: e.g. (convex)

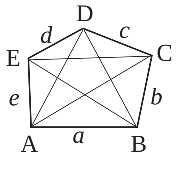
i)



ii)



iii)



a) *A **polygon** is enclosed only by straight sides.*

b) *A polygon has the same number of vertices as it has sides.*

c) *Each **vertex** of a polygon is shared by only 2 **sides**.*

d) *The broken line enclosing a polygon is closed and does not cross itself.*

Individual work, monitored, helped

Sentences written on BB or SB or OHT

Ps use BB ruler!

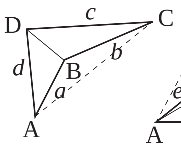
Revision. Ps who remember what to do come to BB to explain and demonstrate, or T reminds Ps.

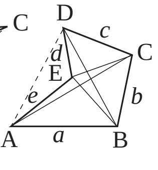
Responses shown in unison.

Agreement, self-correction, praising

Ps come to BB to draw them. Agreement, praising

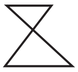
or ii) (concave) iii)





(line segments or a broken line)

(or sides and angles)

e.g.  is not a polygon

22 min

Y6

Lesson Plan 43

Activity

Notes

4

Erratum

In *Pbs*: 'triangle' should be 'triangles'

PbY6a, page 43

Q.2 Read *In your exercise book, draw three separate* ***acute*** *angles.*

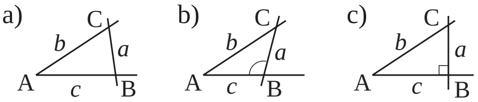
Cut the 2 arms of each angle with a straight line so that these triangles are formed:

a) acute-angled triangle
b) obtuse-angled triangle
c) right-angled triangle.

Set a short time limit. T monitors closely. T has 3 acute angles already drawn on BB or SB or OHT and chooses 3 Ps to make them into the 3 different triangles, labelling the vertices and sides appropriately. Class agrees/disagrees.

Ps compare their triangles with those on BB and correct them if necessary.

Solution:



Individual work, monitored, (helped)

Angles drawn on BB or SB or OHT

Agreement, self-correcting, praising

Elicit that:

- acute-angled triangle: each angle < 90°
- obtuse-angled triangle: 90° < 1 angle < 180°, 2 angles < 90°
- right-angled triangle: 1 angle = 90°, 2 angles < 90°

26 min

5

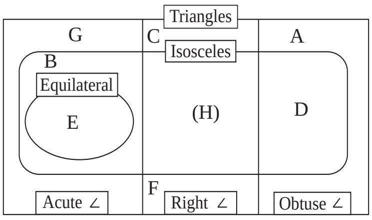
PbY6a, page 43

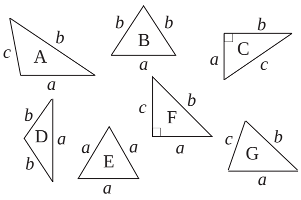
Q.3 Read: *Write the letters of these triangles in the correct part of the set diagram.*

Set a time limit of 2 minutes. Review with whole class. Ps come to BB to write the letters, explaining reasoning. Class agrees/ disagrees. Mistakes discussed and corrected.

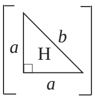
Elicit that an equilateral triangle has 3 equal sides (and is acute-angled) and an isosceles triangle has at least 2 equal sides (so an equilateral triangle is also an isosceles triangle).

Solution:





e.g.



Extension

Ps say true statements about the set diagram.

e.g. No equilateral triangle has an obtuse angle.
Every equilateral triangle has 3 acute angles. etc.
There is an isosceles triangle which has an obtuse angle.

Individual work, monitored, helped

(or whole class activity)

Drawn on BB or use enlarged copy master or OHP

Reasoning, agreement, self-correction, praising

What kind of triangle is not shown here so its set is empty? (A right-angled, isosceles triangle)

P comes to BB to draw a rough sketch of such a triangle but to label its sides correctly. (Ps draw one in space in *Pbs* too.) Let's call it H.

Ps write H in correct place in set diagram on BB and in *Pbs*.

Whole class activity

Praising, encouragement only

30 min

Y6

Lesson Plan 43

Activity ***Notes***

6

PbY6a, page 43

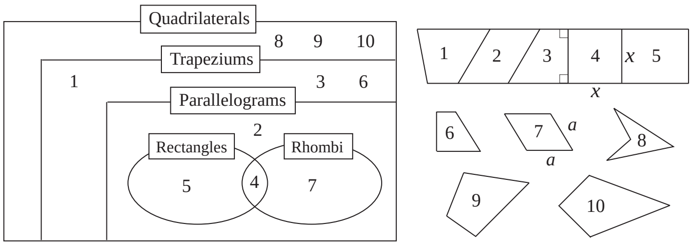
Q.4 Read: *Write the numbers of these quadrilaterals in the correct part of the set diagram.*

First review the definitions of each type of shape:

- a quadrilateral is a 4-sided polygon;
- a trapezium is a quadrilateral which has at least 1 pair of parallel sides;
- a parallelogram is a qadrilateral which has 2 pairs of parallel (and equal) sides;
- a rectangle is a quadrilateral which has opposite sides equal and parallel and adjacent sides perpendicular (or has only right angles);
- a rhombus is a quadrilateral which has opposite sides parallel and all its sides equal.

Set a time limit of 2 minutes. Review with whole class. Ps come to BB to write the numbers, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:



Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Quick revision with whole class to start

Elicit definitions from Ps.

Reasoning, agreement, self-correction, praising

What extra labels could we write on the set diagram and where could we put them?

- Square: at intersection of rectangles and rhombi;
- Deltoid: additional set inside quadrilaterals set but outside trapeziums set.

Extension

Ps say true statements about the set diagram.
e.g. Every rhombus is a trapezium.
There is a rhombus which is also a rectangle.
Not every parallelogram is a rectangle. etc.

Whole class activity

Praising, encouragement only

35 min

7

PbY6a, page 43

Q.5 Read: *Write the names of the solids below each diagram.*

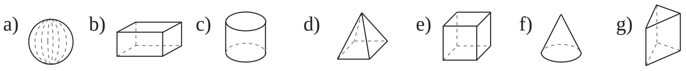
What is different about these shapes compared with the shapes in the previous questions? (3-dimensional) How do we know? (Edges which would not be visible if we were looking at real solids are shown by dotted lines in the diagrams.)

T: We call such diagrams axonometric diagrams.

Set a time limit of 1 minute.

Review with whole class. Ps come to BB to write names and say what they know about the solids. Class agrees/disagrees. Mistakes (including spelling mistakes) discussed and corrected.

Solution:



sphere cuboid cylinder pyramid cube cone prism

Individual work, monitored, (helped)

Drawn on BB or use enlarged copy master or OHP

BB: axonometric diagrams

Discussion, agreement, self-correction, praising

Ps give examples of such shapes in real life. (e.g. ball, matchbox, tin of fruit, dice, clown's hat or traffic cone, Toblerone box)

Extra praise for clever examples

39 min

Y6

Lesson Plan 43

Activity

Notes

7

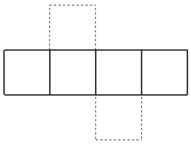
Nets

These diagrams are supposed to be the nets of a cube. Are they correct? (No, they shouldhave 6 faces.) How could we correct them?

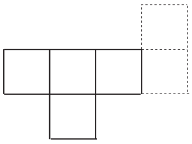
Ps come to BB to complete the nets. Class imagines the net folded to form a cube and agrees/disagrees. (If disagreement, T could cut the net from squared paper and fold to check.) Who can show the net completed in another way? Agree that several solutions are possible.

BB: e.g. (Possible amendments shown by dotted lines)

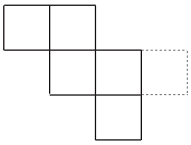
a)



b)



c)



Whole class activity

Drawn on BB or use enlarged copy master or OHP

Involve several Ps.

In good humour!

Discussion, reasoning, agreement, praising

Extra praising if Ps suggest a completely different correct net.

45 min

Homework

Ps note the task in *Ex. Bks*. T quickly revises how to use compasses if necessary. Encourage Ps to have sharp pencils and to measure accurately.

BB: Construct these shapes on plain paper using a ruler and a pair of compasses and label them.

a) A circle with radius 3 cm
b) A square with 4 cm sides
c) A 3 cm by 4.5 cm rectangle
d) An equilateral triangle with 3 cm sides.

N.B. Ps should by now have their own sets of instruments (ruler, compasses, protractor, set square) but school should supply them for Ps who do not have them.

Review as Activity 2 in *Lesson 44*.

Y6

R: Calculations. Construction

C: Recognise and estimate angles. Using protractors. Sum of the angles of a triangle

E: Sum of the angles of a quadrilateral

Lesson Plan 44

Activity

Notes

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 5 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- $\underline{44} = 2 \times 2 \times 11 = 2^2 \times 11$ Factors: 1, 2, 4, 11, 22, 44
- $\underline{219} = 3 \times 73$ Factors: 1, 3, 73, 219
- $\underline{394} = 2 \times 197$ Factors: 1, 2, 197, 394
- $\underline{1044} = 2 \times 2 \times 3 \times 3 \times 29 = 2^2 \times 3^2 \times 29$

  Factors: 1, 2, 3, 4, 6, 9, 12, 18, 29 ↓
  1044, 522, 348, 261, 174, 116, 87, 58, 36

8 min

Individual work, monitored (or whole class activity)

BB: 44, 219, 394, 1044

Calculators allowed.

Reasoning, agreement, self-correction, praising

Whole class listing of the factors of 1044.

e.g.

219	3
73	73
1	

394	2
197	197
1	

1044	2
522	2
261	3
87	3
29	29
1	

2

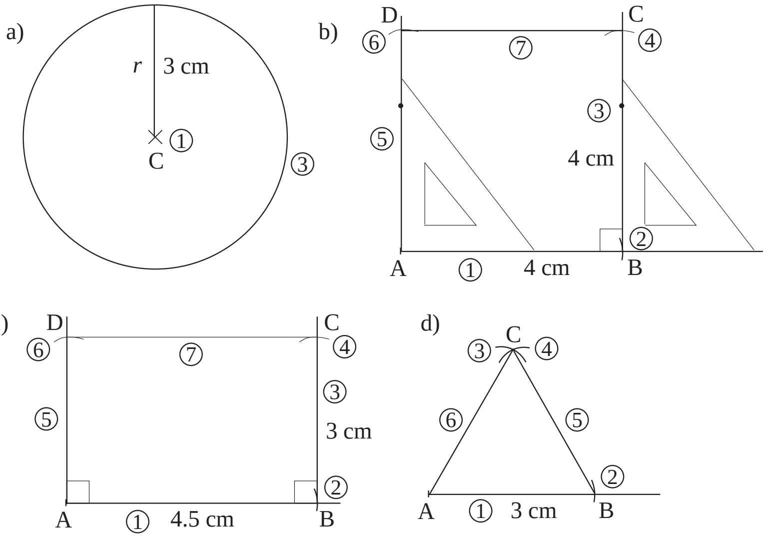
Review of homework

Ps have *Ex. Bks* open on desks. T does a quick check of all Ps' work.

Deal with one shape at a time in detail. Ps come to BB or dictate what T should do. (If necessary, T demonstrates how to set a pair of compasses to the required length using BB compasses and BB ruler.)

T corrects or adds steps as required, emphasising accuracy. Ps redraw any of their diagrams which are not close to the required dimensions.

BB: (Order of steps shown in diagrams as circled numbers.]



What can you say about the size of the angles in the square (rectangle, triangle)? (Angles in the square and rectangle are all 90°. Angles in the equilateral triangle are all 60°.)

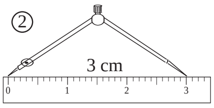
What can you say about the sum of the angles in the square (rectangle, triangle)? Elicit that:

- sum of the angles in the rectangle (and also in the square) is 360°;
- sum of the angles in the triangle is 180°.

13 min

Whole class check and discussion of the homework

e.g. a)



Reasoning, agreement, redrawing where necessary

Praising, encouragement only

Extra praise for a correct drawing of the equilateral triangle. (AB drawn first, then compasses set to 3 cm and arcs drawn with pointed arm of compass on A, then on B. Point where arcs intersect is C.)

Agreement, praising

Ps use protractors to measure the angles in the triangle

BB: $90° \times 4 = 360°$

$60° \times 3 = 180°$

Y6

Lesson Plan 44

Activity

Notes

3

Measuring angles

a) T: Measurement of angles means making a comparison: how many times more is the angle than the unit angle?

The unit angle used is usually 1° (one degree) and is one 360th of a whole angle (or of one complete turn).

Sometimes the unit angle used is the straight angle of 180°.

We call this unit angle a radian and use the Greek letter, pi (π), as its symbol.

e.g. A right angle is 90° or $\frac{\pi}{2}$ (half a radian)

b) Let's remind ourselves how to use a protractor to measure angles using 1 degree as the unit of measure.

T draws an angle on BB and Ps draw one in *Ex. Bks*. T uses a BB protractor to demonstrate how to measure the angle, while Ps copy the steps with own protractors in *Ex. Bks*. T draws an arc to show the angle and writes the size of the angle inside it. Ps do the same for their angles.

T asks 3 or 4 Ps what size of angle they drew.

Whole class activity

T explains and Ps listen.

BB: Unit angles

$1°$ (1 degree)

$360 \times 1° = 360°$ (whole angle)

π (1 radian)

$\pi = 180°$ (straight angle)

Ps watch then copy what T does.

(or T can use an OHT and a normal sized protractor if no BB protractor s available)

Praising only

17 min

4

PbY6a, page 44

Q.1 Read: *Measure these angles.*

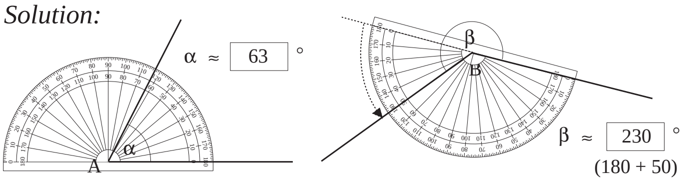
Set a time limit of 5 minutes. T monitors carefully, helping and correcting. Ps finished early help the slower Ps near them.

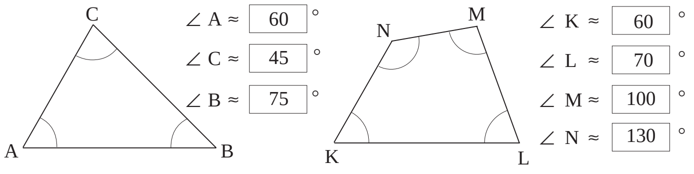
Review with whole class. Ps come to BB or dictate to T, showing (explaining) how they did the measurement.

Who agrees? Who has a different value? (Accept ± 1°, but Ps who are more inaccurate than that measure the angle again (with the help of a P who was correct).

Let's add up the angles of the triangle (quadrilateral).
Ps dictate what T should write. Agree that in the triangle, they sum to 180° and in the quadrilateral they sum to 360°.

Solution:





$60° + 45° + 75° = 180°$ $\quad$ $60° + 50° + 120° + 130° = 360°$

Individual work, monitored, helped, corrected

Drawn on BB or use enlarged copy master or OHP

(or Ps could show angles on scrap paper or slates in unison)

Discussion, reasoning, agreement, self-correcting, praising

Feedback for T

25 min

Activity ***Notes***

5

PbY6a, page 44

Q.2 Read: *Draw these angles in your exercise book.*

a) 40° *b)* 116° *c)* 270°

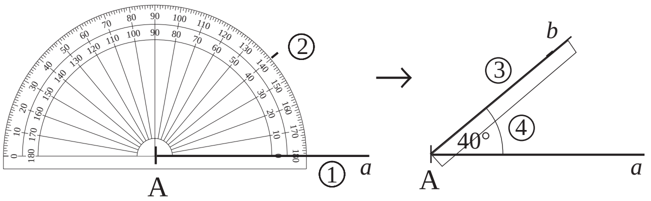
If necessary, T shows the procedure for a) on BB using BB ruler and protractor (or on an OHP with a normal sized protractor), with Ps following each step in *Ex. Bks.* Show Ps how to use their compasses to draw the arc marking the angle.

Set a time limit for the other two angles. T helps, corrects.

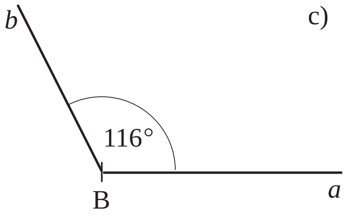
Review with whole class. Ps come to BB to draw the 2 angles using BB instruments and helped by T. Ps label the vertices, angles and rays appropriately. Ps check their neighbour's drawings. Again accept ± 1° accuracy. Ps with wildly inaccurate drawings do them again (with help of nearest P who was correct). What do you notice about c)? (*a*, *b* perpendicular)

Solution:

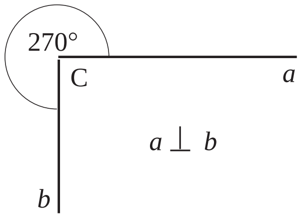
a)



b)



c)



Individual work, monitored, helped, corrected

Demonstration with whole class first if necessary

Agreement, checking, self-correction, praising only

Feedback for T

30 min

6

PbY6a, page 44

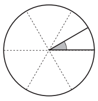
Q.3 Read: *How many degrees are these angles?*

Let's see if you can work them out without using your protractor! Set a time limit.

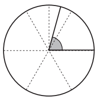
Review with whole class. Ps come to BB to or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Solution:

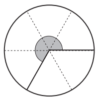
First 3 circles: $\frac{1}{6}$ of $360^\circ = 60^\circ$, so each sector is 60°



$60^\circ \div 2 = \underline{30^\circ}$

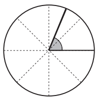


$60^\circ + 30^\circ \div 2 = \underline{75^\circ}$

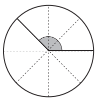


$180^\circ + 60^\circ = \underline{240^\circ}$

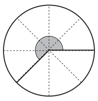
Last 3 circles: $\frac{1}{8}$ of $360^\circ = 45^\circ$, so each sector is 45°



$45^\circ + 45^\circ \div 2 = \underline{67.5^\circ}$



$90^\circ + 45^\circ = \underline{135^\circ}$



$180^\circ + 45^\circ = \underline{225^\circ}$

Individual work, monitored, helped

Drawn on BB or use enlarged copy master or OHP

Discussion, reasoning, agreement, self-correction, praising

Extra praise for clever ideas.

e.g.

2nd circle from LHS:

$90^\circ - 15^\circ = 75^\circ$

3rd circle from RHS:

$90^\circ - 22.5^\circ = \underline{67.5^\circ}$

or $22.5^\circ \times 3 = \underline{67.5^\circ}$

Y6

Lesson Plan 44

Activity | ***Notes***

6
Extension

(Continued)

T draws an angle on BB. How could we halve this angle without drawing a circle and dividing the circle into equal segments?

Ps make suggestions or come to BB to try out their ideas. If no P is on the right track, T gives hint about using compasses. If still no P has the correct idea, T leads Ps through the procedure while Ps follow the steps in *Ex. Bks*.

1. Set the compasses to a width less than the length of the arms.
2. Place the pointed arm on the vertex of the angle and mark a point on each of the arms by drawing an arc.
3. Keeping the compasses at the same width, place the pointed arm on each of these two marked points in turn and draw an arc.
4. Using a ruler, draw a line from the vertex through the point where the arcs cross.

Ps check that the two angles formed are equal with a protractor.

T: The line we have drawn divides the angle into two equal parts. We say that the line <u>bisects</u> the angle and we call the line the <u>bisector</u> of the angle.

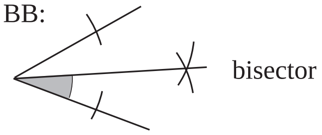
Why do you think that this method works?

Whole class acitivy

Discussion, demonstration, checking, agreement, praising

Extra praise if a P suggests the correct method without help from T

BB:



Elicit that shaded angle is half of the original angle.

(Every point on the bisector is an equal distance from any two corresponding points on the two arms of the angle.)

35 min

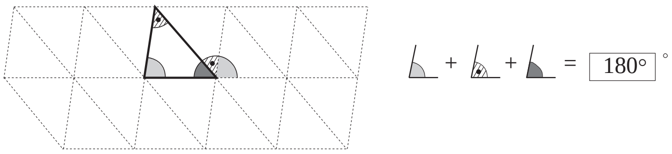
7

PbY6a, page 44**, **Q.4

a) Read: *What is the sum of the angles in this triangle? The shading might help you.*

Allow Ps a minute to think about it, then Ps show angle on slates or scrap paper on command. Ps with different angles come to BB to explain their reasoning. Class decides who is correct and Ps write correct angle in *Pbs*.

BB:



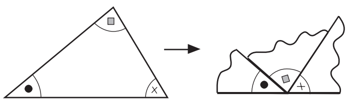
Read: *Is the sum the same for any other triangle in the grid?*

Ps show responses on scrap paper or slates (or with pre-agreed actions) on command. Agree that all the triangles in the grid are congruent, so the sum of their angles will be the same: 180°.

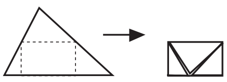
Will it be the same for any triangle? Who thinks yes (no)?

Let's check it. T has different kinds of large triangles cut from paper. Ps come to front of class to choose a triangle. How could we check that their angles sum to 180°? If no P suggests tearing or folding, T suggests it and asks class what they think about it. Ps at front of class demonstrate under T's' guidance.

<u>Tearing</u>



<u>Folding</u>



Agree that the sum of the angles of <u>any</u> triangle is 180°.
(i.e. They form a <u>straight</u> angle.)

Whole class activity
(or individual trial of whole question first, then review)

Drawn on BB or use enlarged copy master or OHP

Responses shown in unison.

Discussion, reasoning, agreement, praising

Agreement, praising

Whole class checking

(or Ps could also have different triangles on desks and tear and fold individually)

In good humour!

Agreement, praising

Activity ***Notes***

7

(Continued)

b) Read: *Fill in the missing items.*

Allow 1 minute. Review with whole class. Ps show angles on scrap paper or slates on command. Ps answering correctly explain to Ps who were wrong. Mistakes discussed and corrected.

Elicit that quadrilateral ABCD is made up of 2 triangles, so its angles sum to $180° \times 2 = 360°$.

Solution:

i) The sum of the angles in triangle ABC is $\boxed{180°}$

ii) The sum of the angle in triangle ACD is $\boxed{180°}$

iii) The sum of the angles in ABCD is $\boxed{360°}$

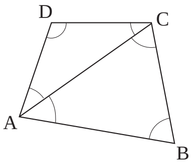
Individual work, monitored (or continue as whole class activity)

Drawn on BB or use enlarged copy master or OHP

Responses shown in unison.

Reasoning, agreement, self-correction, praising

BB:



41 min

8

PbY6a, page 44,

Q.5 Read: *Remember that* $1° = 60'$ *(angle minutes) and*
$1' = 60''$ *(angle seconds)*

Set a time limit. Ps read questions themselves, calculate in *Ex. Bks* and write the result in *Pbs*.

Review with whole class. Ps could show answers on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:

a) *Calculate the 3rd angle of a triangle which has angles of* $48° 30'$ *and* $62° 25'$.

Plan: $180° - (48°\ 30' + 62°\ 25') = 180° - 110°\ 55'$
$= \underline{69°\ 05'}$

Answer: The third angle of the triangle is $69°\ 05'$.

b) *What kind of triangle is it?* (acute-angled, scalene)

If no P writes 'scalene', elicit that as all the angles are different sizes, all the sides must be different lengths, so it is also a <u>scalene</u> triangle. T draws rough sketch on BB and Ps label angles, vertices and sides appropriately.

Individual work, monitored, helped

(or whole class acivity if time is short)

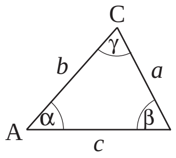
Resonses shown in unison.

Discussion, reasoning, agreement, self-correction, praising

(Change $1°$ to $60'$)

BB:

$$\begin{array}{r} 48°30' \\ +\ 62°25' \\ \hline 110°55' \\ \hline \end{array} \qquad \begin{array}{r} 179°60' \\ \cancel{180°} \\ -\ 110°55' \\ \hline 69°05' \\ \hline \end{array}$$



$\alpha = 48°30'$
$\beta = 62°25'$
$\gamma = 69°05'$

acute-angled, scalene triangle

45 min

Y6

Lesson Plan
45

Activity | ***Notes***

Factorising 45, 220, 395 and 1045. Revision, activities, consolidation

<u>45</u> = $3^2 \times 5$
Factors: 1, 3, 5, 9, 15, 45

<u>220</u> = $2^2 \times 5 \times 11$
Factors: 1, 2, 4, 5, 10, 11, 20, 22, 44, 55, 110, 220

<u>395</u> = 5 × 79
Factors: 1, 5, 79, 395

<u>1045</u> = 5 × 11 × 19
Factors: 1, 5, 11, 19, 55, 95, 209, 1045

(or set factorising as homework at the end of *Lesson 44* and review at the start of *Lesson 45)*

PbY6a, page 45

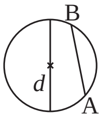
Solutions:

Q.1 e.g.

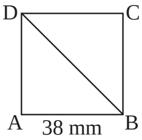
a) 1, 3, 7: It is a polygon.
b) 4, 5, 9: It is enclosed by a single curved line.
c) 2, 4, 5, 6, 8, 9: It has at least 1 curved side.
d) 1, 3, 6, 7, 10: It has at least 1 pair of parallel sides.
e) 1, 3, 7, 10: It has at least 1 pair of perpendicular sides.
f) 3, 4, 6, 8, 9, 10: It is concave.
g) 1, 2, 5, 6, 9: It has line symmetry.
h) e.g. 6, 7, 8: It has 4 sides.

Accept any valid criteria.

Q.2 a) i) d = 2.2 cm + 2.2 cm = 4.4 cm
ii) Ps' exact measurement.



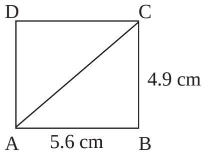
b)



i) BD ≈ <u>54 mm</u>
ii) P = 38 mm × 4 = <u>152 mm</u>
A = 38 mm × 38 mm = <u>1444 mm</u>^{2}

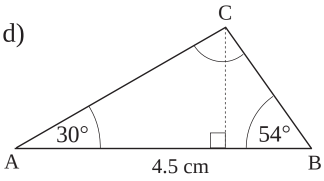
38 × 40 – (38 × 2)
= 1520 – 76 = <u>1444</u>

c) i) AC ≈ <u>7.4 cm</u>
ii) P = (5.6 + 4.9) × 2
= 10.5 × 2 = <u>21</u> (cm)
A = 56 mm × 49 mm
= <u>2744 mm</u>^{2} (= 27.44 cm^2)



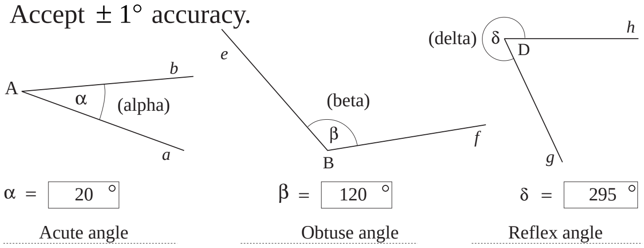
56 × 50 – 56
= 2800 – 56 = <u>2744</u>

d)

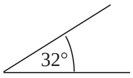


i) P = <u>10.5 cm</u>
ii) ∠ C = 96°
iii) Perp. height ≈ <u>1.8 cm</u>

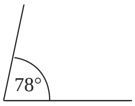
Q.3 a) Accept ± 1° accuracy.



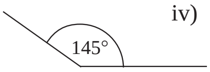
b) i)



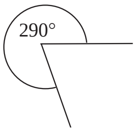
ii)



iii)



iv)



Y6

R: Calculation

C: Measures. Standard metric units. Time. Conversion

E: Different times around the world

Lesson Plan
46

Activity | *Notes*

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- <u>46</u> = 2 × 23 Factors: 1, 2, 23, 46
- <u>221</u> = 13 × 17 Factors: 1, 13, 17, 221
- <u>396</u> = $2 \times 2 \times 3 \times 3 \times 11 = 2^2 \times 3^2 \times 11$
  Factors: 1, 2, 3, 4, 6, 9, 11, 12, 18
  396, 198, 132, 99, 66, 44, 36, 33, 22
- <u>1046</u> = 2 × 523 Factors: 1, 2, 523, 1046
  (523 not exactly divisible by 2, 3, 5, 7, 9, 11, 13, 17, 19 and 23 × 23 < 523)

Individual work, monitored (or whole class activity)

BB: 46, 221, 396, 1046

Calculators allowed.

Reasoning, agreement, self-correction, praising

Whole class listing of the factors of 396

e.g.

$$\begin{array}{r|l} 221 & 13 \\ 17 & 17 \\ 1 & \end{array} \qquad \begin{array}{r|l} 396 & 2 \\ 198 & 2 \\ 99 & 3 \\ 33 & 3 \\ 11 & 11 \\ 1 & \end{array} \qquad \begin{array}{r|l} 1046 & 2 \\ 523 & 523 \\ 1 & \end{array}$$

8 min

2

Measuring

a) <u>Length</u>

Measure the length and width of your *Ex. Bks* and write them on each side of your slates (or sheet of scrap paper). Remember to write the unit of measure too!

Show me the length (width) . . . now! Ps will inevitably have varying degrees of accuracy. How could we write <u>true</u> statements about the length and width? (as inequalities) T and Ps agree on acceptable upper and lower limits in a suitable unit of measure.
T chooses 2 Ps to write inequalities on BB. Ps could write them in *Ex. Bks* too.

BB: . . . . .cm < length < . . . . .cm
. . . . .cm < width < . . . . cm

Let's list the units of length and write the relationship between them. Ps come to BB or dictate to T. Class agrees/disagrees. Ps write it in *Ex. Bks*. too.

BB:

$$\boxed{\begin{array}{c} 1\text{ mm} < 1\text{ cm} < 1\text{ m} < 1\text{ km} \\ \times 10 \quad \times 100 \quad \times 1000 \end{array}}$$

Extension

[T might mention a <u>light year</u>, which is the unit used to measure the huge distances between suns and galaxies in space. It is the distance light travels in 1 year.

BB: 1 <u>light year</u> ≈ 6 million million miles
(6 000 000 000 000 miles = 6×10^{12} miles)

Ps might agree that it is easier to write and read a very large number as a power of 10 than to write lots of zeros.]

Whole class activity but individual measuring

T monitors, helps, corrects

Each value shown in unison.

Discussion, agreement, praising

(Insert actual measurements according to size of *Ex. Bks*.)

At a good pace

Agreement, praising

Ps come to BB to write the actual number and also as a power of 10.

We say that we have written the number in <u>standard form</u>.

Activity

2

Extension

(Continued)

b) Area

Some Ps work in pairs to measure and calculate, e.g. the area of their desks, some work individually to measure, e.g. the surface area of an empty matchbox (Ps could have cm grid squares to help them) and some Ps work in a group to measure, e.g. the floor area of the classroom using a measuring tape or metre rule.

Set a time limit of 5 minutes. Ps report their findings to class and show their calculations on BB. Class points out errors.

Let's list the units of area and the relationships between them. Ps come to BB or dicate to T. Ps write it in *Ex. Bks*. too.

BB:

$$\boxed{\begin{array}{c} 1\text{ mm}^2 \;<\; 1\text{ cm}^2 \;<\; 1\text{ m}^2 \;<\; 1\text{ km}^2 \\ \times 100 \quad \times 10\,000 \quad \times 1\,000\,000 \end{array}}$$

T might mention a hectare used by farmers to measure the area of their fields.

BB: 1 hectare = 10 000 m^2 (i.e. an area 100 m × 100 m)

Elicit that 100 hectares = 1 km^2.

c) Mass

T has scales and various items on table at front of class. (e.g. glass or bottle of water, bag of sugar, apple, book, feather, button, etc.)

Ps come to front of class to choose an item and weigh it. Other Ps give estimates first and T writes them on BB. Then P who did the weighing writes the actual mass on BB. P with nearest estimate is given a clap.

Let's list the units of measure and the relationships between them. Ps come to BB or dictate to T. Class agrees/disagrees.

BB:

$$\boxed{\begin{array}{c} 1\text{ mg} \;<\; 1\text{ g} \;<\; 1\text{ kg} \;<\; 1\text{ tonne} \quad (<\; 1\text{ Megatonne}) \\ \times 1000 \quad \times 1000 \quad \times 1000 \qquad \times 1000 \end{array}}$$

Talk about the difference between mass and weight.

If an object has a mass of 1 kg on the Earth, it will also have a mass of 1 kg on the Moon. Mass involves the size of something and how dense the material is which makes it up.

Weight is how heavy something is and involves the force of gravity, which is much greater on the Earth than on the Moon.

BB: weight = mass × the local force of gravity

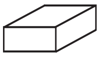
So if something weighs 1 kg on Earth, it will seem much lighter on the Moon. (Ps will no doubt have seen pictures of people and objects floating in space or on space ships.)

T points out that as the force of gravity is constant on Earth, mass and weight is often thought of as being the same thing.

Notes

Tasks set according to ability of Ps and number of measuring tools available.

Ps could use transparent cm measuring squares (see copy master)



Surface area of a matchbox = sum of areas of its 6 faces

Necessary calculations done in *Ex. Bks*.

Praising, encouragement only

Agreement, praising

BB: 1 m^2 > 1 ha < 1 km^2

×10 000 ×100

Praising

(Prepared before the lesson)

At a good pace

In good humour!

T helps in reading the scale.

Agreement, praising

[T might mention Megatonne (Mt) which is equal to 1000 tonnes.]

Extension

Force of gravity is measured in Newtons (N). 1 N is the force needed to move a mass of 1 kg by 1 m per second every second.

	On Earth	On the Moon
mass:	1 kg =	1 kg
weight (or gravitational force) for a mass of 1 kg:	10 N	1.6 N

Activity ***Notes***

2 (Continued)

d) <u>Capacity</u>

What is capacity? (The amount of liquid a container can hold.)

T has a measuring jug, various containers (e.g. spoon, cup, glass, bottle) and a bucket of water on desk. Ps come to BB to choose a container. Class estimates its capacity first and T writes estimates on BB. P fills the container with water and then pours it into the measuring jug. P reads the scale and writes the capacity on BB. P(s) with nearest estimate is given a pat on the back.

Let's list the units of capacity and the relationships between them. Ps come to BB or dictate to T. Class agrees/disagrees.

If we measured the amount of space each amount of water took up, what would their <u>volumes</u> be? T reminds Ps if they have forgotten.

BB:

$$\boxed{\begin{array}{ccccc} 1\text{ ml} & < & 1\text{ cl} & < & 1\text{ litre} \\ & \times 10 & & \times 100 & \end{array}}$$

Volume equivalents: 1 cm^3 10 cm^3 1000 cm^3 (of water)

Whole class demonstration, involving Ps where possible

At a good pace

In good humour!

Agreement, praising

If possible, T shows volume equivalents using multi-link cubes (prepared beforehand).

e) <u>Volume</u>

We can also say that the capacity of a container is the volume of the space inside it. What is volume? (The amount of space something takes up.) Let's list the units of volume. Ps dictate to T.

T reminds Ps or elicits how to write very large numbers in a simpler form as powers of 10. We call this writing a number in <u>standard form</u>.

BB:

$$\boxed{\begin{array}{ccccccc} 1\text{ mm}^3 & < & 1\text{ cm}^3 & < & 1\text{ m}^3 & < & 1\text{ km}^3 \\ & \times 1000 & & \times 1000\,000 & & \times 1000\,000\,000 & \\ & \text{(1 thousand)} & & \text{(1 million)} & & \text{(1 billion)} & \\ & \times 10^3 & & \times 10^6 & & \times 10^9 & \end{array}}$$

Elicit that volume is 3-dimensional and is the product of 3 measures: length, width and height.

BB: <u>Standard form</u>

written as a power of 10

i.e. the 'power' shows the number of times the number has been multiplied by 10, so the number of zeros on RHS.

20 min

3 ***PbY6a, page 46***

Q.1 Read: *Fill in the missing items.*

Set a time limit of 3 minutes. Review with whole class.

Ps come to BB or dictate what T should write. Class agrees or disagrees. Mistakes discussed and corrected.

Solution:

a) **Length** $1\text{ mm} \underset{\times 10}{<} 1\text{ cm} \underset{\times 100}{<} \boxed{\mathbf{1\ m}} \underset{\boxed{\times 1000}}{<} 1\text{ km}$

b) $\boxed{\textbf{Area}}$ $1\text{ mm}^2 \underset{\times 100}{<} \boxed{\mathbf{1\ cm^2}} \underset{\times 10\,000}{<} 1\text{ m}^2 \underset{\times 10\,000}{<} 1\text{ hectare} \underset{\boxed{\times \mathbf{100}}}{<} \text{km}^2$

c) **Mass** $1\text{ mg} \underset{\times 1000}{<} 1\text{ g} \underset{\boxed{\times \mathbf{1000}}}{<} 1\text{ kg} \underset{\times 1000}{<} \boxed{\mathbf{1\ t}}$

d) $\boxed{\textbf{Capacity}}$ $1\text{ ml} \underset{\times 10}{<} \boxed{\mathbf{1\ cl}} \underset{\boxed{\times \mathbf{100}}}{<} 1\text{ litre}$

e) **Volume** $1\text{ mm}^3 \underset{\times 1000}{<} \boxed{\mathbf{1\ cm^3}} \underset{\times 1\text{ million}}{<} 1\text{ m}^3 \underset{\times 1\text{ billion}}{<} \boxed{\mathbf{1\ km^3}}$

f) $\boxed{\textbf{Angle}}$ $1'' \underset{\times 60}{<} 1' \underset{\times 60}{<} 1°$

g) **Time** $1\text{ sec} \underset{\boxed{\times \mathbf{60}}}{<} 1\text{ min} \underset{\boxed{\times \mathbf{60}}}{<} 1\text{ hour} \underset{\times 24}{<} \boxed{\mathbf{1\ day}} \underset{\times 7}{<} 1\text{ week} \underset{\boxed{\times \mathbf{52}}}{<} \boxed{\mathbf{1\ year}}$

$\boxed{\times \mathbf{365}}$ (or 366)

Individual work, monitored, helped

Written on BB or use enlarged copy master or OHP

Differentiation by time limit.

Discussion, agreement, self-correction, praising

Feedback for T

Extension

What other units of <u>time</u> do you know? (month, year, decade, century, millennium) Ps say the unit of measure and also its relationship with another unit. e.g.

1 millennium = 1000 years

Which unit is not an <u>exact</u> standard unit of time? (month, year: months vary from 29 to 31 days and a year can be 365 or 366 days)

25 min

Y6		*Lesson Plan 46*
Activity		***Notes***
4	***PbY6a, page 46*** Q.2 Read: *Write the missing numbers.* Deal with one row at a time or set a time limit. Ps do necessary calculations in *Ex. Bks* or on scrap paper or slates. Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Show details of calculations on BB if problems or disagreement. Mistakes discussed and corrected. *Solution:* a) 34.6 m = $\underline{3460}$ cm = $\underline{34\ 600}$ mm = $\underline{0.0346}$ km b) 0.6 tonnes = $\underline{600}$ kg = $\underline{600\ 000}$ g c) 4567 g = $\underline{4.567}$ kg = $\underline{0.004567}$ tonnes d) 6282 ml = $\underline{628.2}$ cl = $\underline{6.282}$ litres e) 3.2 hours = $\underline{192}$ min = $\underline{11\ 520}$ sec f) 1.5 m^2 = $\underline{15000}$ cm^2 = $\underline{1500\ 000}$ mm^2	Individual work, monitored, helped Written on BB or use enlarged copy master or OHP Reasoning, agreement, self-correction, praising Feedback for T BB: e.g. e) $3.2\text{ h} = 3 \times 60 + \frac{1}{5}$ of 60 $= 180 + 12$ $= \underline{192}$ (min) 192 min $= 192 \times 60$ (sec) $= 1920 \times 6$ (sec) $= \underline{11\ 520}$ (sec)
Extension	Ps could write the large numbers in standard form. *31min*	
5	***PbY6a, page 46, Q.3*** Deal with one part at a time. T (or P) reads out each part. Ps calculate in *Ex. Bks* then show result on scrap paper or slates on command. P answering correctly explains at BB to Ps who were wrong. Who agrees? Who did it another way? etc. Mistakes discussed and corrected. *Solution:* *a) What is 3 quarters of 1 kg?* (750 g) BB: $1\text{ kg} \div 4 \times 3 = 1000\text{ g} \div 4 \times 3 = 250\text{ g} \times 3 = \underline{750\text{ g}}$ b) *What is 0.7 of 230 m?* (161 m) BB: $230\text{ m} \div 10 \times 7 = 23\text{ m} \times 7 = \underline{161\text{ m}}$ or 0.7 of 230 m $= 230\text{ m} \times 0.7 = 23\text{ m} \times 7 = \underline{161\text{ m}}$ c) *What is one and two fifths of 120 litres?* (168 litres) BB: $120 + 120 \div 5 \times 2 = 120 + 24 \times 2 = 120 + 48 = \underline{168}\ (\ell)$ d) *What is 3 quarters of 3 quarters of a km?* (562.5 m) BB: $\frac{3}{4}$ of $\frac{3}{4}$ km $= 750\text{ m} \div 4 \times 3 = 187.5\text{ m} \times 3 = \underline{562.5\text{ m}}$ or $\frac{3}{4}$ of $\frac{3}{4}$ km $= \frac{3}{4}$ km $\div 4 \times 3 = \frac{3}{16}$ km $\times 3 = \underline{\frac{9}{16}\text{ km}}$ *36 min*	Whole class activity but individual calculation in *Ex. Bks.* Responses shown in unison. Reasoning, agreement, self-correction, praising or using direct proportion: a) $\frac{4}{4} \to 1\text{ kg} = 1000\text{ g}$ $\frac{1}{4} \to 1000\text{g} \div 4 = 250\text{ g}$ $\frac{3}{4} \to 250\text{ g} \times 3 = \underline{750\text{ g}}$ Accept any valid method of calculation and any form of correct answer.

Y6

Lesson Plan 46

Activity

Notes

6

PbY6a, page 46

Q.4 Read: *Calculate the times and angles.*

Set a time limit of 3 minutes. Ps write answers in *Pbs*.

Review with whole class. Ps ome to BB to explain in detail how they did the calculation. Who did the same? Who did it a different way? Mistakes discussed and corrected.

Solution:

a) 2 h 15 min 5 sec
+ 1 h 49 min 45 sec
~~3 h 64 min 50 sec~~
4 h 4 min 50 sec

b) 25° 42' 36"
– 7° 15' 27"
18° 27' 9"

c) 32° 30' × 2
= 64° 60'
= 65°

Individual work, monitored, helped

Written on BB or SB or OHT

Reasoning, agreement, self-correction, praising

Accept any valid reasoning.

d) 4 h 59 min ÷ 2
= 2 h 29.5 min
= 2 h 29 min 30 sec

40 min

7

World Time Zones

The Earth is turning around its own axis. (T demonstrates with a globe.) How long does it take for 1 complete turn? (1 day)

a) If it takes 24 hours to turn 360°, what angle does it turn every hour? P comes to BB or dictates to T. Class agrees/disagrees.

BB: 360° ÷ 24 = 30° ÷ 2 = 15°

b) How long does the Earth take to turn 1°? P comes to BB or dictates what T should write.

BB: 15° → 1 hour = 60 minutes
1° → 60 min ÷ 15 = 12 min ÷ 3 = 4 min.

So every 4 minutes the Earth turns 1°.

Because of this, all the countries on Earth belong to different time zones. The time zones are counted from the imaginary 0° line of longitude which passes through London. We call it the Greenwich Meridien. T shows it on the globe.

Here is a map of the world showing the different time zones. The Greenwich Meriden is shown as a dotted line. Why do you think that some of the time zones are zi-zagged? (Because of where the borders of countries are.)

Let's fill in the missing times in this sentence. T (Ps) points to the relevant cities on the map (labelled with initial letters and Ps come to BB to work out the times and write them in the boxes. Class agrees/ disagrees.

BB:

When it is midnight in Los Angeles, it is 3.00 am in New York, 8.00 am in London, 9.00 am in Budapest and 5.00 pm in Tokyo.

Whole class activity

T has a globe and Time Zone Map, or use enlarged copy master or OHP.

(If possible, Ps have copies on desks too.)

At a good pace

Discussion, reasoning, agreement, praising

BB: 1° → 4 minutes

Greenwich Meridien
0° → 0 minutes

Discussion, agreement, praising

Sentence written on BB or SB or OHT, with boxes instead of the underlined words.

Reasoning, agreement, praising

Class reads completed sentence in unison.

45 min

Y6

R: Calculations

C: Imperial units and rough equivalents to metric units

E: Word problems

Lesson Plan 47

Activity

Notes

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- <u>47</u> is a prime number — Factors: 1, 47
- <u>222</u> = 2 × 3 × 37 — Factors: 1, 2, 3, 6, 37, 74, 111, 222
- <u>397</u> is a prime number — Factors: 1, 397

  (as not exactly divisible by 2, 3, 5, 7, 9, 11, 13, 17, 19 and 23 × 23 < 397)
- <u>1047</u> = 3 × 349 — Factors: 1, 3, 349, 1047

  (349 is not exactly divisible by 2, 3, 5, 7, 9, 11, 13 and 17, and 19 × 19 < 349)

8 min

Individual work, monitored (or whole class activity)

BB: 47, 222, 397, 1047

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.

$$\begin{array}{r|l} 222 & 2 \\ 111 & 3 \\ 37 & 37 \\ 1 & \end{array} \qquad \begin{array}{r|l} 1047 & 3 \\ 349 & 349 \\ 1 & \end{array}$$

2

Imperial and Metric units

In this country we used to use only Imperial units for measuring. Who can tell me some Imperial units of measure? (e.g. inches, feet, yards, ounces, pounds, etc.) Which Imperial units do we still use today? (e.g. pints, miles)

Then we changed to using mostly metric units, which are based on powers of 10. Who can tell me some metric units of measure? (e.g. cm, g, litre, etc.)

Let's complete this table and get to know the relationship between the two kinds of measures.

For each set of units, Ps say what type of measure they are.

For each line, Ps say the given approximation in unison, then dictate the appropriate operation and work out the result using calculators to complete the reverse approximations. T helps with rounding appropriately where necessary. T writes agreed value in table on BB and Ps write it in own tables (if they have them).

BB: **<u>Imperial and Metric Units</u>**

Length

1 mm ≈ 0.03937 inch	1 inch ≈ $\boxed{25.4 \text{ mm}}$	(1 ÷ 0.03937)
1 cm ≈ 0.3937 inch	1 inch ≈ $\boxed{2.54 \text{ cm}}$	(1 ÷ 0.3937)
1 m ≈ 39.37 inches = 1.094 yards	1 yard ≈ $\boxed{0.914 \text{ m}}$	(1 ÷ 1.094)
1 m ≈ 3.281 feet	1 foot ≈ $\boxed{0.3048 \text{ m}}$	(1 ÷ 3.281)
1 km ≈ 1093.61 yards = 0.6214 mile	1 mile ≈ $\boxed{1.6093 \text{ km}}$	(1 ÷0.6214)

Whole class activity

Written on BB or use enlarged copy masters or OHP

(Ps could also have a copy of the sheet to complete and stick in the back of their *Pbs*.)

At a good pace

Discussion, reasoning, agreement, praising only

T points out the 1 /*x* key on Ps' calculators and shows them how to use it.

[If possible, project calculator from a computer to show the actual results before rounding where necessary.]

Elicit/remind/tell that:

BB: 12 inches = 1 foot

3 feet = 1 yard

1760 yards = 1 mile

Activity ***Notes***

2 (Continued)

BB:

Area

1 mm^2	≈	0.00155 squ. inch	1 square inch	≈	645.16 mm^2
1 cm^2	≈	0.155 squ. inch	1 square inch	≈	6.4516 cm^2
1 m^2	≈	1.196 squ. yards	1 square yard	≈	0.8361 m^2
1 km^2	≈	0.386 squ. miles	1 square mile	≈	2.5907 km^2
1 km^2	≈	247.1 acres	1 acre	≈	0.004047 km^2

[T might also mention:

1 are = 100 m^2

≈ 0.02471 acre

1 hectare = 100 ares

≈ 2.471 acres]

Mass

1 g	≈	0.0353 ounce (oz)	1 oz	≈	28.35 g
1 kg	≈	35.27 ounces (oz)	1 oz	≈	0.02835 kg
1 kg	≈	2.205 pounds (lb)	1 lb	≈	0.4536 kg
1 t	≈	2204.62 pounds	1 lb	≈	0.0004536 t
1 t	≈	19.688 hundredweights (cwt)	1 cwt	≈	0.0508 t

Elicit/remind/tell that:

BB: 16 oz = 1 lb

(14 lb = 1 stone

8 stones = 1 cwt)

112 lb = 1 cwt

Capacity

1 ml	≈	0.00176 pint	1 pint	≈	568.18 ml
1 cl	≈	0.0176 pint	1 pint	≈	56.818 cl
1 litre	≈	1.76 pints	1 pint	≈	0.56818 litres
1 litre	≈	0.22 gallons	1 gallon	≈	4.545 litres

Elicit/remind/tell that:

BB: 8 pints = 1 gallon

[T might also mention:

1 litre ≈ 2.1 US pints

1 US pint ≈ 0.4762 litres]

Volume

1 cm^3	≈	0.06102 cubic inches	1 cubic inch	≈	16.388 cm^3
1 m^3	≈	35.315 cubic feet	1 cubic foot	≈	0.0283 m^3
1 m^3	≈	1.308 cubic yards	1 cubic yard	≈	0.7645 m^3

Temperature

– 17.8°C ≈ 0°F

– 10°C ≈ 14°F

0°C ≈ 32°F

10°C ≈ 50°F

20°C ≈ 68°F

30°C ≈ 86°F

40°C ≈ 104°F

100°C ≈ 212°F

36.6°C ≈ 97.8°F

(Normal body temperature)

T shows the formulae for conversion and Ps write them on sheets. Use them to check 2 of the temperatures on BB.

$$x^\circ\text{C} = \left(\frac{9x}{5} + 32\right)^\circ\text{F}$$

$$y^\circ\text{F} = \frac{(y - 32) \times 5}{9}\,^\circ\text{C}$$

20 min

3 ***PBY6a, page 47***

Q.1 Read: *Precise measurements are important in design, technology, engineering, chemistry, medicine, etc.*

In everyday life, it is enough to use rough estimates and conversions.

Complete the missing items. Write as fractions and as decimals.

Y6

Lesson Plan 47

Activity **Notes**

Solution:

Individual work, monitored, helped

(or whole class activity)

Written on BB or use enlarged copy master or OHP

Differentiation by time limit

Discussion, reasoning, checking, agreement, self-correction, praising

30 min

4 ***PbY6a, page 47***

Q.2 a) Read: *On a map of the Balearic Islands, Palma on the island of Majorca is situated at latitude* 2.7° *East and longitude* 39.5° *North. Find Palma on your map.*

a)	If 1 inch	≈ 2.5 cm,	then	1 cm	≈	$\boxed{\frac{2}{5}}$	in	≈	$\boxed{0.4}$	inch
b)	If 1 foot	≈ 0.3 m,	then	1 m	≈	$\boxed{3\frac{1}{3}}$	ft	≈	$\boxed{3.33}$	feet
c)	If 1 metre	≈ 1.1 yards,	then	1 yard	≈	$\boxed{\frac{10}{11}}$	m	≈	$\boxed{0.91}$	metre
d)	If 1 mile	≈ 1.6 km,	then	1 km	≈	$\boxed{\frac{10}{16} = \frac{5}{8}}$	miles	=	$\boxed{0.625}$	mile
e)	If 1 ounce	≈ 28 g,	then	1 g	≈	$\boxed{\frac{1}{28}}$	oz	≈	$\boxed{0.036}$	ounce
f)	If 1 kg	≈ 2.2 lb,	then	1 lb	≈	$\boxed{\frac{10}{22} = \frac{5}{11}}$	kg	≈	$\boxed{0.45}$	kilogram
g)	If 1 pint	≈ 0.57 litres,	then	1 litre	≈	$\boxed{\frac{100}{57}}$	pt	≈	$\boxed{1.75}$	pints
h)	If 1 gallon	≈ 4.5 litres,	then	1 litre	≈	$\boxed{\frac{10}{45} = \frac{2}{9}}$	gal	≈	$\boxed{0.22}$	gallon

T (or Ps) explains about the lines of latititude (horizontal and North or South of the Equator) and longitude (vertical and East or West of the Greenwich Meridien). T points them out on large map and Ps find them on own maps.

T and Ps find the *Balearic Islands* on a map of the world first, then on a more detailed map of Spain, identify the island of Majorca, then find Palma.

If any P has been to Majorca or to Palma, ask them to tell the class about it. If not, T says somehing about them.

Deal with remaining problems one at a time. Ps read the question themselves and solve it in *Ex. Bks*. under a time limit, rounding where necessary, and Ps who have an answer show result on scrap paper or slates on command

Ps with correct answers explain reasoning at BB, with T's help if necessary. Class agrees/ disagrees. Mistakes discussed and corrected.

T chooses a P to say the answer in a sentence.

4 (Continued)

Solution: e.g.

b) *The area of Majorca is 3640.16 km^2. Convert its area to square miles. [1 square mile ≈ 2.6 km^2]*

Plan: $3640.16 \div 2.6 \approx \underline{1400}$ (square miles)

Answer: 3640.16 km^2 is about 1400 square miles.

c) *The length of Majorca's coast is 554.7 km. Convert it to miles. [1 km ≈ 5 eighths of a mile]*

Plan: $554.7 \times \frac{5}{8} = 554.7 \div 8 \times 5 \approx \underline{346.7}$ (miles)

Answer: 554.7 km is about 346.7 miles.

d) *The annual average temperature in Majorca is 15.8˚ C. Convert it to degrees Fahrenheit using this formula:*

$$x°\text{C} = \left(\frac{9x}{5} + 32\right)°\text{F}$$

Show operations in detail on BB if necessary. e.g.

a) $1 \div 2.5 = 10 \div 25$

$$= \frac{10}{25} = \frac{2}{5} \text{ (inch)}$$

(≈ 91 cm)

(≈ 455 g)

Ps have own atlas or map on desks and T has large map(s) stuck on BB (or projected from a computer)

Individual work, monitored, helped

Initial whole class revision of latitude and longitude, identifying thelines and meridiens (Greenwich and Equator) on a map of the world, then on a map of Spain

In case no P has been to Majorca or Palma, T should have at hand some pictures to show and information gleaned from travel brochures.

Responses shown in unison.

Discussion, reasoning, agreement, self-correction, praising

Y6

Lesson Plan 47

Activity

Notes

Plan: $$15.8^\circ\text{C} = \left(\frac{9 \times 15.8}{5} + 32\right)^\circ\text{F}$$

$$= \left(\frac{142.2}{5} + 32\right)^\circ\text{F}$$

$$= (28.44 + 32)^\circ\text{F}$$

$$= 60.44^\circ\text{F}$$

Answer: 15.8°C is the same as 60.44°F .

Accept any correct rounding

(If possible, T projects the calculator on a computer to show the answer to several decimal places, then Ps discuss an acceptable rounding for the answer.

It is usual to round to the same number of decimal places as the value given in the question.)

e) *The shortest shipping route betwen Majorca and Menorca is 34 Miles long and is about 63 km. Is this nautical Mile the same as the usual road mile?*

Plan: 1 NM ≈ 63 km ÷ 34 ≈ <u>1.85 km</u>

1 mile ≈ 1.6 km, 1.6 km < 1.85 km

Answer: No, this nautical Mile is longer than the usual road mile.

f) *On the plane to Majorca, the captain informed us that our plane was flying at a height of 30 000 feet. What is the*

height in metres and kilometres?

Plan: 1 foot ≈ 0.3 m

30 000 feet ≈ 0.3 m × 30 000 = <u>9000 m</u> = <u>9 km</u>

Answer: We were flying at a height of about 9000 metres or 9 kilometres.

There is no need to round here, as the given temperature is exact.

f) *The captain told us that our plane was flying at a speed of 900 km per hour. Calculate the speed in miles per hour. (mph)*

Plan: 1 km ≈ $\frac{5}{8}$ mile, 900 km ≈ $900 \times \frac{5}{8}$ = <u>562.5</u> (miles)

Answer: The plane is flying at about 562.5 miles per hour.

40 min

5

PbY6a, page 47

Q.3 Read: *Solve the problems in your exercise book.*

Deal with one at a time or set a time limit. Ps read the questions themselves, write plans, do the calculations and write the answers in sentences in *Ex. Bks.*

Review with whole class. Ps could show answers on scrap paper or slates on command. Ps answering correctly come to BB to explain reasoning. Who agrees? Who did it another way? etc. Mistakes discussed/corrected.

T chooses a P to say the answer in a sentence.

Solution: e.g.

a) *The road sign shows that it is 15 and a half miles to Stanstead Airport. If our coach is travelling at a speed of 96 km per hour, how long will it be before we get there?*

Plan: 1 km ≈ $\frac{5}{8}$ mile,

900 ÷ 8 × 5 = 112.5 × 5
= <u>562.5</u> (miles)

Activity

$$96 \text{ km} \approx 96 \times \frac{5}{8} = 60 \text{ (miles)}$$

So speed is about 60 miles per hour.

60 miles → 60 minutes
1 mile → 1 minute
15.5 miles → <u>15.5 minutes</u>

Answer: We will get there in about 15 to 16 minutes.

b) *What is 2 thirds of 360 lb in kg?*

Plan: $\frac{2}{3} \times 360 \text{ lb} = 240 \text{ lb}$

$1 \text{ lb} \approx 0.45 \text{ kg}$

$240 \text{ lb} \approx 0.45 \times 240 = 4.5 \times 24 = 96 + 12 = \underline{108} \text{ (kg)}$

Answer: Two thirds of 360 lb is about 108 kg.

c) *A capacity of 1 litre is practically equivalent to 1000 cm*^{3}*, and 1 kg of water is close to 1 litre.*
How many kg is 600 cm^3 *of water?*

Plan: $1000 \text{ cm}^3 \approx 1 \text{ litre}$

$$600 \text{ cm}^3 \approx \frac{600}{1000} \text{ litre} = \frac{6}{10} \text{ litre} = 0.6 \text{ litre}$$

1 litre ≈ 1 kg, so 0.6 of a litre ≈ <u>0.6 kg</u>

Answer: 600 cm^3 of water is about 0.6 kg of water.

Notes

Individual work, monitored, helped

(or whole class activity if time is short)

Differentiation by time limit

Solutions shown in unison.

Reasoning, agreement, self-corrrection, praising

45 min

Homework

(Optional)

In a brewery, yeast is being grown to make beer. At 8.00 am there is 1 mg of yeast but its mass will increase by 10 times every hour.

How much yeast will there be at 6.00 pm?

Solution: 8.00 am to 6.00 pm is 10 hours. 1 mg = 1 thousandth of a g

Hours:	1	2	3	4	5	6	7	8	9	10
1 mg,	10 mg,	100 mg,	1 g,	10 g,	100 g,	1 kg,	10 kg,	100 kg,	1 t,	<u>10 t</u>

Notes

or $1 \text{ kg} \approx 2.2 \text{ lb}$

$240 \text{ kg} \div 2.2 \approx \underline{109} \text{ (lb)}$

Accept both answers if reasoned correctly.

Review before the start of *Lesson 48*.

or $1 \text{ mg} \times 10^{10}$
$= 10\,000\,000\,000 \text{ mg}$
(10 billion milligrams)

Answer: At 8.00 pm there will be 10 tonnes of yeast.

Y6

R: Calculations

C: Suitable units and measuring equipment. Estimation

E: Problems

Lesson Plan 48

Activity

Notes

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 4 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- <u>48</u> $= 2 \times 2 \times 2 \times 2 \times 3 = 2^4 \times 3$

  Factors: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48
- <u>223</u> is a prime number Factors: 1, 223

  (as not exactly divisible by 2, 3, 5, 7, 11, 13, and $17 \times 17 > 223$)
- <u>398</u> $= 2 \times 199$ Factors: 1, 2, 199, 398
- <u>1048</u> $= 2 \times 2 \times 2 \times 131 = 2^3 \times 131$

  Factors: 1, 2, 4, 8, 131, 262, 524, 1048

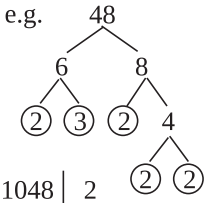
Individual work, monitored (or whole class activity)

BB: 48, 223, 398, 1048

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.



398	2
199	199
1	

1048	2
524	2
262	2
131	131
1	

6 min

2

Measuring

T poses a problem and asks Ps to suggest what to do. Ps demonstrate the actual measuring in front of the class. T helps where necessary. Class helps with any calculations on BB.

a) *How could we measure the mass of the water in this jug?* e.g.

P_1: Weigh the jug with the water in it on the scales, then pour out the water and weigh the empty jug. The difference in values is the mass of water that was in the jug.

P_2: Pour the water into a measuring jug to find its volume, then convert it to a mass, as we know that:

1 litre of water → 1 kg water.

b) *How could we measure the volume of this stone ?* e.g.

Pour half a litre of water into a measuring jug. Drop the stone into the jug and note where the level of water is now. The difference between the two levels is the volume of the stone.

(e.g. A difference of 30 cl: 30 cl = 300 ml → 300 cm^3,

as 1 ml of water has a volume of 1 cm^3 .)

c) *How could we measure the height of this pyramid (or cone)?* e.g.

Stand the pyramid on a table. Lay a sheet of strong card on its point so that the card is parallel to the table and measure the distance between the two planes with a ruler.

Accept and praise any valid method suggested by Ps.

Whole class activity

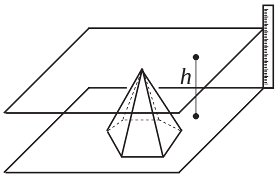
T has the materials and measuring tools already prepared

At a good pace, in good humour

Encourage Ps to make own suggestions but T gives hints or directs Ps' thinking if Ps have no ideas.

Reasoning, agreement, praising

Use an irregularly shaped stone or any solid object which is difficult to measure but will sink in water. Make sure that there is enough water in the measuring jug to cover it!



20 min

Y6

Lesson Plan 48

Activity

Notes

3

PbY6a, page 48

Q.1 Read: *Which quantity is more?*

Set a time limit. Ps do necessary calculations in *Ex. Bks,* then circle the greater quantity, or write appropriate sign, in *Pbs*.

Review with whole class. Ps could raise left or right hand to indicate whether quantity on LHS or RHS is greater.

Ps come to BB to explain reasoning. Who thought the same? Who knew the answer <u>without</u> needing to do a calculation? Mistakes discussed and corrected.

Solution:

a) $\frac{3}{4}$ of 500 kg $\textcircled{=}$ $\frac{3}{8}$ of 1 tonne

$500\text{ kg} \div 4 \times 3 = 125\text{ kg} \times 3 = 375\text{ kg}$

$1000\text{ kg} \div 8 \times 3 = 125\text{ kg} \times 3 = 375\text{ kg}$

b) 0.4 of £1250 $\textcircled{<}$ $\frac{4}{5}$ of £1250

$£1250 \times 0.4 = £125 \times 4 = £500$

$£1250 \div 5 \times 4 = £250 \times 4 = £1000$

c) $\frac{5}{2}$ of 5700 m^2 $\textcircled{>}$ 2 times 4900 cm^2

$5700\text{ m}^2 \div 2 \times 5 = 2850\text{ m}^2 \times 5 = 14250\text{ m}^2$

$4900\text{ cm}^2 \times 2 = 9800\text{ cm}^2$

Individual work, monitored, helped

Written on BB or SB or OHT

Responses shown in unison. [Both hands raised for a)!]

Reasoning, agreement, self-correction, praising

Extra praise for Ps who can reason logically, e.g.

a) a certain fraction of a quantity is the same as half the fraction of double the quantity.

b) $0.4 = \frac{4}{10}$, $\frac{4}{5} = \frac{8}{10}$, and $\frac{4}{10} < \frac{8}{10}$

c) 2 and a half times a greater quantity is more than 2 times a smaller quantity.

25 min

4

PbY6a, page 48, Q.2

If possible, T has the actual coins and notes mentioned in the question to pass round the class.

First talk about holidays abroad and the different currencies encountered by Ps or T and how the exchange rate varies from day to day.

Let's think about what the information in your *Pbs* really means.

BB: On **12.10.2000**: 1 GBP ≈ 1.46 USD
1 GBP ≈ 1.69 EUR
so 1 EUR ≈ 0.87 USD

On **12.08.2003**: 1 GBP ≈ 1.60 USD
1 GBP ≈ 1.42 EUR
so 1 EUR ≈ 1.13 USD

T elicits what the dates are (12th October 2000 and 12 August 2003) and makes sure that Ps understand which currency is meant by GBP, EUR, etc.

Deal with one part at a time. T chooses a P to read out the question and Ps come to BB to solve it (with T's and other Ps' help where necessary). Ps work in *Ex. Bks* at the same time.

If Ps have no ideas what to do, T gives hints or directs Ps thinking. T uses language associated with currency exchange.

Whole class activity

(or individual work after initial whole class discussion to clarify the context)

Rates written on BB or SB or OHT

Discussion, reasoning, agreement, praising

Y6

Lesson Plan 48

Activity

4

(Continued)

Solution:

a) *What changes do you notice in the value of:*

i) the £ against the $ (£ is worth more $ in 2003)

T: We say that in August 2003, the £ was stronger against the Dollar than it was in October 2000.

ii) the £ against the Euro (£ is worth fewer Euros in 2003)

T: We say that in August 2003, the £ was weaker against the Euro than it was in October 2000.

iii) the Euro against the $? (Euro is worth more $ in 2003)

T: We say that in August 2003, the Euro was stronger against the Dollar than it was in October 2000.

b) *How many Dollars and how many Euros were the equivalent of £1500 on each of these two dates?*

BB: <u>12.10.2000</u>:

£1500 ≈ 1.46$ × 1500 = 146$ × 15 = <u>2190</u> $

≈ 1.69€ × 1500 = 169€ × 15 = <u>2353</u> €

BB:

On **12.10.2000**:	On **12.08.2003**:
1 GBP ≈ 443 HUF	1 GBP ≈ 367 HUF
1 USD ≈ 303 HUF	1 USD ≈ 228 HUF
1 EUR ≈ 263 HUF	1 EUR ≈ 259 HUF

c) *To which of the 3 currencies was the Hungarian Forint most closely linked?*

Ps could show currency on scrap paper or slates on command.
Ps with different responses explain reasoning. Class agrees on correct answer.

(The HUF was most closely linked to the Euro, as its value against the Euro showed the least change from 2000 to 2003 compared with other currencies.)

d) *How many Hungarian Forints were equivalent to £1500, 1500 $ and 1500 € on each of these two dates?*

T draws a table on BB as dictated by Ps. Ps come to BB to do the calculations and fill in the table. Class agrees/disagrees.

BB:

	£1500	1500 $	1500 €
12.10.2000	664 500 HUF	454 500 HUF	394 500 HUF
12.08.2003	550 500 HUF	342 000 HUF	388 500 HUF

35 min

Notes

T decides whether to allow Ps to use a calculator.

Written on BB or SB or OHT

Responses shown in unison.

Discussion, reasoning, agreement, praising

BB:

£1500 ≈ 443 × 1500
= <u>664 500</u> (HUF)

$1500 ≈ 303 × 1500
= <u>454 500</u> (HUF)

etc.

Y6

Lesson Plan 48

Activity ***Notes***

5

PbY6a, page 48

Q.3 Read: *The quality of gold and jewels is measured in carats.*

The carat for gold is different from the carat for diamonds.

The purity of gold is measured in 24ths. For example, a 1-carat gold ring means that one 24th of its mass is pure gold.

a) How much pure gold is in an 8-carat gold ring which weighs 2 and 2 thirds grams?

b) How much pure gold is in a 14- carat gold necklace which weighs 4.5 g?

Set a time limit of 3 minutes. Review with whole class. Ps could show results on scrap paper or slates in unison. Ps answering correctly explain at BB to Ps who were wrong Mistakes discussed and corrected. T chooses a P to say each answer in a sentence.

Solution:

a) *Plan*: $\frac{8}{24}$ of $2\frac{2}{3}$ g = $\frac{1}{3}$ of $\frac{8}{3}$ g = $\frac{8}{3}$ g ÷ 3 = $\frac{8}{9}$ g

Answer: There is 8 ninths of a gram of pure gold in an 8-carat gold ring which weighs 2 and 2 thirds grams.

b) *Plan*: $\frac{14}{24}$ of 4.5 g = $\frac{7}{12}$ of 4.5 g = 4.5 g ÷ 12 × 7

= 0.375 g × 7 = $\underline{2.625 \text{ g}}$

Answer: There is 2.625 grams of pure gold in a 14 -carat gold neclace which weighs 4.5 g.

Individual work, monitored, helped

T asks Ps in class if they have any gold jewellery and if they know how many carats it is.

(T might have some jewellery to show to class.)

Agree that the higher the carat, the more pure gold there is, so the more expensive it is.

Differentiation by time limit

Responses shown in unison.

Reasoning, agreement, self-correction, praising

or b):

$\frac{7}{12}$ of $4\frac{1}{2}$ = $\frac{9}{2}$ ÷ 12 × 7

= $\frac{9}{24}$ × 7 = $\frac{3}{8}$ × 7

= $\frac{21}{8}$ = $2\frac{5}{8}$ (g)

40 min

6

PbY6a, page 48

Q.4 a) Read: *What is your mass: i) in grams ii) in tonnes? (Answer to the nearest kg.)*

T has several bathroom scales available for Ps who do not know their mass. Make sure that all Ps have a value in kg before they convert it to grams and tonnes.

(e.g. 45 kg = 45 000 g = 0.045 tonnes)

b) Read: *The weight of any object on the moon would be 1 sixth lighter than it is here on Earth. What would the mass of a 1 kg loaf of bread be on the moon?*

Show me . . . now! (1 kg)

Elicit that the mass of an object does not change, but weight involves the force of gravity, which is greater on the Earth (10 N) than on the Moon (1.6 N).

c) Read: *A plane took off at 8.45 am in Budapest and landed at 12.35 pm in New York. If New York time is 6 hours earlier than Budapest time, how long was the flight?*

Show me . . . now! (9 h 50 min)

(12h 35 min – 8 h 45 min) + 6 h = 3 h 50 min + 6 h

= <u>9 h 50 min</u>)

Elicit that flying time would be longer on the return flight, as the flight would be in the same direction as the Earth turns.

Individual or paired work, closely monitored, checked, corrected

T asks several Ps to tell class their results. Class points out errors in conversions.

Responses shown in unison.

In good humour!

Praising

Or when plane lands in NY, time is 18.35 in Budapest.

18 h 35 min – 8 h 45 min

= 17 h 95 min – 8 h 45 min

= <u>9 h 50 min</u>

(i.e. West to East)

45 min

Y6

R: Calculations. Miscellaneous practice of measures

C: Calculating the perimeter and area of compound shapes

E: Problems

Lesson Plan
49

Activity ***Notes***

1

Factorisation

Factorise these numbers in your exercise book and list their positive factors. T sets a time limit of 6 minutes.

Review with whole class. Ps come to BB or dictate to T, explaining reasoning. Class agrees/disagrees. Mistakes discussed and corrected.

Elicit that:

- 49 = 7 × 7 = 7^2 (square number) Factors: 1, 7, 49
- 224 = 2 × 2 × 2 × 2 × 2 × 7 = 2^5 × 7

  Factors: 1, 2, 4, 7, 8, 14, 6, 28, 32, 56, 112, 224
- 399 = 3 × 7 × 19 Factors: 1, 3, 7, 19, 21, 57, 133, 399
- 1049 is a prime number Factors: 1, 1049

  (as not exactly divisible by 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, and 37 × 37 > 1049)

Individual work, monitored (or whole class activity)

BB: 49, 224, 399, 1049

Calculators allowed.

Reasoning, agreement, self-correction, praising

e.g.

224	2
112	2
56	2
28	2
14	2
7	7
1	

399	3
133	7
19	19
1	

8 min

2

Perimeter and area of a cuboid

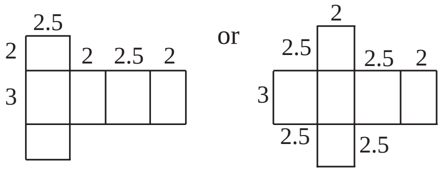
a) Draw around the faces of each of your cuboids, turning the cuboid over until you have drawn all 6 faces to form a net. Use a different sheet for each net. Measure the sides of the nets and note the lengths on your diagram.

e.g. 1) 2 cm × 2.5 cm × 3 cm 2) 2 cm × 2 cm × 4 cm

3) 3 cm × 3 cm × 3 cm

T monitors closely and helps or corrects as necessary. T chooses Ps to show their nets on BB, or T has some already prepared. Ps compare their own net shapes with those on BB. e.g. for 1):

BB:



(etc. for the same cuboid)

b) Let's calculate the perimeter of the nets. Deal with one cubiod at a time. Ps come to BB or dictate to T for the nets on BB. Class agrees or disagrees. Ps calculate perimeter of own nets too. e.g.

LHS above: $P = (8 \times 2 + 4 \times 2.5 + 2 \times 3)$ cm = 32 cm

RHS above: $P = (8 \times 2.5 + 4 \times 2 + 2 \times 3)$ cm = 34 cm

Who has drawn a net with a different perimeter? Deal with all cases. (max: 38 cm, min: 32 cm)

Similarly for the square-based cuboid (min P: 32 cm, max P: 44 cm) and the cube (P = 42 cm)

c) Let's calculate the area of the nets. Deal in a similar way to b) but this time agree that only one value per cuboid is possible.

$A_1 = 2 \times (2 \times 2.5 + 2 \times 3 + 2.5 \times 3)\text{ cm}^2 = 2 \times 18.5\text{ cm}^2 = \underline{37\text{ cm}^2}$

$A_2 = 2 \times (2 \times 2)\text{ cm}^2 + 4 \times (2 \times 4)\text{ cm}^2 = (8 + 32)\text{ cm}^2 = \underline{40\text{ cm}^2}$

$A_3 = 6 \times (3 \times 3)\text{ cm}^2 = 6 \times 9\text{ cm}^2 = \underline{54\text{ cm}^2}$

Elicit that the area of the nets is the same as the surface area of the matching cuboid, so it is impossible to have different values.

Whole class activity but individual drawing

Ps have 3 different cuboids (wood or plastic or made from card, e.g of the sizes given opposite) and 3 sheets of plain paper on desks.

T could have various nets prepared on SB or OHP for each type of cuboid to save time.

Discussion, reasoning, agreement, praising

Ps with different perimeters lengths from those on BB show their nets and calculations to class.

Agree that the cube has only one possible value for its perimeter as all sides are equal.

Ps again come to BB or dictate to T, referring to diagrams on BB.

Ps calculate areas of own nets too.

Agreement, praising

18 min

Y6

Lesson Plan 49

Activity

Notes

3

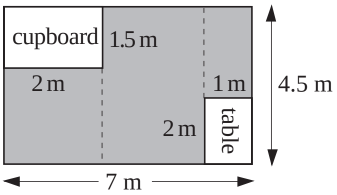
Area of an irregular shape

Let's measure part of the floor of the classroom and draw a sketch for it.

T chooses an irregular shape (e.g. around cupboards) and organises groups of Ps to do the measuring, drawing and recording (with T's help).

T (Ps) draw a sketch (i.e. a diagram not to scale) on BB. Rest of Ps draw own sketches in *Ex. Bks*. too. e.g.

BB:



Let's calculate the perimeter and area of the shaded part.

(T suggests dividing the shape into rectangles if no P has an idea how to calculate the area.)

Ps come to BB or dictate what T should write. Class agrees/disagrees. Ps write calculations in *Ex. Bks*. too. e.g.

$P = 6\text{ m} + 2\text{ m} + 1\text{ m} + 2.5\text{ m} + 5\text{ m} + 1.5\text{ m} + 2\text{ m} + 3\text{ m} = \underline{23\text{ m}}$,

or $P = 2 \times (7 + 4.5)\text{ m} = 2 \times 11.5\text{ m} = \underline{23\text{ m}}$ (see opposite)

$A = (2 \times 3)\text{ m}^2 + (4 \times 4.5)\text{ m}^2 + (1 \times 2.5)\text{ m}^2 = (6 + 18 + 2.5)\text{ m}^2 = \underline{26.5}\text{ m}^2$

or $A = (7 \times 4.5)\text{ m}^2 - [\,(2 \times 1.5)\text{ m}^2 + (2 \times 1)\text{ m}^2\,] = (31.5 - 5)\text{ m}^2 = \underline{26.5}\text{ m}^2$

26 min

Whole class acitivity

T has tape measures available.

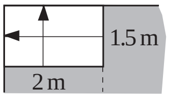
(or Ps can choose it)

Discussion, reasoning, agreement, praising

At a good pace

Extra praise if a P thinks of this without help

as, e.g.



Extra praise if a P suggests this, otherwise T shows it.

Ps say which method they prefer and why.

4

PbY6a, page 49

Q.1 Read: *This is the plan of a house and its garden.*

Talk about the plan first and elicit what the scale 1 : 400 means, including what unit of measure is most appropriate to use.

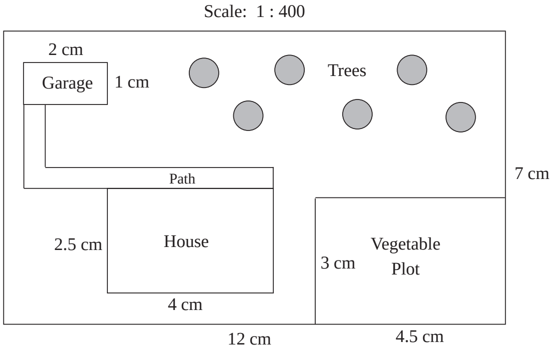
(Elicit that every 1 cm on the plan represents 400 cm in real life.)

a) Read: *Measure on the plan, then calculate the real lengths and widths of:*

i) the house ii) the garge iii) the vegetable plot iv) the whole garden.

Set a time limit. Ps measure with rulers (or compasses and rulers) and write values on plan. Review quickly. Ps re-measure inaccurate measurements.

BB:



Then Ps do calculations in *Ex. Bks*. Review with whole class. Ps show real lengths on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

Individual work, monitored helped

Drawn on BB or use enlarged copy master or OHP (for reference only)

Agreement, self-correction, praising

Solution:

a) i) house: 16 m by 10 m

ii) garage: 8 m by 4 m

iii) veg. plot: 18 m by 12 m

iv) whole garden: 28 m by 48 m

Activity

Notes

4

(Continued)

b) Read: *Calculate:*

i) the perimeter of the vegetable plot

ii) the area of the garden.

Set a time limit. Ps calculate in *Ex. Bks* and write the answers in sentences.

Review with whole class. Ps show results on scrap paper or slates on command. Ps responding correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:

i) $P = 2 \times (18\text{ m} + 12\text{ m}) = 2 \times 30\text{ m} = \underline{60\text{ m}}$

Answer: The perimeter of the vegetable plot is 60 m.

ii) $A = 28\text{ m} \times 48\text{ m} = \underline{1344}\text{ m}^2$

(Also accept area without house and garage:

$1344\text{ m}^2 - (160\text{ m}^2 + 32\text{ m}^2) = 1344\text{ m}^2 - 192\text{ m}^2$

$= \underline{1152}\text{ m}^2$)

Answer: The area of the garden is 1344 m^2,
(or 1152 m^2 exccluding the house and garage).

Responses shown in unison

Discussion, agreement, self-correcting, praising

Extra praise if Ps thought of this.

Extension

Ps think of other questions to ask about the plan.

Extra praise for creativity!

32 min

5

PbY6a, page 49

Q.2 Read: *These are diagrams of a living cell and a longitudinal section of a bacterium.*

Measure the lengths and widths on the diagrams, then calculate their sizes in real life.

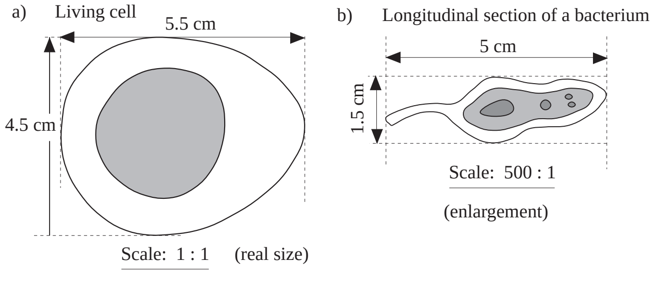
What do you think the diagram in a) could be?

Set a time limit. Ps measure with rulers, or compasses and rulers, then write real sizes in *Ex. Bks*.

Review lengths with whole class. Ps show results on scrap paper or slates on command. Ps answering correcly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

What do you think a) could be? (an egg)

Solution:



b) In real life:

Length $= 5\text{ cm} \div 500 = 5\text{ mm} \div 50 = 0.5\text{ mm} \div 5$

$= \underline{0.1\text{ mm}}$

Width $= 1.5\text{ cm} \div 500 = 1.5\text{ mm} \div 50 = 0.15\text{ mm} \div 5$

$= \underline{0.03\text{ mm}}$

Individual work, monitored, helped

Use enlarged copy master or OHP for reference only.

Initial discussion on what is meant by a living cell (the smallest unit which can live independently and which has a nucleus) and a bacterium (an organism which can cause disease but can only be seen under a microscope)

If possible, T has a hard-boiled egg (the yolk is the nucleus of the cell), a microscope and a longitudinal section prepared on a slide for Ps to look at. (Colleagues in the science department at the local high school might help.)

Results shown in unison.

Reasoning, agreement, self-correction, praising

Extra praise to Ps who realised that the 'living cell' is an egg!

37 min

Activity ***Notes***

6

PbY6a, page 49

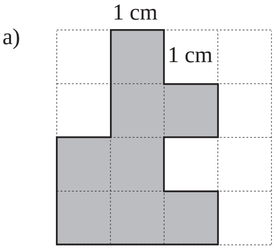
Q.3 Read: *Measure the sides of each shape, then calculate its perimeter and area.*

Set a time limit. Ps measure with rulers, or rulers and compasses, and write the lengths on diagrams. Ps then do calculations in *Ex. Bks.* and write results in P*bs.*

Review with whole class. Ps show perimeters and areas on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong. Mistakes discussed and corrected.

Solution:

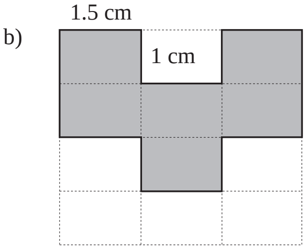
a)



$P = 16$ cm

$A = 8$ cm^2

b)



$P = 6 \times 1.5$ cm + 8 cm

$= \underline{17\text{ cm}}$

$A = 3 \times (2 \times 1.5)$ cm^2 = $\underline{9\text{ cm}^2}$

Individual work, monitored, helped

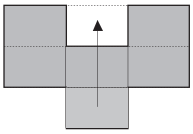
Drawn on BB or use enlarged copy master or OHP

Responses shown in unison.

Reasoning, agreement, self-correction, praising

or $A = 2 \times 4.5$ cm^2 = $\underline{9\text{ cm}^2}$

since:



42 min

7

Problems

T reads the problem. Ps note the data and calculate in *Ex. Bks*. then show results on scrap paper or slates on command. Ps answering correctly explain at BB to Ps who were wrong.

a) *The area of a rectangle is* $4\frac{2}{3}$ *cm*^{2}.

If one of its sides is 2 cm long, what length is the adjacent side?

BB: $4\frac{2}{3}$ cm^2 $\div$ 2 cm = $2\frac{1}{3}$ cm

Answer: The adjacent side is 2 and 1 third cm long.

b) *The area of a square is 1.44 cm*^{2}. *What is the length of each side?*

$a \times a$ = 1.44 cm^2 = 144 mm^2;

But 144 mm^2 = 12 mm $\times$ 12 mm, so a = $\underline{12\text{ mm}}$ (= 1.2 cm)

Whole class activity but individual calculation

Responses shown in unison.

Reasoning, agreement, self-correction, praising

Feedback for T

45 min

Y6

Lesson Plan
50

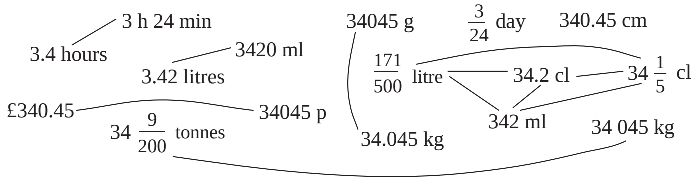
Activity

Factorising 50, 225, 400 and 1050. Revision, activities, consolidation

PbY6a, page 50

Solutions:

Q.1



Q.2

a)
$$\begin{array}{rrrr} & \text{6 h} & \text{53 min} & \text{10 sec} \\ + & \text{8 h} & \text{19 min} & \text{55 sec} \\ \hline & \text{15 h} & \text{13 min} & \text{5 sec} \\ \hline & {}_1 & {}_1 & \end{array}$$

b)
$$\begin{array}{rrrr} & \text{12 h} & \text{23 min} & \text{65 sec} \\ & \cancel{\text{12 h}} & \cancel{\text{24 min}} & \cancel{\text{5 sec}} \\ - & \text{4 h} & \text{23 min} & \text{17 sec} \\ \hline & \text{8 h} & \text{0 min} & \text{48 sec} \\ \hline \end{array}$$

c)
$$\begin{array}{rrrr} & \text{15 h} & \text{97 min} & \text{29 sec} \\ & \cancel{\text{16 h}} & \cancel{\text{37 min}} & \cancel{\text{29 sec}} \\ - & \text{14 h} & \text{51 min} & \text{6 sec} \\ \hline & \text{1 h} & \text{46 min} & \text{23 sec} \\ \hline \end{array}$$

Q.3 a) The Earth takes 24 hours to turn by 360° around its axis.

So the Earth turns $\boxed{15°}$ each hour and takes $\boxed{\text{4 min}}$ to turn 1°.

b) i) When it is 8.00 am GMT, it is:

<u>3.00 am</u> in New York, <u>6.00 pm</u> in Sydney,
<u>4.00 pm</u> in Beijing, <u>11.00 am</u> in Moscow,
<u>8.00 am</u> in London

ii) When it is 13:30 in Budapest, it is:
<u>12:30</u> in London, <u>20:30</u> in Beijing,
<u>04:30</u> in San Francisco, <u>09:30</u> in Rio de Janeiro

Q.4 a) 11 hours + 11 hours – 8 hours = 14 hours

It was <u>14:00</u> (or 2.00 pm) in San Francisco when the plane landed.

b) From 10.00 pm on Sunday to 4.00 am on Monday: 6 hours

As Moscow time is 3 hours ahead of London time, actual flying time is <u>3 hours</u>.

c) 12 hours – 9.5 hours = 2.5 hours (London time)

As Beijing time is 8 hours ahead of London time, the plane took off when it was <u>10:30 am</u> in Beijing.

Notes

<u>50</u> = 2×5^2

Factors: 1, 2, 5, 10, 25, 50

<u>225</u> = $3^2 \times 5^2$ (= 15^2)
(square number)

Factors: 1, 3, 5, 9, 15, 25, 45, 75, 225

<u>400</u> = $2^4 \times 5^2$ (= 20^2)
(square number)

Factors: 1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 200, 400

<u>1050</u> = $2 \times 3 \times 5^2 \times 7$

Factors: 1, 2, 3, 5, 6, 7, 10, 14, 15, 21, 25, 30, 35, 42, 50, 70, 75, 105, 150, 175, 210, 350, 525, 1050

(or set factorising as homework at the end of *Lesson 49* and review at the start of *Lesson 50)*