1

Experiment 1

a) Toss two equal coins 20 times and note the outcomes in this table.

e.g.

Outcome	Tally of 20 throws	Pupil Totals
H H	𝍸 |	6
H and T	𝍸 ||||	9
T T	𝍸	5
		(20)

(n = total number of tosses)

b) Collect the data for the whole class and fill in the table.

e.g.

Outcome	Class Totals	Relative frequency
H H	123	$\frac{123}{500} = 0.246 \rightarrow 24.6\%$
H and T	253	$\frac{253}{500} = 0.506 \rightarrow 50.6\%$
T T	124	$\frac{124}{500} = 0.248 \rightarrow 24.8\%$
	$n = 500$	

c) What do you notice about the results?

Write a sentence about it.

e.g:
- Relative frequencies of 'HH' and 'TT 'are almost equal and are about half of the relative frequency for 'H and T'.
- Relative frequency of 'HH' and of 'TT' is about 25% or $\frac{1}{4}$, and relative frequency of 'a Head and a Tail' is about 50% or $\frac{1}{2}$.

2

Experiment 2

a) Toss three equal coins 40 times and note the outcomes in this table.

e.g.

Outcome	Tally of 40 throws	Pupil Totals
H H H	𝍸 ||	7
1 H and 2 T	𝍸 𝍸 𝍸 |	16
2 H and 1 T	𝍸 𝍸 ||	12
T T T	𝍸	5
		(40)

b) Collect the data for the whole class and fill in the table.

e.g.

Outcome	Class Totals	Relative frequency
H H H	127	$\frac{127}{1000} = 0.127 \rightarrow 12.7\%$
1 H and 2 T	373	$\frac{373}{1000} = 0.373 \rightarrow 37.3\%$
2 H and 1 T	376	$\frac{376}{1000} = 0.376 \rightarrow 37.6\%$
T T T	124	$\frac{124}{1000} = 0.124 \rightarrow 12.4\%$
	$n = 1000$	

c) What do you notice about the results?

Write a sentence about it.

e.g:
- The relative frequencies of 'HHH' and 'TTT 'are almost equal and are about 1 third of the relative frequency for '1 Head and 2 Tails' and for '2 Heads and 1 Tail'.
- The relative frequency of 'HHH' and of 'TTT' is between 12% and 13%, and the relative frequency of 'a Head and 2 Tails' and of '2 Heads and a Tail' is each between 37% and 38%.

1

Throw two equal dice 72 times and write the data in the table.

e.g. For a class of 30 pupils:

Outcome	**Tally of 72 throws**	**Pupil Total**	**Relative frequency**	**Class Total**	**Relative frequency**	≈
1 and 1	|	1	$\frac{1}{72}$	63	≈ 0.0292	(2.92%)
1 and 2	𝍸	5	$\frac{5}{72}$	118	≈ 0.0546	(5.46%)
1 and 3	|||	3	$\frac{3}{72}$	120	≈ 0.0556	(5.56%)
1 and 4	||||	4	$\frac{4}{72}$	123	≈ 0.0569	(5.69%)
1 and 5	||||	4	$\frac{4}{72}$	117	≈ 0.0542	(5.42%)
1 and 6	||	2	$\frac{2}{72}$	121	≈ 0.0560	(5.60%)
2 and 2	|||	3	$\frac{3}{72}$	58	≈ 0.0269	(2.69%)
2 and 3	𝍸 |	6	$\frac{6}{72}$	116	≈ 0.0537	(5.37%)
2 and 4	||||	4	$\frac{4}{72}$	121	≈ 0.0560	(5.60%)
2 and 5	|||	3	$\frac{3}{72}$	120	≈ 0.0556	(5.56%)
2 and 6	𝍸	5	$\frac{5}{72}$	118	≈ 0.0546	(5.46%)
3 and 3	||	2	$\frac{2}{72}$	59	≈ 0.0273	(2.73%)
3 and 4	||||	4	$\frac{4}{72}$	121	≈ 0.0560	(5.60%)
3 and 5	|||	3	$\frac{3}{72}$	121	≈ 0.0560	(5.60%)
3 and 6	||||	4	$\frac{4}{72}$	120	≈ 0.0556	(5.56%)
4 and 4		0	0	60	≈ 0.0278	(2.78%)
4 and 5	𝍸	5	$\frac{5}{72}$	120	≈ 0.0556	(5.56%)
4 and 6	||||	4	$\frac{4}{72}$	119	≈ 0.0550	(5.50%)
5 and 5	|||	3	$\frac{3}{72}$	61	≈ 0.0282	(2.82%)
5 and 6	||||	4	$\frac{4}{72}$	124	≈ 0.0574	(5.74%)
6 and 6	|||	3	$\frac{3}{72}$	60	≈ 0.0278	(2.78%)
	n =	72	n =	2160		

2

Using the class data in *Question 1*, fill in this table where we deal with the **sum** of the two numbers thrown.

e.g. Sample table for a class of 30 pupils:

Sum	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Frequency	0	0	63	118	178	239	297	362	299	240	180	124	60	0
Relative frequency	0	0	$\frac{63}{2160}$ 2.9%	$\frac{118}{2160}$ 5.5%	$\frac{178}{2160}$ 8.2%	$\frac{239}{2160}$ 11.1%	$\frac{297}{2160}$ 13.8%	$\frac{362}{2160}$ 16.8%	$\frac{299}{2160}$ 13.8%	$\frac{240}{2160}$ 11.1%	$\frac{180}{2160}$ 8.3%	$\frac{124}{2160}$ 5.7%	$\frac{60}{2160}$ 2.8%	0
Probability	0	0	$\frac{1}{36}$ 2.8%	$\frac{2}{36}$ 5.6%	$\frac{3}{36}$ 8.3%	$\frac{4}{36}$ 11.1%	$\frac{5}{36}$ 13.8%	$\frac{6}{36}$ 16.7%	$\frac{5}{36}$ 13.8%	$\frac{4}{36}$ 11.1%	$\frac{3}{36}$ 8.3%	$\frac{2}{36}$ 5.6%	$\frac{1}{36}$ 2.8%	0

What do you notice about the table? e.g.

- The relative frequencies are very close to the probabilities.
- The frequencies and relative frequncies for a sum of 2 and a sum of 12, (and for 3 and 11, 4 and 10, 5 and 9, 6 and 8) are very similar).

1

Using the class data in *Question 1* on page 142, fill in this table where we deal with the **product** of the numbers thrown. Calculate in your exercise book.

Sample table for a class of 30 Ps, each throwing 2 dice 72 times:

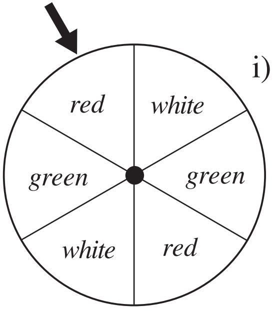
e.g. $n = 2160$

Product	1	2	3	4	5	6	8	9	10	12	15	16	18	20	24	25	30	36
Frequency	63	118	120	181	117	237	121	59	120	239	121	60	120	120	119	61	124	60
Relative frequency ≈	$\frac{63}{2160}$ 2.9%	$\frac{118}{2160}$ 5.5%	$\frac{120}{2160}$ 5.6%	$\frac{181}{2160}$ 8.4%	$\frac{117}{2160}$ 5.4%	$\frac{237}{2160}$ 11%	$\frac{121}{2160}$ 5.6%	$\frac{59}{2160}$ 2.7%	$\frac{120}{2160}$ 5.6%	$\frac{239}{2160}$ 11.1%	$\frac{121}{2160}$ 5.6%	$\frac{60}{2160}$ 2.8%	$\frac{120}{2160}$ 5.6%	$\frac{120}{2160}$ 5.6%	$\frac{119}{2160}$ 5.6%	$\frac{61}{2160}$ 2.8%	$\frac{124}{2160}$ 5.7%	$\frac{60}{2160}$ 2.8%
Probability ≈	$\frac{1}{36}$ 2.8%	$\frac{2}{36}$ 5.6%	$\frac{2}{36}$ 5.6%	$\frac{3}{36}$ 8.3%	$\frac{2}{36}$ 5.6%	$\frac{4}{36}$ 11.1%	$\frac{2}{36}$ 5.6%	$\frac{1}{36}$ 2.8%	$\frac{2}{36}$ 5.6%	$\frac{4}{36}$ 11.1%	$\frac{2}{36}$ 5.6%	$\frac{1}{36}$ 2.8%	$\frac{2}{36}$ 5.6%	$\frac{2}{36}$ 5.6%	$\frac{2}{36}$ 5.6%	$\frac{1}{36}$ 2.8%	$\frac{2}{36}$ 5.6%	$\frac{1}{36}$ 2.8%

2

What is the **probability** of these events happening?

a)



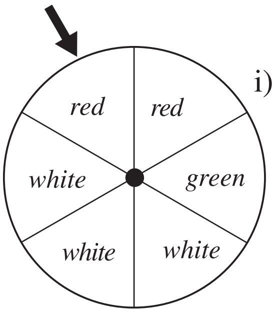
i) *Red* wins. $\boxed{\left(\frac{2}{6} = \frac{1}{3}\right)}$

ii) *Red* **or** *green* wins. $\boxed{\left(\frac{4}{6} = \frac{2}{3}\right)}$

iii) *Green* does **not** win. $\boxed{\left(\frac{4}{6} = \frac{2}{3}\right)}$

iv) Neither *green* **nor** *red* wins. $\boxed{\left(\frac{2}{6} = \frac{1}{3}\right)}$

b)



i) *Red* wins. $\boxed{\left(\frac{2}{6} = \frac{1}{3}\right)}$

ii) *Red* **or** *green* wins. $\boxed{\left(\frac{3}{6} = \frac{1}{2}\right)}$

iii) *Green* does **not** win. $\boxed{\left(\frac{5}{6}\right)}$

iv) Neither *green* **nor** *red* wins. $\boxed{\left(\frac{3}{6} = \frac{1}{2}\right)}$

3

A cuboid which measured 1.5 cm by 2 cm by 2.5 cm was used as a dice. The cuboid was thrown 1000 times and the frequency of each outcome was noted in the table.

Outcome	**Frequency**	**Relative frequency**
1	145	14.5%
2	168	16.8%
3	189	18.9%
4	186	18.6%
5	162	16.2%
6	150	15%
	(1000)	

a) Calculate the **relative frequency** for each outcome and complete the table.

b) If the sum of the numbers on any two opposite faces is 7, which numbers are written on the two:

i) largest faces $\boxed{3}$ and $\boxed{4}$

ii) smallest faces? $\boxed{1}$ and $\boxed{6}$

c) What is the **relative frequency** of each of the 3 sizes of face?

largest	*middle-sized*	*smallest*
37.5%	33%	29.5%

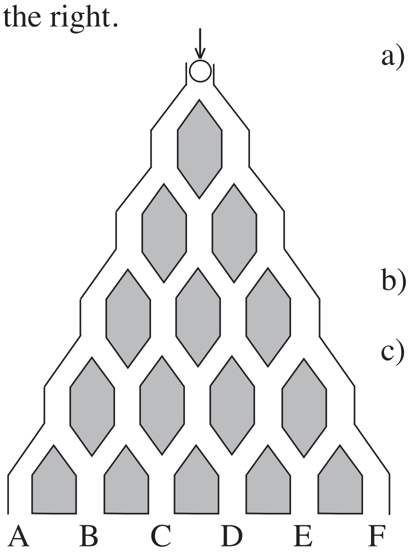
1

If the wheel is spun, what is the probability of these outcomes? Complete the table.

Outcome	1	2	3	4	5	6	At least 5	At most 5
Probability	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{2}{6} = \frac{1}{3}$	$\frac{5}{6}$

2

A marble is dropped into this maze and has an equal chance of falling to the left or to the right.



a) In how many ways can the marble come out at:

A 1 B 5 C 10
D 10 E 5 F? 1

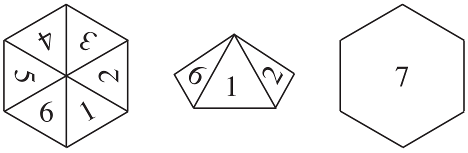
b) How many routes are there altogether? 32

c) What is the probability of each outcome?

Outcome	A	B	C	D	E	F
Probability	$\frac{1}{32}$	$\frac{5}{32}$	$\frac{10}{32}$	$\frac{10}{32}$	$\frac{5}{32}$	$\frac{1}{32}$

3

Sue used this hexagon-based pyramid as a dice. It has 7 written on its hexagon base and 1, 2, 3, 4, 5 and 6 written on its triangular faces.


Top view *Side view* *Bottom view*

Sue threw the dice 100 times and noted the numbers it landed on. She wrote how many times (**frequency**) the dice landed on each number (**outcome**) in this table.

Outcome	1	2	3	4	5	6	7
Frequency	11	12	13	10	12	14	28
Relative frequency	$\frac{11}{100}$	$\frac{12}{100}$	$\frac{13}{100}$	$\frac{10}{100}$	$\frac{12}{100}$	$\frac{14}{100}$	$\frac{28}{100}$

a) Fill in the bottom row of the table to show the **ratio** of the number of times a number was landed on to the total number of throws (**relative frequency**).

b) How many times did Sue throw: i) at least a 4 64

ii) at most a 4? 46

1

A bag of sweets contains 8 mints, 6 toffees and 2 boiled fruits, all wrapped in foil and all the same size and shape.

You take one sweet from the bag with your eyes closed. What is the probability that it is:

a) a mint $\boxed{\frac{1}{2}}$ b) a toffee $\boxed{\frac{3}{8}}$ c) a boiled fruit $\boxed{\frac{1}{8}}$

d) **not** a mint $\boxed{\frac{1}{2}}$ e) **not** a toffee $\boxed{\frac{5}{8}}$ f) a mint **or** a toffee? $\boxed{\frac{7}{8}}$

2

If the wheel is spun, what is the probability of each outcome? Complete the table.

Outcome	1	2	3	4	5	6	7	8	≥ 7	≤ 4	prime number
Probability	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{2}{8}$	$\frac{4}{8}$	$\frac{4}{8}$
									$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$

N.B. 1 is not a prime number as it has only one factor, 1.
A prime number has 2 factors, itself and 1.

3

A dice is thrown 100 times and a tally is kept of the numbers thrown.

The table shows the number of times (**frequency**) that each number (**outcome**) is thrown.

Outcome	1	2	3	4	5	6 $\frac{5}{8}$
Frequency	12	11	14	13	26	24
Relative frequency	$\frac{12}{100}$	$\frac{11}{100}$	$\frac{14}{100}$	$\frac{13}{100}$	$\frac{26}{100}$	$\frac{24}{100}$

a) Fill in the bottom row of the table to show the relative frequency.

b) Do you think that the dice is **biased** or **unbiased**? Biased

Give a reason for your answer.

If it was a fair dice we would expect each outcome to have the same frequency but 5 and 6 were thrown almost twice as often.

4

A bag contains 100 balls, each marked with a natural number from 1 to 100.
You take out a ball with your eyes closed. What is the probability that it is:

a) an even number $\boxed{\frac{1}{2}}$ b) a multiple of 3 $\boxed{\frac{33}{100}}$

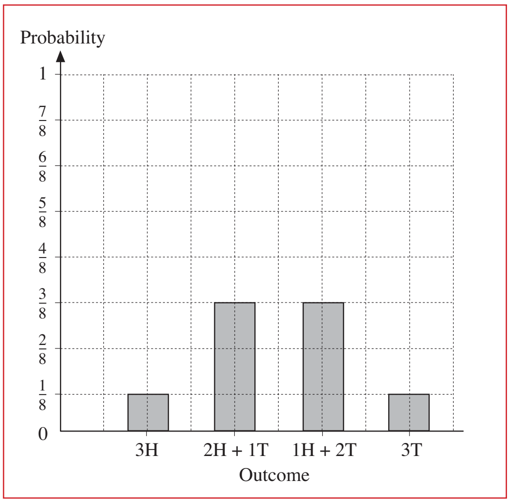
c) **not** a multiple of 3 $\boxed{\frac{67}{100}}$ d) a multiple of 10 $\boxed{\frac{10}{100} = \frac{1}{10}}$

e) **not** a multiple of 10 $\boxed{\frac{9}{10}}$ f) a square number? $\boxed{\frac{10}{100} = \frac{1}{10}}$

1

Three equal coins are tossed.

Draw a graph to show the probability of each outcome.

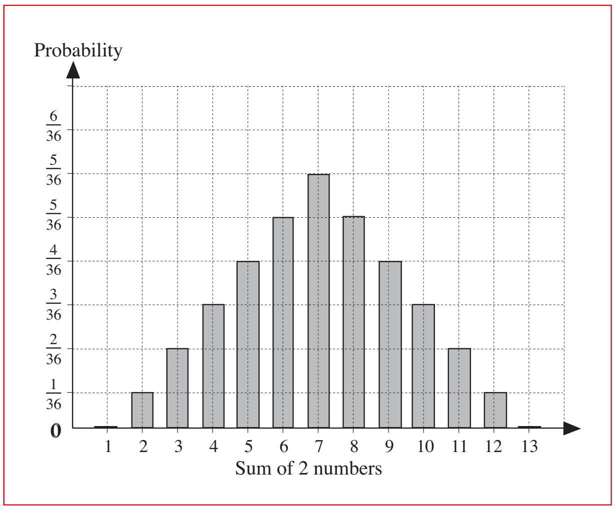


2

Two equal dice are thrown.

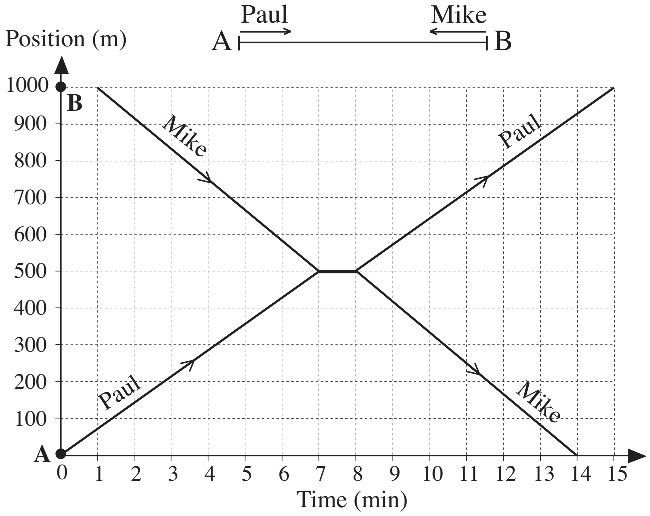
Draw a graph to show the probability of each possible **sum** of the two numbers thrown.

(Use the probability data from *Question 2*, page 142)



3

Paul is walking from A to B and Mike from B to A. The graph shows their positions during that time.



a) Who started first? . . . .
Paul, 1 min before Mike

b) Who arrived first? . . . .
Mike, 1 min beforePaul

c) How long did:

i) Paul take . . . 15 mins . . .

ii) Mike take? . . 13 mins . . .

d) What happened during the 7th and 8th minutes?

. . . . They met and stopped. . . . .

1 Write in the table how many pupils in your class have birthdays in each month.

e.g. For a class of 30 pupils:

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2	1	6	3	1	2	4	0	7	3	0	1

b) Show the data in a graph.

c) Write the data in increasing order.

. . . .

. . . .

. . . .

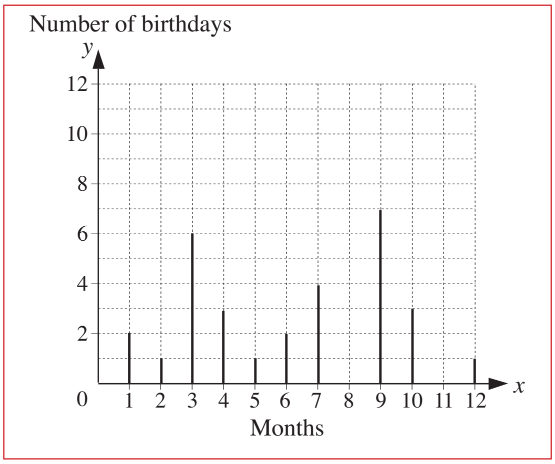
d) What are these values? e.g.

i) Mode: 1

ii) Median: 2

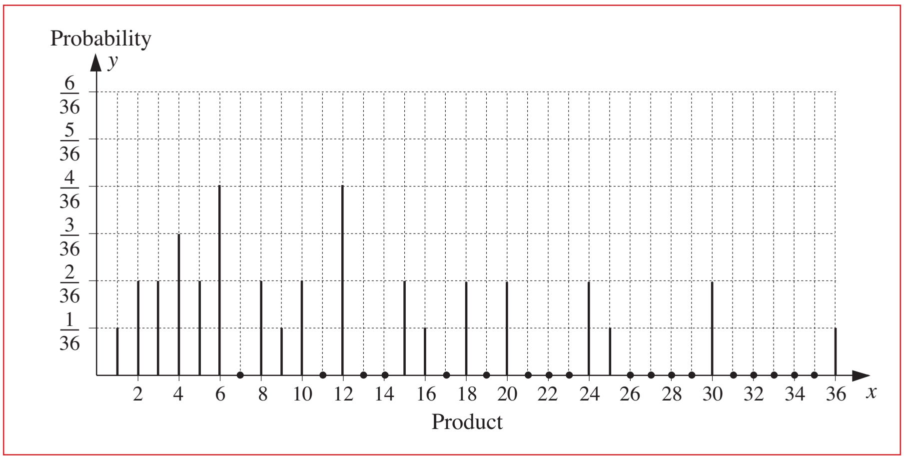
iii) Mean: 2.5

e.g.



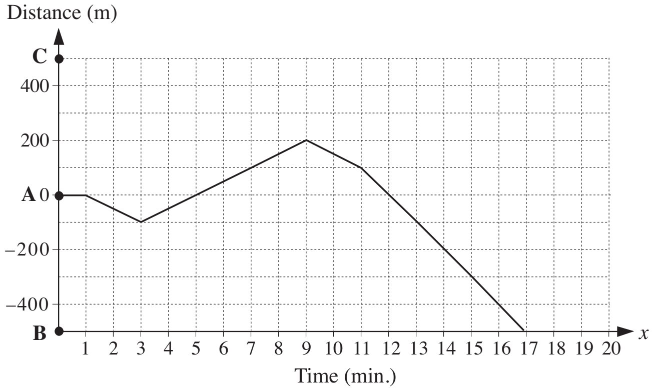
2 Show in a graph the probability of each possible **product** when 2 dice are thrown.

(Use the probability data from *Question 1*, page 143.)



3 Henry cannot make up his mind which cinema, B or C, to go to from his house at A.

The graph shows what Henry did.



a) Which cinema **did** Henry go to? B

b) When did he change his mind? at 3 min and 9 min

c) When did he start to run? at 11 min

1 Two groups of pupils are in a competition to see which of them does better in a maths test out of 8 marks.
Both groups contain 8 pupils but their marks are similar. They need one overall mark for each group to make the comparison easier and decide to use the **mean** value.
Calculate the mean mark for each group and compare them. Fill in the missing sign.

Group A: 8, 8, 7, 5, 6, 8, 6, 7 (marks)

Mean: $\frac{8+8+7+5+6+8+6+7}{8} = \frac{55}{8}$

$= \underline{6.875}$

Group B: 6, 6, 6, 7, 6, 7, 8, 8

Mean: $\frac{6+6+6+7+6+7+8+8}{8} = \frac{54}{8}$

$= \underline{6.75}$

2 Solve the problem in your exercise book and write the answer here.

Two groups of children collected blackberries. There were 6 children in **Group A** and 8 children in **Group B**.

The members of **Group A** collected these amounts of blackberries:

1.2 kg, 0.8 kg, 1.6 kg, 2.4 kg, 0.6 kg, 0.9 kg

The members of **Group B** collected these amounts of blackberries:

0.9 kg, 1.4 kg, 1.2 kg, 0.6 kg, 2 kg, 1 kg, 0.45 kg, 0.7 kg

Which group worked harder?

Mean of *Group A*: $\frac{1.2+0.8+1.6+2.4+0.6+0.9}{6} = \frac{7.5}{6} = 1.25\text{ (kg)}$

Mean of *Group B*: $\frac{0.9+1.4+1.2+0.6+2+1+0.45+0.7}{8}\text{ (kg)}$

$= \frac{8.25}{8}\text{ (kg)} = 1.03125\text{ kg} \approx 1.03\text{ kg}$

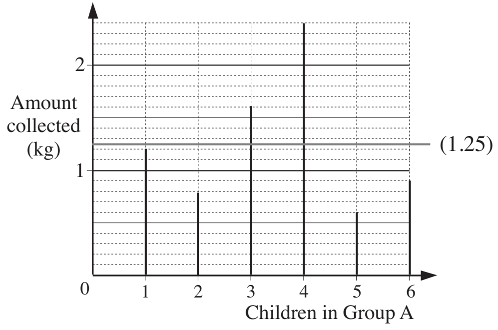
Answer: The children in Group A worked harder as they gathered more blackberries per person on average than those in Group B.

3 Draw graphs to show the data from *Question 2*.

Draw a *red* horizontal line at each **mean**.

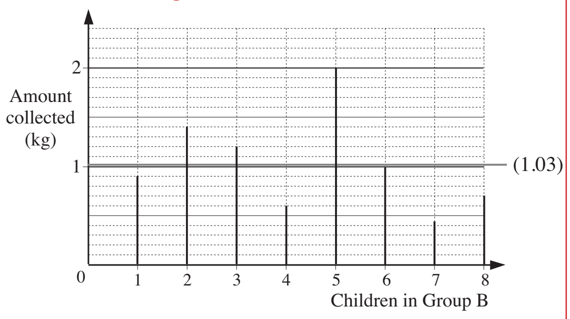
Group A

Mean: 1.25 kg



Group B

Mean: 1.03 kg



1

The ages of the members of the *Cabbage* family are:

1 year, 3 years, 33 years, 34 years and 65 years

The ages of the members of the *Parsnip* family are:

10 years, 12 years, 19 years, 21 years, 42 years and 43 years.

a) Calculate the **mean** age of each family.

Cabbage family: $\boxed{\frac{1+3+33+34+65}{5} = \frac{136}{5} = \underline{27.2} \text{ (years)}}$

Parsnip family: $\boxed{\frac{10+12+19+21+42+43}{6} = \frac{147}{6} = \underline{24.5} \text{ (years)}}$

b) Both families are working in their gardens. Which family do you think will be able to do more work? Give a reason for your answer.

The *Parsnip* family would be able to do more work in the garden because all of them can work.

2

One summer's day in Budapest, the temperature was noted every two hours and recorded in this table.

Time (hours)	0	2	4	6	8	10	12	14	16	18	20	22	24
Temperature (°C)	10.6	10.0	9.5	11.1	15.2	20.9	25.0	28.3	29.0	26.1	21.0	17.4	13.0

a) Calculate the **mean** of the temperatures on that day from the given data.

Mean: $\boxed{\frac{237.1}{13} \approx \underline{18.2} \text{ (° C)}}$

b) Write the data in increasing order then find the **mode** and **median**.

9.5, 10.0, 10.6, 11.1, 13.0, 15.2, 17.4, 20.9, 21.0, 25.0, 26.1, 28.3, 29.0

Mode: Any or all of these temperatures (as each occurs once)

Median: 17.4°C

3

One winter's day in Budapest, the temperature was noted every two hours and recorded in this table.

Time (hours)	0	2	4	6	8	10	12	14	16	18	20	22	24
Temperature (°C)	– 10	–11	– 11	– 10	– 8	– 3	1	4	5	2	0	– 4	– 8

a) Calculate the **mean** of the temperatures on that day from the given data.

Mean: $\boxed{-4 \text{°C}}$

b) Write the data in increasing order then find the **mode** and **median**.

– 11, – 11, – 10, – 10, – 8, – 8, – 4, – 3, 0, 1, 2, 4, 5

Mode: $\boxed{-11 \text{ or } -10 \text{ or } -8}$ Median: $\boxed{-4 \text{°C}}$

1

Mike is growing two different varieties of tomato plants in his greenhouse.

During one week, he keeps a record of the number of tomatoes he picks from each type of plant and notes the data in a table.

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Variety A	5	5	4	1	0	2	5
Variety B	5	3	3	3	7	9	6

a) For **Variety A**, what is the:

i) Mode: 5 ii) Median: 4 iii) Mean: $\frac{22}{7} = \underline{3\frac{1}{7}}$

b) For **Variety B**, what is the:

i) Mode: 3 ii) Median: 5 iii) Mean: $\frac{36}{7} = \underline{5\frac{1}{7}}$

c) Compare the two sets of data. Which variety do you think is best and why?

Variety B is best, as it produces more tomatoes per day on average.

2

A group of pupils took tests in 4 subjects: English, Mathematics, History and Geography. Each test was out of 10 marks. The teacher wrote the results in this table.

	English	Mathematics	History	Geography	Mean mark per pupil
Anne	7	8	6	7	**7**
Brenda	8	8	7	5	**7**
Claire	9	10	9	8	**9**
Darren	7	9	9	7	**8**
Ella	10	9	5	8	**8**
Freddy	8	10	6	5	**7.25**
Graham	7	9	7	9	**8**
Mean mark per subject	**8**	**9**	**7**	**7**	

a) Complete the table by calculating: i) the mean mark per **pupil**

ii) the mean mark per **subject**.

b) Which pupil did best overall? Claire

c) Which subject did the pupils find: i) easiest Pupils found the Mathematics test easiest.

ii) most difficult? Pupils found History and Geography equally most difficult.

1

KS2A
1999
Q.1

Calculator not allowed

Write in the **missing** numbers.

a) $(4 \times 3) + \boxed{5} = 17$ [1 mark]

b) $(5 \times 5) - \boxed{3} = 22$ [1 mark]

2

KS2A
1999
Q.12

Calculator not allowed

Calculate 459 × 6 [1 mark]

$459 \times 6 = 2400 + 300 + 54 = \underline{2754}$ or

$$\begin{array}{r} 4\,5\,9 \\ \times\ \ 6 \\ \hline 2\,7\,5\,4 \\ \hline {\scriptstyle 3\ 5\ \ } \end{array}$$

3

KS2B
1999
Q.9

Calculator allowed

Write the number that is the nearest to 5000 which uses **all** the digits 4, 5, 6 and 8.

4 8 6 5 [1 mark]

4

Practise calculation.

a)
$$\begin{array}{ccccccc} & & 2 & 0 & 8 & 1 & 7 \\ & & & 4 & 0 & 5 & 3 \\ & 1 & 0 & 4 & 1 & 0 & 4 \\ + & & 5 & 0 & 5 & 0 & 5 \\ \hline & 1 & 7 & 9 & 4 & 7 & 9 \end{array}$$

b)
$$\begin{array}{ccccccc} & 2 & 2 & 0 & 8 & 1 & 7 \\ - & & 6 & 7 & 0 & 9 & 2 \\ \hline & 1 & 5 & 3 & 7 & 2 & 5 \end{array}$$

c)
$$\begin{array}{ccccccc} & & 8 & 3 & 6 & 0 & 5 \\ & & & & \times & 1 & 4 \\ \hline & & & & & & \\ + & & & & & & \\ \hline 1 & 1 & 7 & 0 & 4 & 7 & 0 \end{array}$$

5

HMC
2002
Age 9

We have 80 books altogether. They are arranged on 3 shelves.

If we moved 7 books from the top shelf to the middle shelf and took 8 books away from the bottom shelf, there would be an equal number of books on each shelf.

How many books are on each shelf?

e.g.
Number of books: 80 Number of books to be moved: 7
Number of books to be taken away completely: 8

Number of books left: 80 − 8 = 72

Number of books on each of 3 shelves if equal: 72 ÷ 3 = $\underline{24}$

Actual number of books on: top shelf: 24 + 7 = $\underline{31}$
middle shelf: 24 − 7 = $\underline{17}$
bottom shelf: 24 + 8 = $\underline{32}$

Answer: There are 31 books on the top shelf, 17 books on the middle shelf and 32 books on the bottom shelf.

1

KS2B 1999 Q.2

Calculator allowed

Circle **two** numbers which add up to 160.

63	64	65	66	67
73	74	75	76	77
83	84	85	86	87
93	94	95	96	97

63 + 97, 64 + 96, 65 + 95, 66 + 94, 67 + 93,
73 + 87, 74 + 86, 75 + 85, 76 + 84, 77 + 83

[1 mark]

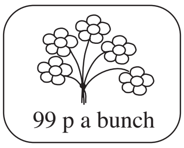
2

KS2A 1999 Q.7

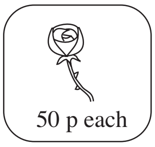
Calculator not allowed

A shop sells these flowers.

Daisies



Roses



a) John buys **4 bunches** of **daisies**. How much does he pay altogether?

99 p × 4 = 100 p × 4 − 4 p = 400 p − 4 p = 396 p = £3.96
or = £1 × 4 − 4 p = £4 − 4 p = £3.96

[1 mark]

Answer: John paid £3.96 for 4 bunches of daisies.

b) Karpal has **£5.00** to spend on **roses**. How many **roses** can she buy for **£5.00**?

£5 ÷ 50 p = 500 p ÷ 50 p = 50 p ÷ 5 p = 10 (times)

[1 mark]

Answer: Karpal can buy 10 roses.

3

a) $\frac{3}{4} + \frac{2}{4} + \frac{1}{4} = \left(\frac{6}{4} = \frac{3}{2} = 1\frac{1}{2}\right)$

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

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

d) $\frac{7}{8} - \frac{1}{5} = \left(\frac{35-8}{40} = \frac{27}{40}\right)$

e) $\frac{2}{7} \times 3 = \left(\frac{6}{7}\right)$

f) $\frac{8}{9} \div 4 = \left(\frac{2}{9}\right)$ (or $= \frac{8}{36} = \frac{4}{9}$)

4

KS2A 1999 Q.18

Calculator not allowed

Circle the **two** numbers which add up to 1.

0.11 [✓ 0.85] 0.9 0.25 [✓ 0.15]

[1 mark]

5

a)
$$\begin{array}{r} 10.2 \\ 103.45 \\ +\ 62.97 \\ \hline 176.62 \end{array}$$

b)
$$\begin{array}{r} 36.82 \\ -\ 14.59 \\ \hline 22.23 \end{array}$$

c)
$$\begin{array}{r} 4.3 \\ \times\ 7 \\ \hline 30.1 \end{array}$$

d)
$$\begin{array}{r} 1.7 \\ 4\,\overline{)\,6.8} \end{array}$$

6

HMC 2002, I Age 10

$$\begin{array}{r} A\ B \\ +\ B\ C \\ \hline D\ A \end{array}$$

In this addition, different letters stand for different digits and the same letters stand for the same digits. A is **not less** than 3.

a) Which digit could each letter stand for? Find different solutions in your exercise book.

b) What is: i) the smallest 43 ii) the greatest 98 possible sum?

1

Practise addition.

a) i) 3 + 2 = 5 ii) 3 + 0 = 3 iii) 3 + (– 2) =1

iv) 3 + (– 4) = −1 v) 3 + (– 6) = −3

b) i) – 3 + (– 2) = − 5 ii) – 3 + 0 = −3 iii) – 3 + 2 = −1

iv) – 3 + 4 =1 v) – 3 + 6 = 3

c) i) 25 + (– 41) + 12 + (– 10) = − 15

ii) – 100 + (– 30) + 78 + (– 48) = −100

iii) 5000 + (– 2000) + (– 3000) = 0

iv) – 85 000 + (– 15 000) + (– 20 000) = − 100 000 + (− 20 000) = − 120 000

v) – 236 700 + 0 = − 236 700

2

Write an operation and calculate the answer.

a) Ian had £1500 in cash and was £400 in debt, then £300 of his debt was cancelled. What is his balance now?

Plan: 1500 + (– 400) – (– 300) = 1500 + (– 100) = $\underline{1400}$

Answer: Ian's balance is £1400.

b) Lucy had £1500 in cash and was £400 in debt. She went on holiday and spent £1200. What is her balance now?

Plan: 1500 + (– 400) + (– 1200) = 300 + (– 400) = $\underline{–\ 100}$

Answer: Lucy's balance is – £100.

3

Practise calculation.

a) i) 20 – (+ 14) = $\underline{6}$		b) i) 20 + (– 14) = $\underline{6}$
ii) 20 – (+ 36) = $\underline{–\ 16}$		ii) 20 + (– 36) = $\underline{–\ \ 16}$
iii) 40 – (+ 40) = $\underline{0}$	⊜	iii) 40 + (– 40) = $\underline{0}$
iv) 35 – (– 20) = $\underline{55}$		iv) 35 + (+ 20) = $\underline{55}$
v) – 30 – (– 10) = $\underline{–\ \ 20}$		v) – 30 + (+ 10) = $\underline{–\ \ 20}$
vi) – 30 – (– 30) = $\underline{0}$		vi) – 30 + (+ 30) = $\underline{0}$
vii) – 20 – (– 50) = $\underline{30}$		vi) – 20 + (+ 50) = $\underline{30}$
viii) – 20 – (+ 30) = $\underline{–\ 50}$		viii) – 20 + (– 30) = $\underline{–\ \ 50}$

4

HMC 2002, II Age 9

What is the smallest possible, 3-digit, positive integer which fulfils these conditions?

- If it is multiplied by 3, the result is also a 3-digit number.
- If it is multiplied by 4, the result is a 4-digit number.

$\boxed{250}$

1

Practise rounding:

a) to nearest 10	b) to nearest 100	c) to nearest tenth
6208 ≈ 6210	6208 ≈ 6200	62.08 ≈ 62.1
14 035 ≈ 14 040	14 035 ≈ 14 000	140.35 ≈ 140.4
90 455 ≈ 90 460	90 455 ≈ 90 500	904.55 ≈ 904.6
83 ≈ 380	383 ≈ 400	3.83 ≈ 3.8
9 999 ≈ 10 00	9 999 ≈ 10 000	99.99 ≈ 100.0

2

KS2A 1999 Q.9

Calculator not allowed

e.g. $538 - 396 = 238 - 96 = 148 - 6 = \underline{142}$

or $542 - 400 = \underline{142}$ (Adding equal amounts to reductant and subtrahend does not change the difference.)

[1 mark]

3

KS2B 1999 Q.5

Calculator allowed

Write in the **four missing digits**.

Put **one** digit in each box. $\boxed{9}\boxed{9} + \boxed{9}\boxed{9} = 198$

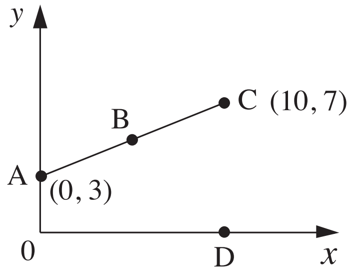
[1 mark]

4

KS2A 1999 Q.20

Calculator not allowed

Here is a graph.



a) The points **A**, **B** and **C** are **equally spaced**.
What are the **coordinates** of the point **B**?

(5 , 5)

[1 mark]

b) Point **D** is directly below point **C**.
What are the **coordinates** of the point **D**?

(10, 0)

[1 mark]

5

HMC 2002, I Age 10

In a race, the runners are started 1 minute after each other. The first runner covers 174 m each minute and the second runner covers 182 m each minute.

What distance will be between the two runners:

a) 10 minutes after the first runner started

174 m × 10 – 182 m × 9
= 1740 m – 1638 m = $\underline{102\ (\text{m})}$

b) 30 minutes after the first runner started?

174 m × 30 – 182 m × 29
= 5220 m – 5278 m = $\underline{-\ 58\ \text{m}}$

1

Practise calculation.

a) $\frac{3}{5} + \frac{4}{5} + \frac{7}{10} = 2\frac{1}{10}$

b) $\frac{3}{8} + \frac{1}{7} = \frac{29}{56}$

c) $3\frac{3}{4} + \frac{3}{8} = 4\frac{1}{8}$

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

e) $1\frac{5}{6} - \frac{2}{3} = 1\frac{1}{6}$

f) $\frac{7}{9} - \frac{1}{3} - \frac{1}{9} = \frac{1}{3}$

2

Practise calculation.

a) $\frac{2}{3} \times 4 = 2\frac{2}{3}$

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

c) $\frac{3}{8} \times 5 = 1\frac{7}{8}$

d) $\frac{1}{3} \div 2 = \frac{1}{6}$

e) $\frac{6}{7} \div 3 = \frac{2}{7}$

f) $\frac{5}{9} \div 5 = \frac{1}{9}$

3

a)

		3	7.	0	2
	1	4	9.	4	
+		6	8.	9	9
	2	5	5.	4	1

b)

	7	8.	3	9
–	4	9.	5	3
	2	8.	8	6

c)

	2.	7
×	9	
2	4.	3

d)

		7.	5	1
6	4	5.	0	6

4

What is the largest possible, 3-digit, positive integer which fulfils **both** conditions?

- If it is muliplied by 3, the result is also a 3-digit number. $999 \div 3 = \underline{333}$ (3 digits)
- If it is multiplied by 4, the result is a 4-digit number. $\underline{333} \times 4 = 1332$ (4-digits)

Largest possible number which fulfils both conditions is 333.

5

In a school the ratio of boys to girls in Year 5 is 5 : 7. There are 12 more girls than boys in Year 5. How many pupils are in Year 5?

72 pupils

6

What is the smallest possible natural number that has a remainder of 1 when divided by 2, 3, 4, 5 or 6 but which can be divided by 7 exactly?

301

7

What are the four consecutive **odd** numbers which add up to 80?

17 19 21 23

1

Practise calculation.

a) $37 - 80 + 43 + 64 - 44 = 20$

b) $3.7 - 8 + 4.3 + 6.4 - 4.4 = 2$

c) $5 \times 31 \times 25 \times 20 \times 4 = 310\,000$

d) $2 \times 50 \div 4 \times 27 = 675$

2

Practise calculation.

a) $30 - 16 \div 4 + 9 \times 5 + 15 = 86$

b) $72 \div 8 - 20 \times 6 \div 5 + 300 \div 100 = -12$

c) $20 \div 8 \times 6 + 3 \times 12 \div 9 + 15 \div 5 - 5 = 17$

3

Do each calculation in two different ways.

a) $650 - (450 + 120) = 650 - 570 = 80$
or $650 - 450 - 120 = 200 - 120 = 80$

b) $650 - (450 - 120) = 650 - 330 = 320$
or $650 - 450 + 120 = 200 + 120 = 320$

c) $50 \times (12 + 38) = 50 \times 50 = 2500$
or $50 \times 12 + 50 \times 38 = 600 \times 1900 = 2500$

d) $(200 - 180) \times 7 = 20 \times 7 = 140$
or $200 \times 7 - 180 \times 7 = 1400 - 1260 = 140$

e) $(90 + 72) \div 18 = 162 \div 18 = 81 \div 9 = 9$
or $90 \div 18 + 72 \div 18 = 5 + 4 = 9$

f) $600 \div (25 \times 6) = 600 \div 150 = 60 \div 15 = 4$
or $600 \div 25 \div 6 = 100 \div 25 = 4$

4

HMC 2002, II Age 9

Which positive, whole numbers make all three inequalities true at the same time?

$$3 \times (5 + \square) < 35$$

$$8 + \square > 11$$

$$20 - 3 \times \square \leq 9$$

Possible numbers: $\square$: 4, 5, 6

1

KS2A 1999 Q.17

Calculator not allowed

Megan makes a sequence of numbers starting with **100**.

She **subtracts 45** each time. Write the next **two** numbers in the sequence. [1 mark]

100, 55, 10, $\boxed{-35,}$, $\boxed{-80}$, [1 mark]

2

KS2A 1999 Q.16

Calculator not allowed

Eggs are put in **trays of 12**. The trays are packed in boxes.

Each box contains **180 eggs**. How many trays are in each box?

*Show your **working**. You may get a mark.*

Plan: 180 ÷ 12 (= 30 ÷ 2 = <u>15</u>) or $\begin{array}{r} 15 \\ 12\overline{)180} \\ 6\ \end{array}$

Answer: There are 15 trays in each box.

Check: $\begin{array}{r} 15 \\ \times\,12 \\ \hline 30 \\ 150 \\ \hline 180 \\ \hline \end{array}$ ✓

[2 marks]

3

KS2B 1999 Q.19

Calculator allowed

Calculate $\frac{7}{8}$ of 7000. Answer: 6125 [1 mark]

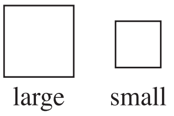
4

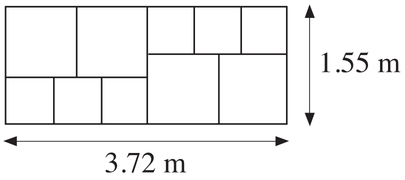
KS2B 1999 Q.21

Calculator allowed

Mr. Jones has two sizes of square paving stones.

He uses them to make a path.





The path measures **1.55 metres** by **3.72 metres**.

Calculate the **width** of a **small paving stone**.

*Show your **method**. You may get a mark.* 0.62 m or 62 cm [2 marks]

5

HMC 2002, II Age 10

Some children and their Dads went on a journey by train. There were 10 Dads with 1 child each, 10 Dads with 2 children each and 10 Dads with 3 children each.

The group took up the 3 coaches at the front of the train and each child was in the same coach as his or her father.

How could they sit so that the number of Dads and the number of children were the same in each of the 3 coaches?

e.g.

Coach 1	Coach 2	Coach 3
D D D D D D D D D D C C C C C C C C C C C C C C C C C C C C	D D D D D D D D D D C C C C C C C C C C C C C C C C C C C C	D D D D D D D D D D C C C C C C C C C C C C C C C C C C C C
5 × 3 + 5 × 1	5 × 3 + 5 × 1	10 × 2

1

Fill in the missing numbers and signs. $843 + 157 = 1000$

a) $843 + (157 + 36) = 1000 + \boxed{36}$

b) $843 + (157 + k) = 1000 \boxed{+} k$

c) $(843 + 41) + 157 = 1000 \boxed{+} 41$

d) $(843 + n) + 157 = 1000 + \boxed{n}$

e) $843 + (157 - 69) = 1000 \boxed{-} 69$

f) $843 + (157 - t) = 1000 - \boxed{t}$

g) $(843 - 55) + 157 = 1000 - \boxed{55}$

h) $(843 - u) + 157 = 1000 \boxed{-} u$

i) $(843 + 16) + (157 + 16) = 1000 \boxed{+} \boxed{32}$

j) $(843 + x) + (157 + x) = 1000 \boxed{+} \boxed{2 \times x}$

k) $(843 + 72) + (157 - 72) = \boxed{1000}$

l) $(843 + y) + (157 - y) = \boxed{1000}$

2

Fill in the missing numbers and signs. $685 - 185 = 500$

a) $(685 + 15) - 185 = 500 + \boxed{15}$

b) $(685 + a) - 185 = 500 \boxed{+} a$

c) $685 - (185 + 23) = 500 \boxed{-} 23$

d) $685 - (185 + b) = 500 - \boxed{b}$

e) $(685 - 45) - 185 = 500 \boxed{-} 45$

f) $(685 - c) - 185 = 500 \boxed{-} c$

g) $685 - (185 - 30) = 500 \boxed{+} 30$

h) $685 - (185 - d) = 500 + \boxed{d}$

i) $(685 + 51) - (185 + 51) = \boxed{500}$

j) $(685 + e) - (185 + e) = \boxed{500}$

k) $(685 + 4) - (185 - 4) = 500 \boxed{+} \boxed{8}$

l) $(685 + f) - (185 - f) = 500 \boxed{+} \boxed{2 \times f}$

m) $(685 - 10) - (185 + 10) = 500 \boxed{-} \boxed{20}$

n) $(685 - g) - (185 + g) = 500 \boxed{-} \boxed{2 \times g}$

3

KS2B
1999
Q.13

Calculator allowed

a)

Rakes	*Spades*	*Flowerpots*
£7.70 each	£9.55 each	£11.75 each

Nicola has **£50**. She buys **3 flowerpots** and a **spade**.
How much money does she have left?

£ 5.20 [2 marks]

b) Seeds are **£1.49** for a packet. Stephen has **£10** to spend on seeds.
What is the **greatest number** of packets he can buy? 6 [1 mark]

4

HMC
2002, I
Age 10

How many positive 3-digit numbers less than 500 are there in which the middle digit is half of the sum of the two outside digits?

11111118

1

Fill in the missing numbers and signs. $60 \times 20 = 1200$

a) $(60 \times 3) \times 20 = 1200 \boxed{\times} 3$

b) $(60 \times n) \times 20 = 1200 \times \boxed{n}$

c) $60 \times (20 \times 4) = 1200 \boxed{\times} 4$

d) $60 \times (20 \times m) = 1200 \times \boxed{m}$

e) $(60 \div 3) \times 20 = 1200 \div \boxed{3}$

f) $(60 \div s) \times 20 = 1200 \boxed{\div} s$

g) $60 \times (20 \div 4) = 1200 \boxed{\div} 4$

h) $60 \times (20 \div t) = 1200 \div \boxed{t}$

i) $(60 \times 2) \times (20 \times 2) = 1200 \times \boxed{4}$

j) $(60 \times u) \times (20 \times u) = 1200 \times \boxed{u \times u}$

k) $(60 \div 4) \times (20 \div 4) = 1200 \div \boxed{16}$

l) $(60 \div v) \times (20 \div v) = 1200 \div \boxed{v \times v}$

m) $(60 \times 5) \times (20 \div 5) = \boxed{1200}$

n) $(60 \times a) \times (20 \div a) = \boxed{1200}$

2

Fill in the missing numbers and signs. $1500 \div 30 = 50$

a) $(1500 \times 2) \div 30 = 50 \times \boxed{2}$

b) $(1500 \times a) \div 30 = 50 \boxed{\times} a$

c) $1500 \div (30 \times 2) = 50 \boxed{\div} 2$

d) $1500 \div (30 \times a) = 50 \div \boxed{a}$

e) $(1500 \div 2) \div 30 = 50 \div \boxed{2}$

f) $(1500 \div a) \div 30 = 50 \boxed{\div} a$

g) $1500 \div (30 \div 2) = 50 \boxed{\times} 2$

h) $1500 \div (30 \div a) = 50 \times \boxed{a}$

i) $(1500 \times 2) \div (30 \div 2) = 50 \boxed{\times} \boxed{4}$

j) $(1500 \times a) \div (30 \div a) = 50 \boxed{\times} \boxed{a \times a}$

k) $(1500 \div 2) \div (30 \times 2) = 50 \boxed{\div} \boxed{4}$

l) $(1500 \div a) \div (30 \times a) = 50 \boxed{\div} \boxed{a \times a}$

m) $(1500 \times 2) \div (30 \times 2) = 50 \boxed{\xcancel{}} \boxed{\xcancel{}}$

n) $(1500 \times a) \div (30 \times a) = 50 \boxed{\xcancel{}} \boxed{\xcancel{}}$

o) $(1500 \div 2) \div (30 \div 2) = 50 \boxed{\xcancel{}} \boxed{\xcancel{}}$

p) $(1500 \div a) \div (30 \div a) = 50 \boxed{\xcancel{}} \boxed{\xcancel{}}$

3

KS2A
1999
Q.23

Calculator not allowed

Calculate 286×53

Show your working.
You may get a mark.

$$\begin{array}{r} 2\,8\,6 \\ \times\ 5\,3 \\ \hline 8\,5\,8 \\ 1\,4\,3\,0\,0 \\ \hline 1\,5\,1\,5\,8 \end{array}$$

$\boxed{15158}$ [2 marks]

4

HMC
2002, II
Age 9

What is the greatest 3-digit natural number in which the **product** of its digits is 108?

$\boxed{962}$

1

Do each calculation in two different ways.

a) $720 - (320 + 150) = 720 - 320 - 150 = 400 - 150 = 250$

or $= 720 - 470 = 250$

b) $720 - (320 - 150) = 720 - 320 + 150 = 400 + 150 = 550$

or $= 720 - 170 = 550$

c) $40 \times (11 + 29) = 40 \times 1 + 40 \times 29 = 440 + 1160 = 1600$

or $= 40 \times 40 = 1600$

d) $(300 - 270) \times 7 = 300 \times 7 - 270 \times 7 = 2100 - 1890 = 210$

or $= 30 \times 7 = 210$

e) $(90 + 60) \div 15 = 90 \div 15 + 60 \div 15 = 6 + 4 = 10$

or $= 150 \div 15 = 10$

f) $500 \div (20 \times 5) = 500 \div 20 \div 5 = 25 \div 5 = 5$

or $= 500 \div 100 = 5$

2

Compare the amounts. Fill in the missing signs. (<, > or =)

a) $\frac{1}{2}$ of 60 $\boxed{=}$ 50% of 60

b) 40% of 50 m $\boxed{=}$ 20% of 100 m

c) $\frac{3}{4}$ of £100 $\boxed{>}$ 70% of £100

d) 30% of 90 kg $\boxed{<}$ 20% of 150 kg

e) 20% of 5 km $\boxed{=}$ $\frac{2}{10}$ of 5 km

f) $\frac{3}{5}$ of £70 $\boxed{<}$ 60% of £75

g) 75% of 2 litres $\boxed{<}$ 1.75 litres

h) $\frac{1}{10}$ of 42 km $\boxed{>}$ 0.42 km

i) 105% of 10 litres $\boxed{<}$ $1\frac{1}{5}$ of 10 litres $\boxed{>}$ 10.5 litres

3

What is the greatest 3-digit, natural number in which the product of its digits is 72?

Check:

$\boxed{942}$

4

In a **magic square**, the sum of the numbers in each row, column and diagonal is the same. Complete these magic squares.

a)

6	11	7
9	8	7
9	5	10

b)

10	3	8
5	7	9
6	11	4

c)

14	7	12
9	11	13
10	15	8

1

KS2B
1999
Q.3

Calculator allowed

These are the times when letters are collected from a post box.

Monday to Friday	Saturday	Sunday
9 am 2 pm 6.30 pm	11.30 am	No collection

What is the **latest** time that letters are collected on **Wednesdays**? 6.30 pm [1 mark]

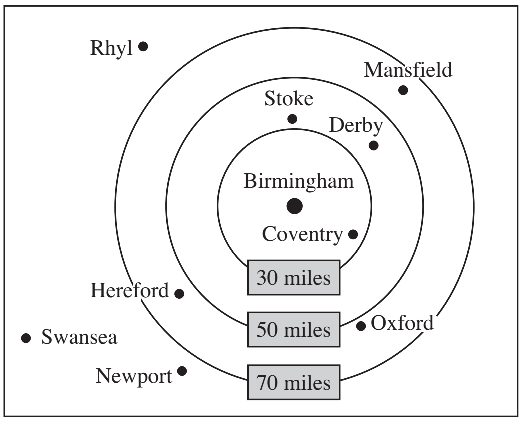
Carla posts a letter at **10 a.m. on Monday**.
How **long** will it be before it is collected? 4 hours [1 mark]

Gareth posts a letter on **Saturday at 4 p.m**.
When will it be collected from the post box? Monday at 9 am

[1 mark]

2

KS2B
1999
Q.10



This diagram shows the distances of different towns from Birmingham.

Write the name of a town which is **between 30 and 50 miles** from Birmingham.

. . . . . . Derby or Stoke . . . . [1 mark]

Use the diagram to estimate the distance in **miles** from **Birmingham** to **Mansfield**.

e.g. 62 miles [1 mark]

3

KS2A
1999
Q.14

Calculator not allowed

Emma parks her car at **9.30 am**.
She collects the car at **1.20 pm**.
How much does she pay?

£1.70 [1 mark]

Car Park Charges

Time	Charge
Up to 1 hour	20 p
1 to 2 hours	50 p
2 to 3 hours	£1.00
3 to 4 hours	£1.70
Over 4 hours	£5.00

Dan and Mark both use the car park.

Dan says, '*I paid exactly twice as much as Mark but I only stayed 10 minutes longer*.'

In your exercise book, explain how Dan could be correct. [1 mark]

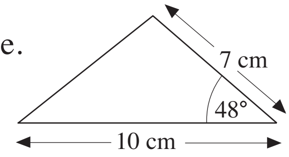
e.g. 'Mark could have parked for 1 hour 54 minutes and paid 50 p, and Dan could have parked for 2 hours 4 minutes and paid £1.00.'

4

KS2A
1999
Q.22

Here is a sketch of a triangle. It is not drawn to scale.

Draw the full size triangle **accurately**.
Use an angle measurer (**protractor**) and a ruler.



[2 marks]

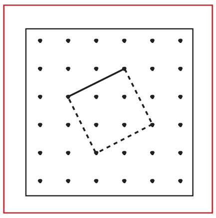
1

*KS2A
1999
Q.2*

The line on the grid is one side of a square.

On the grid, draw the other three sides of the square.

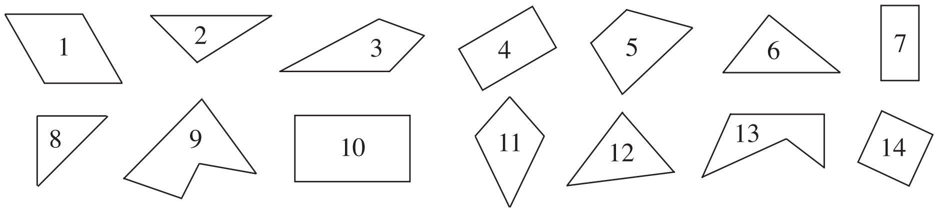
Use a ruler.



[1 mark]

2

Group these plane shapes by listing their numbers.



2, 6, 8, 12	1, 3, 4, 5, 7, 10, 11, 14	4, 6, 7, 8, 10, 13, 14
Triangles	Quadrilaterals	Has at least 1 right angle

3

Decide whether the statements are *true* or *false*, then list their letters below.

a) All rectangles are quadrilaterals. T

b) All quadrilaterals are rectangles. F

c) Every quadrilateral is a rectangle but not every rectangle is a quadrilateral. F

d) The diagonals of a rectangle are equal in length. T

e) The adjacent sides of any rectangle are equal to each other. F

f) The opposite sides of any rectangle are equal and parallel to each other. T

g) Every trapezium has only 1 pair of parallel sides. F

h) Every quadrilateral which has parallel sides is a trapezium. T

i) All quadrilaterals with equal angles are rectangles. T

j) There is a trapezium with equal sides which is not a rhombus. F

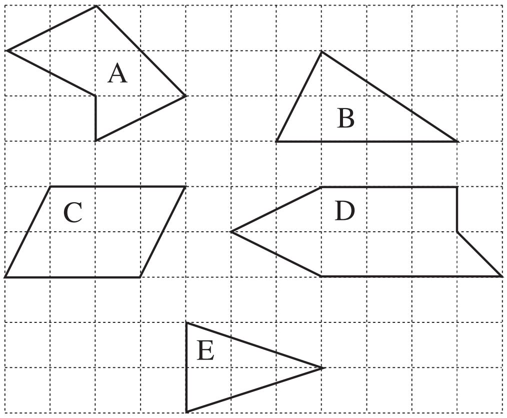
True: a, d, f, h, i

False: b, c, e, g, j

4

*KS2B
1999
Q.6*

Here are five shapes on a square grid.



Write in the **missing** letters.

Shape C has 2 pairs of parallel sides.

[1 mark]

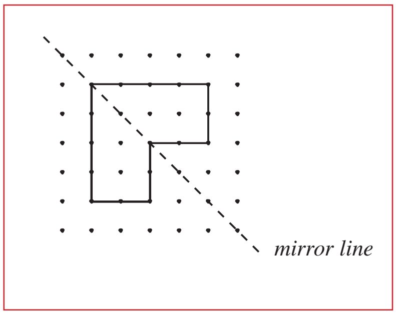
Shape A is a pentagon. [1 mark]

Shape E has reflective symmetry.

[1 mark]

1

KS2A
1999
Q.8



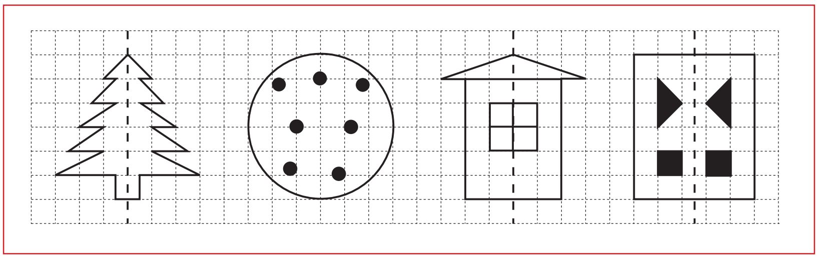
Use a ruler to draw the **reflection** of this shape in the mirror line.

You may use a mirror or tracing paper.

[2 marks]

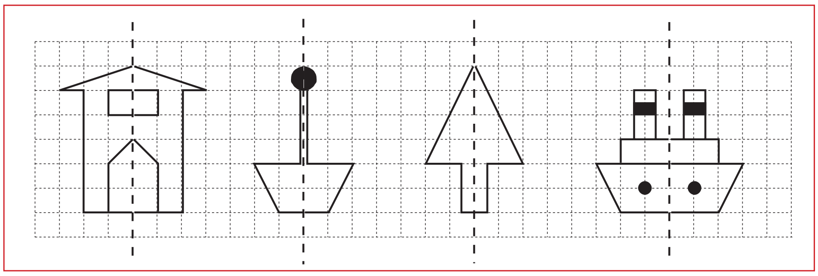
2

Draw mirror lines on the diagrams which have **reflective symmetry.**



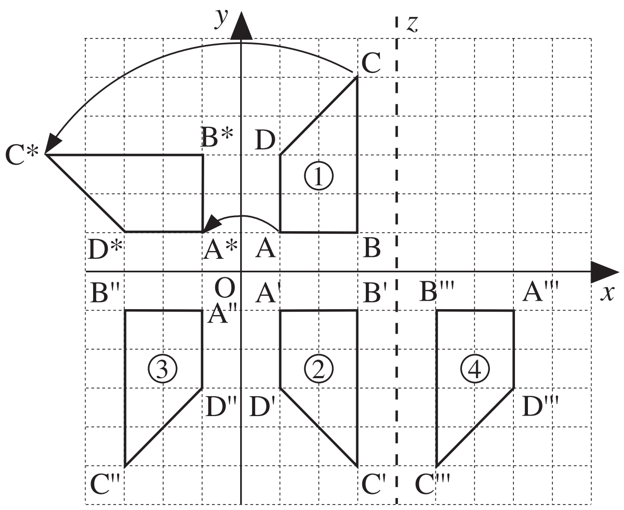
3

Draw the reflection of each shape in its mirror line.



4

Following the instructions:



A (1, 1); B (3, 1)
C (3, 5); D (1, 3)

a) A' (1, – 1); B' (3, – 1)
C' (3, – 5); D' (1, – 3)

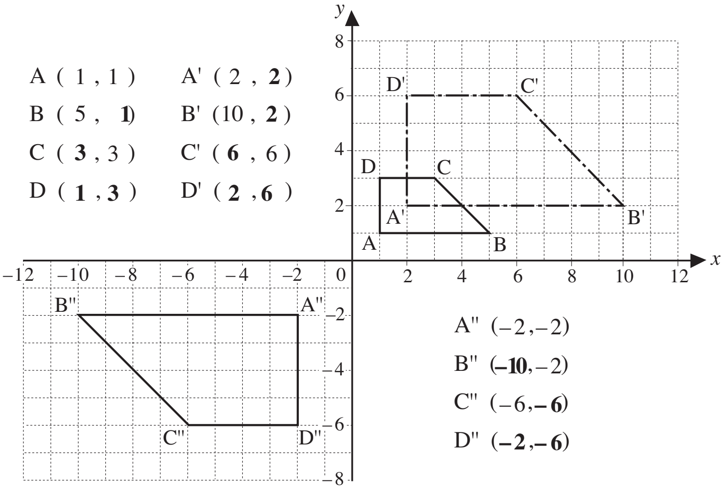
b) A'' (– 1, – 1); B'' (– 3, – 1
C'' (– 3, – 5); D'' (– 1, –

c) A''' (7, – 1); B''' (5, – 1)
C''' (5, – 5); D''' (7, – 3)

d) A* (– 1, 1); B* (– 1, 3)
C* (– 5, 3); D* (– 3, 1)

1

Fill in the missing coordinates.



A (1 , 1)	A' (2 , **2**)
B (5 , **1**)	B' (10 , **2**)
C (**3** , 3)	C' (**6** , 6)
D (**1** , **3**)	D' (**2** , **6**)

A'' (−2 , −2)
B'' (**−10** , −2)
C'' (−6 , **−6**)
D'' (**−2** , **−6**)

What do you notice about the shapes? e.g.

- $A'B'C'D' \cong A''B''C''D''$, $ABCD \sim A'B'C'D' \sim A''B''C''D''$
- ABCD has been <u>enlarged</u> by 2 times and then <u>translated</u> by 1 unit to the right and 1 unit up to form A'B'C'D'.
- A'B'C'D' has been <u>rotated</u> by 180° to form A''B''C''D'' or A'B'C'D' has been <u>reflected</u> in the <u>origin</u> to form A''B''C''D''

2

KS2B 1999 Q.14

Calculator allowed

What is the **length** of the model? Give your answer in **centimetres**, correct to one decimal place.

8.7 cm [1 mark]

The height of the model is **2.9 centimetres**. The height of the real car is **50 times** the height of the model. What is the **height** of the **real car**? Give your answer in **metres**.

*Show your **method**.* Height of real car 2.9 cm × 50 = 29 cm × 5 = 145 cm = 1.45 m

You may get a mark.

1.45 m [2 marks]

3

HMC 2002, I Age 10

Solve the problem in your exercise book.

The lengths of the sides of a rectangle are whole centimetres. The perimeter of the rectangle is 20 cm.

a) How many different such rectangles are possible? 5 Give the length of their sides.

$P = 2 \times (a + b) = 20$ cm, so $a + b = 20$ cm $\div 2 = 10$ cm

a	1	2	3	4	5
b	9	8	7	6	5

b) Which of them has the smallest and greatest areas and what are these areas?

i) <u>Smallest</u> possible area: $a = 1$ cm, $b = 9$ cm

$A = 1$ cm × 9 cm = 9 cm^2

ii) <u>Greatest</u> possible area: $a = 5$ cm, $b = 5$ cm

$A = 5$ cm × 5 cm = 25 cm^2

1 Decide whether the statements are *true* or *false*. Write T or F in the boxes.

a) All squares are rectangles. T b) All squares are parallelograms. T

c) The diagonals of any parallelogram are not equal in length. F

d) Every parallelogram which has perpendicular diagonals is a square. F

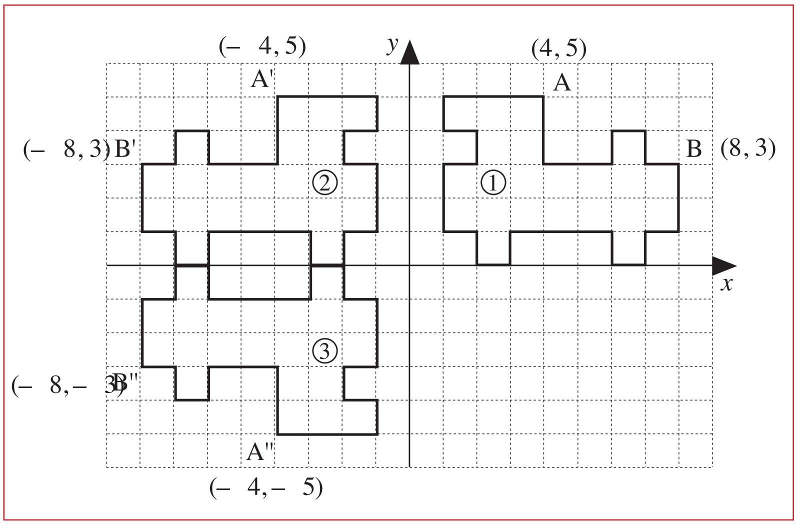
e) Not every parallelogram with equal sides is a square. T

f) A parallelogram with equal sides and equal angles is a square. T

---

2 Follow these instructions.

a) to c)



d) Which single transformation will take shape 1 to shape 3 ?

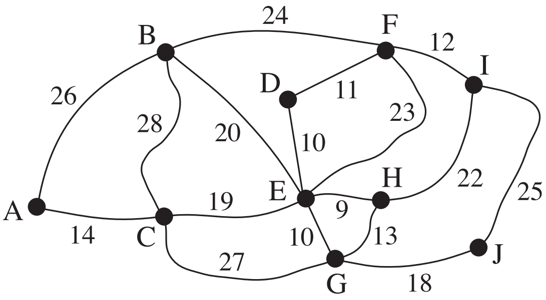
Rotation by 180° around the origin or Reflection in the origin

---

3 A travelling salesman is planning his weekly trip to all the towns on this map.

On the map, the letters are the towns, the lines are the roads and the numbers are the distances in km between towns.

The salesman must start and finish at **A** and must visit every town at least once.



a) Several possible routes:

e.g. visiting every town apart from A only once: ABFDEHIJGCA

Total distance:

26 + 24 + 11 + 10 + 9 + 22 + 25 + 18 + 27 + 14 = 186 km

b) Shortest possible distance: ABEDFIJGHECA

Total distance:

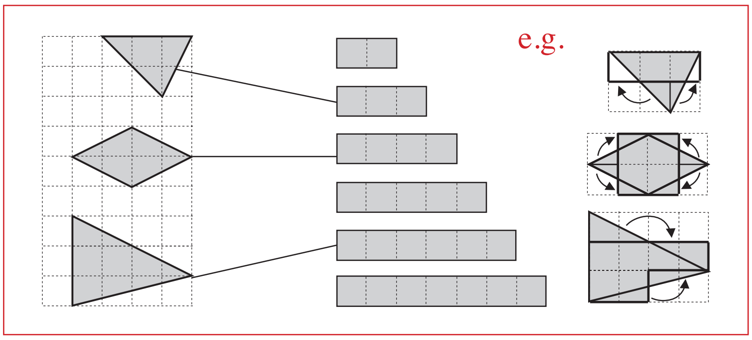
26 + 20 + 10 + 11 + 12 + 25 + 18 + 13 + 9 + 19 + 14 = 177 km

(This route visits E twice but is valid as the salesman must visit every town at least once.)

1

KS2A
1999
Q.5

Draw **one line** from each shape to the rectangle which has the **same area**.

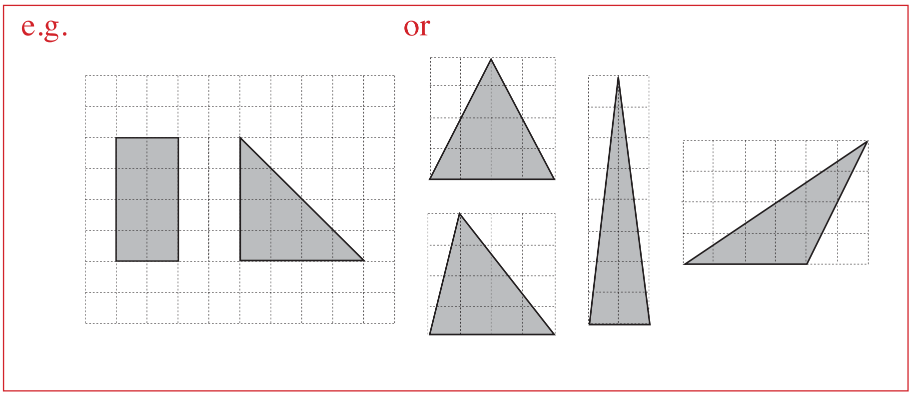


[2 marks]

2

KS2A
1999
Q.19

On the grid, draw a **triangle** which has the **same area** as the shaded rectangle.

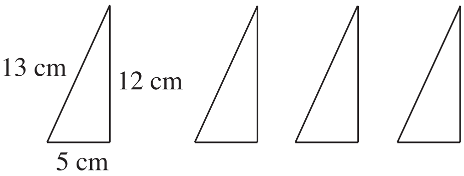


[1 mark]

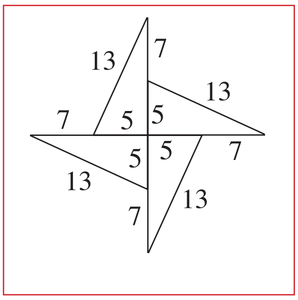
3

KS2B
1999
Q.20

Lindy has 4 triangles, all the same size.
She uses them to make a star.



Not to scale



Calculate the **perimeter** of the star.
Show your ***method****. You may get a mark.*

$$P = 7 + 13 + 7 + 13 + 7 + 13 + 7 + 13$$
$$= 4 \times (7 + 13) = 4 \times 20 = \underline{80} \text{ (cm)}$$

80 cm [2 marks]

4

HMC
2002, II
Age 10

The numbers represented by the square must be even and greater than 6.
List all the numbers which make the inequality true.

$$24 < (\square \div 2 - 3) \times 2 < 50$$

■: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54

1

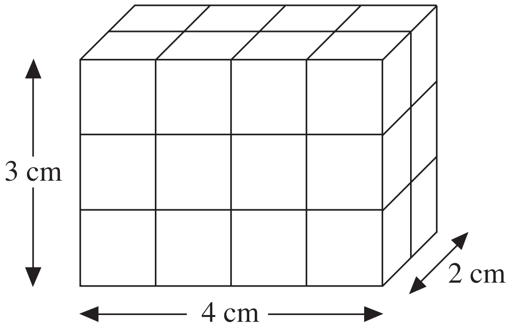
KS2A
1999
Q.13

Calculator not allowed

This cuboid is made from centimetre cubes.
It is 4 cm by 3 cm by 2 centimetres.

What is the **volume** of the cuboid?

24 cm^3 [1 2 mark]



Another cuboid is made from centimetre cubes.
It has a volume of **30 cubic centimetres**.

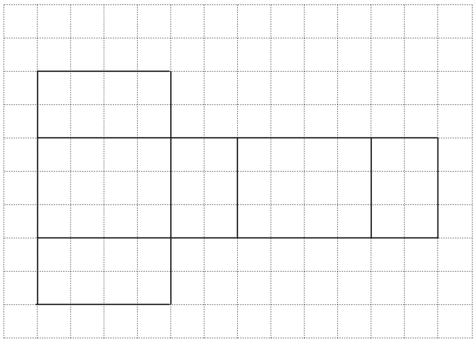
What could the **length**, **height** and **width** be?

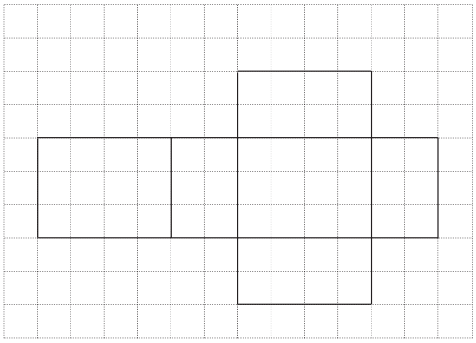
length: 2 cm height: 5 cm width: 3 cm [1 mark]

2

a) Draw the net of a cuboid with sides 4 cm, 3 cm, and 2 cm.

e.g.





b) Calculate its surface area.

$$A = 2 \times (4 \times 3 + 2 \times 3 + 4 \times 2) = 2 \times (12 + 6 + 8)$$
$$= 2 \times 26 = \underline{52} \text{ (cm}^2\text{)}$$

3

HMC
2002, II
Age 10

Use each of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 **only once** to make **five** whole numbers, so that one number is twice, another number is three times, another number is four times and the last number is five times the smallest number.

18, 36, 54, 72, 90 *Check:* $18 \times 2 = \underline{36}$

$18 \times 3 = \underline{54}$

$18 \times 4 = \underline{72}$

$18 \times 5 = \underline{90}$ ✔

1

KS2A
1999
Q.3

Calculator not allowed

This table shows the cost of sending a letter.

Mass	**Cost in pence**	
	First class	Second class
Up to 60 g	26	20
61 g to 100 g	39	31
101 g to 150 g	49	38
151 g to 200 g	60	45
201 g to 250 g	70	55

Paul is sending a letter.
It costs **38 p second class**.
How much would it cost him to send it **first class**?

49 p [1 mark]

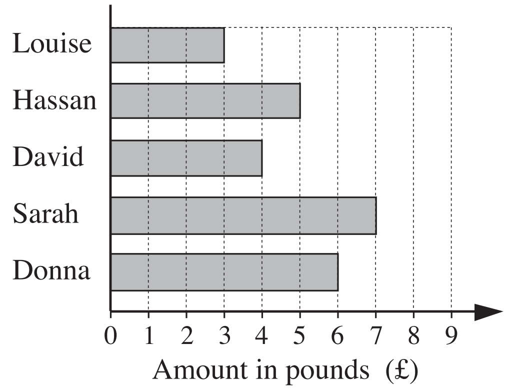
Jenny has a letter with a mass of **170 g**.
What does it cost to send it **first class**?

60 p

2

KS2A
1999
Q.10

Calculator not allowed



Five children collect money to plant trees.
Here is a bar chart of the amounts they have raised so far.

Their target is **£40 altogether**.
How much **more** money do they need to reach the target?
*Show your **working** in your exercise book.*

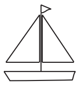
£ 15 [2 marks]

3

KS2B
1999
Q.7

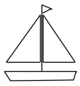
Calculator allowed

Tom, Amy and Helen want to go on a boat trip. There are three boats.



Lark	***Heron***	***Kestrel***
50 minute trip	70 minute trip	90 minute trip
Tickets	**Tickets**	**Tickets**
£2.75 each	£3.50 each	£4.20 each

How much does it cost altogether for **three** people to go on the **Lark**?

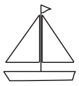


£ 8.25 [1 mark]

Tom and Amy go on the **Heron**. They leave at **2.15 pm**.
At what **time** do they return?

3.25 pm [1 mark]

Helen goes on the **Kestrel** and gets back at **4.15 pm**.
At what time did the boat leave?

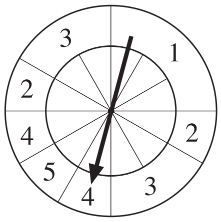


2.45 pm [1 mark]

4

KS2A
1999
Q.21

The inner ring on this spinner is divided into 12 equal sections.



a) On which number is the pointer most likely to stop? 3
Explain your answer in your exercise book.

b) What is the probability of getting an even number? $\frac{1}{3}$

1

KS2A
1999
Q.6

Calculator not allowed

Rob has some number cards. He holds up a card. He says,

'If I multiply the number on this card by 5, the answer is 35.'

What is the number on the card? 7 [1 mark]

He holds up a different card. He says,

'If I divide the number on this card by 6, the answer is 4.'

What is the number on the card? 24 [1 mark]

2

KS2B
1999
Q.8

August 1998

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Here is the calendar for August 1998.

Simon's birthday is on **August 20th**.
In 1998 he had a party on the **Sunday after** his birthday.

What was the **date** of his party?

August 23rd [1 mark]

Tina's birthday is on **September 9th**.
On what **day of the week** was her birthday in 1998? Wednesday [1 mark]

3

KS2B
1999
Q.11

Calculator allowed

The **same** number is missing from each box. Write the **missing** numbers in the boxes.

11 × 11 × 11 = 1331 [1 mark]

4

KS2A
1999
Q.11

Calculator not allowed

Parveen buys **3 small bags of peanuts**. She gives the shopkeeper **£2** and gets **80 p change**. What is the cost in **pence** of **one** bag of peanuts?

*Show your **working** in your exercise book.* 40 p [2 marks]

5

KS2B
1999
Q.12

Calculator allowed

Kalid makes a sequence of numbers. The first number is 2. The last number is 18.
His rule is to add the **same amount** each time. Write in the **missing** numbers.

2, 6, 10, 14, 18

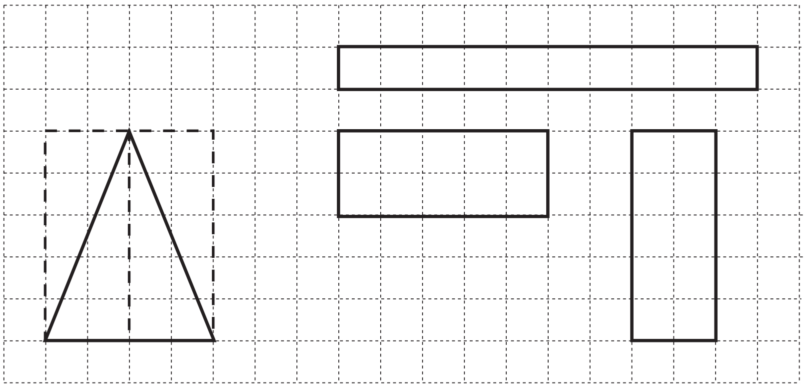
6

HMC
2002

In the year 2002, a man's age in years was equal to the sum of the digits of the year in which he was born. How old was he in 2002? 20 years

1

On the grid, draw 3 different rectangles which have the same area as the shaded triangle. Calculate the **perimeter** of each rectangle.



What are the lengths of the sides of the rectangle which has the shortest possible perimeter? a = 5 b = 2

P = 14 units

or *vice versa*

2

The numbers represented by the square must be a multiple of 3 and greater than 12.

List all the natural numbers which make the inequality true.

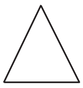
$$11 < (■ \div 3 - 4) \times 3 < 31$$

■: 24, 27, 30, 33, 36, 39, 42 (multiples of 3)

3

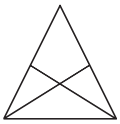
How many triangles can you see in each of these diagrams?

a)



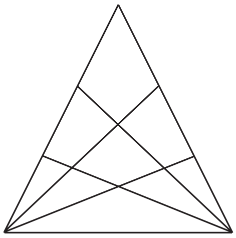
1 triangles

b)



8 triangles

c)



27 triangles

How many triangles do you think will be in the next triangle in the sequence? 64 triangles

4

Which of the numbers 1 to 9 should be written in each square so that the **sum** of the four 2-digit numbers formed (two across and two down) is 67? (You may repeat a digit.)

1	1
2	7

5

Continue the sequence in both directions. Write the rule.

a) 0.01, 0.05, 0.25, **1.25**, **6.25**, **31.25**, 156.25, 781.25 [*Rule*: × 5]

b) 0.01, 0.03, 0.09, **0.27**, **0.81**, **2.43**, 7.29, 21.87 [*Rule*: × 3]

1

KS2B 1999 Q.4

Calculator allowed

Milly and Ryan play a number game: *What's my number?*

Milly	**Ryan**
Is it under 20?	Yes
Is it a multiple of 3?	Yes
Is it a multiple of 5?	Yes

What is the number? 15 [1 mark]

Milly and Ryan play the game again.

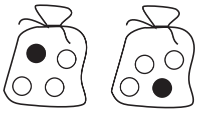
Ryan	**Milly**
Is it under 20?	No
Is it under 25?	Yes
Is it odd?	Yes
Is it a prime number?	Yes

What is the number? 23 [1 mark]

2

KS2A 1999 Q.15

Here are two bags.



Each bag has **3 white balls** and **one black ball** in it.
A ball is taken from **one of the bags** without looking.

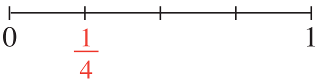
What is the probability that it is a **black ball**?
Give your answer as a fraction.

$\frac{1}{4}$ [1 mark]

All the balls from both bags are now mixed together in a new bag.

Put a **cross** (**x**) on this line to show the probability of taking a **black ball** from the new bag.

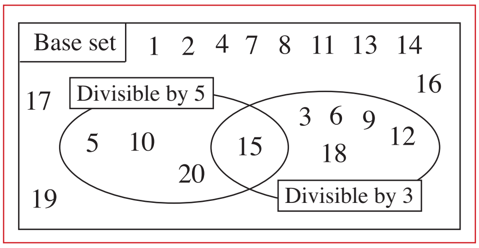
$p\text{ (black)} = \frac{2}{8} = \frac{1}{4}$



[1 mark]

3

Write the positive whole numbers which are not greater than 20 in the Venn diagram.



4

HMC 2002, I Age 9

List the whole numbers greater than 500 and less than 900 in which the digits are **increasing**. Try it out in your exercise book first.

567, 568, 569, 578, 579, 589; 678, 679, 689; 789 (10)

5

As 4

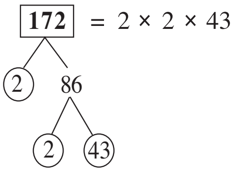
When we add two numbers from four natural numbers, the sums are: 3, 3, 4, 5, 6 and 6. What are the four numbers?

1	2	2	4

Extra questions

1

Factorise 172 and list its positive factors.



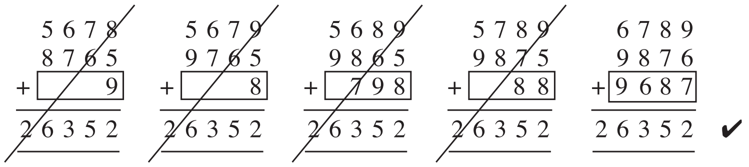
Positive factors: 1, 2, 4, 43, 86, 172

2

HMC
2002, II
Age 10

The digits of a 4-digit number greater than 5000 follow each other in increasing order.
Another 4-digit number has those digits too, but in decreasing order.
A third 4-digit number has those digits too.

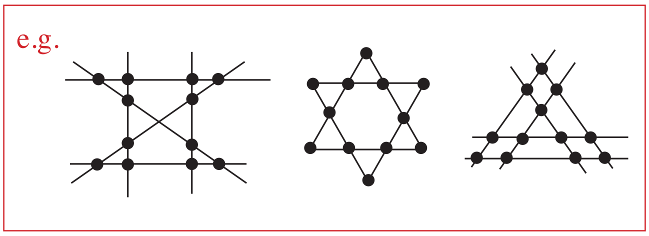
What are the three numbers if we know that their sum is 26352?



3

HJA

We want to place 12 spotlights in the ceiling so that they are in 6 straight lines and there are 4 spotlights in each line. Draw different arrangements

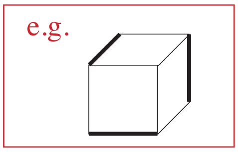


4

HJA

The edges of a cube are to be coloured either *red* or *blue* so that each face has at least one *red* edge. What is the **least** number of edges which should be coloured *red*?
Draw a diagram to show your answer.

3 edges coloured *red* are enough.



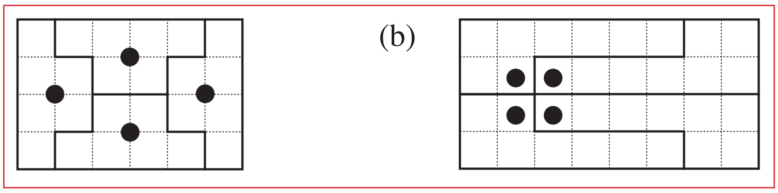
5

HJA

Each diagram is the map of a field in which there are 4 wells. Show how the field could be divided into 4 **congruent** parts so that each part has exactly one well.

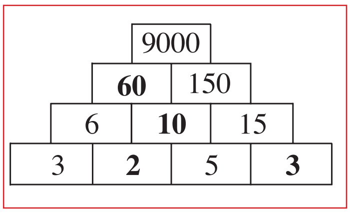
(Only the grid lines shown on the diagrams are to be used.)

(a) (b)



1

Fill in the missing numbers so that the product of any two **adjacent** numbers is the number directly above them.



2

KS2B
1999
Q.15

Sannir spins a **fair** coin and records the results.

In the first four spins, **'heads'** comes up each time.

Sannir says, '*A head is more likely than a tail.*'

Is he **correct**? Circle Yes or No. YES / [✓ NO] [1 mark]

Give a reason for your answer. [1 mark]

e.g. He is not correct because there are 2 possible outcomes, a head or a tail, and as the coin is fair, each outcome is equally likely.

3

KS2B
1999
Q.16

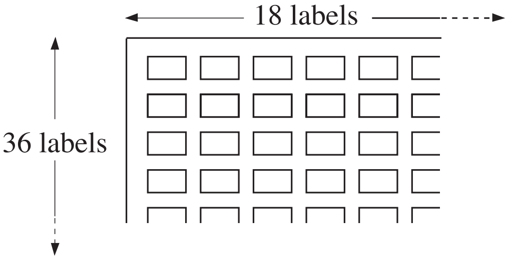
Calculator allowed

A shop sells sheets of sticky labels.

On each sheet there are **36 rows** and **18 columns** of labels.

How many labels are there altogether in **45 sheets**?

Show your ***method***. *You may get a mark.*



Plan: $\underbrace{\underline{36} \times \underline{18}}_{\text{on each sheet}} \times 45 = \underline{29\,160}$

C:
$$\begin{array}{r} 36 \\ \times\ 18 \\ \hline 288 \\ +\ 360 \\ \hline 648 \\ \hline \end{array} \qquad \begin{array}{r} 648 \\ \times\ 45 \\ \hline 3240 \\ +\ 25920 \\ \hline 29160 \\ \hline \end{array}$$

29 160 labels on 45 sheets [2 marks]

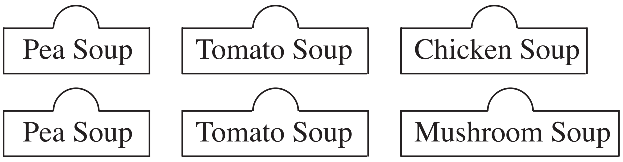
4

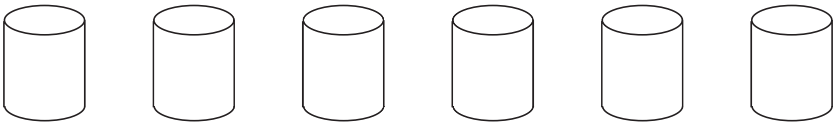
KS2B
1999
Q.18

Harry has **six** tins of soup.

The labels have fallen off.

Here are the labels and tins.





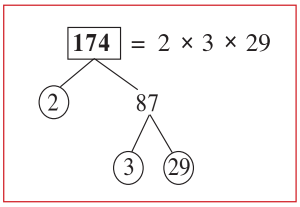
Harry chooses a tin.

What is the **probability** that it is a tin of **Pea Soup**? Give your answer as a fraction. $\left[\frac{2}{6} = \frac{1}{3}\right]$ [1 mark]

What is the **probability** that the tin he chooses is **not** a tin of **Tomato Soup**? Give your answer as a fraction. $\left[\frac{4}{6} = \frac{2}{3}\right]$ [1 mark]

1

Factorise 174 and list its positive factors.

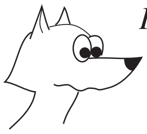


Positive factors:

1, 2, 3, 6, 29, 58, 87, 174

2

HJA



Freddy Fox decided that from that day forward he would always tell the truth on Mondays, Wednesdays and Fridays but he would always tell lies on the other days of the week

One day he said, '*Tomorrow I will tell the truth.*'

On which day of the week do you think he said this? Saturday

3

HJA

Two barrels of equal size contain oil. One of the barrels is full and the other is half full. Their masses are 86 kg and 53 kg.

What is the mass of an empty barrel? 20 kg

4

HJA

Andy, Betty, Cindy and Danny are walking down a mountain and need to go through a narrow, dark tunnel but have to overcome these difficulties.

- They have a torch which has only 12 minutes of power left.
- Andy is able to walk through the tunnel in 1 minute, Betty in 2 minutes, Cindy in 4 minutes and Doris in 5 minutes.
- They are all scared of the dark, so each of them will need the torch.
- The tunnel is so narrow that only 2 of them can walk through it at the same time.

Is it possible for them all to get through the tunnel?

If so, how could they do it? If not, why not? Yes, they could all get through the tunnel.

A + B go through at the same time	(2 minutes)
A returns with the torch.	(1 minute)
C + D go though at the same time.	(5 minutes)
B returns with the torch.	(2 minutes)
A and B go through together.	(2 minutes)

Total time: 12 mins

5

HJA

Write the natural numbers from 1 to 9 into a 3 by 3 grid so that:

- the sum of the 3-digit numbers formed in the top and middle rows is equal to the 3-digit number in the bottom row;
- the sum of the 3-digit numbers formed in the left and middle columns is equal to the 3-digit number formed in the right column.

e.g.

1	5	7
4	8	2
6	3	9

7	1	8
2	3	6
9	5	4

1

Use each of the natural numbers from 1 to 16 only **once** to form 8 pairs of numbers so that the sum of each pair is a **square** number.

For example, (2, 14) is a possible pair, as 2 + 14 = 16 = 4 × 4

(16, 9), (15, 10), (14, 11), (13, 12), [All sum to 25 = 5^2]
(8, 1), (7, 2), (6, 3), (5, 4) [All sum to 9 = 3^2]

2

A group of boys and girls were all brothers and sisters from the same family.

Each boy had as many sisters as he had brothers. Each girl had half as many sisters as she had brothers.

How many girls and boys were in the group? Girls 3 Boys 4

3

A school had a class reunion. Five old friends, *Amy*, *Bill*, *Carrie*, *Dan* and *Eddie* met up again for the first time since they had left school and found out that:

- they lived in different countries: Finland, Greece, Holland, Ireland and Japan;
- they had different jobs: engineer, lawyer, teacher, doctor and model;
- one had 4 children, one had 3 children, one had 2 children, one had 1 child and one had no children.

During the conversation, they also found out that:

- The lawyer was living in Japan.
- *Bill* was living in Greece and had 2 children.
- *Amy* had no children.
- The doctor lived in Finland and had some children.
- *Dan* was an engineer living in Holland.
- *Eddie* did not have 4 children.
- *Carrie* was a model and had one child.

Use the information to answer these questions.

a) How many children had the person living in Holland? 4

b) Where was *Eddie* living? Finland

c) What was the name of the lawyer? Amy

d) How many children did the doctor have? 3

e) What was *Bill*'s job? Teacher

4

A lock on a safe needs a 6-letter code to open it. The code uses each of the letters A to F only once.

Jim tried to guess the code. Here are his guesses.

If we know that each of the 6 letters is in the correct place once in Jim's guesses and that the code starts with A, what is the code?

Jim's guesses

CBADFE (1 letter is correct)
AEDCBF (2 letters are correct)
EDFACB (3 letters are correct)

Code: A E F D C B