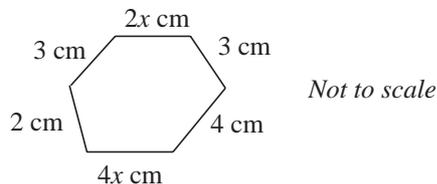


# UNITS 10 – 12

## Miscellaneous Exercises

1.



- (a) Write an expression in terms of  $x$  for the perimeter of this hexagon.  
Simplify your answer.
- (b) The perimeter of the hexagon is 36 cm.  
What is the value of  $x$ ?

(SEG)

2. Solve the equations

- (a)  $3x + 2 = 16$ ,  
(b)  $5(2x - 1) = 35$ ,  
(c)  $4x + 3 = 18 - 2x$ .

(NEAB)

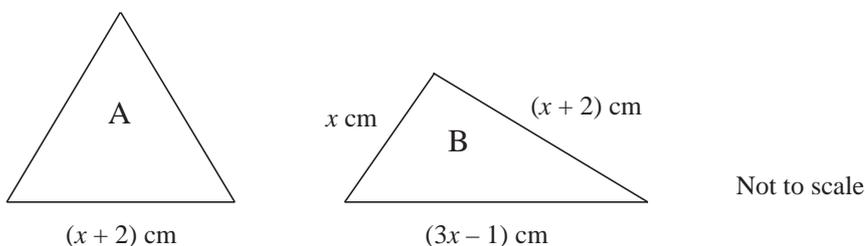
3. (a) The perimeter of a rectangle is  $8x$  cm.



The length of the shorter side is  $x$  cm.

Write an expression, in terms of  $x$ , for the length of the longer side.

(b) The perimeters of these triangles are equal.



- (i) Triangle A is equilateral. Its perimeter is  $3(x + 2)$  cm.  
Multiply out  $3(x + 2)$ .
- (ii) Solve the equation
- $$3(x + 2) = x + (x + 2) + (3x - 1)$$
- (iii) Calculate the perimeter of triangle B.

(SEG)

4. The equation  $x^2 + 3x = 20$  has a solution between 3 and 4.

Use a trial and improvement method to find the solution correct to one decimal place.

(SEG)

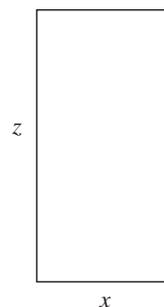
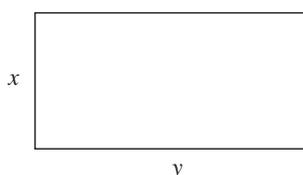
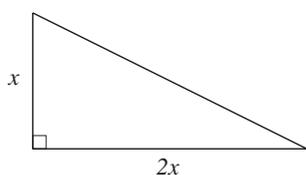
5. Solve the simultaneous equations

$$2x + 3y = 14$$

$$8x - 5y = 5$$

(SEG)

- 6.



- (a) (i) Write down and simplify an expression, in terms of  $x$ , for the area of the triangle.
- (ii) Write down an expression, in terms of  $x$ ,  $y$  and  $z$ , for the **total** area of the triangle and the two rectangles.
- (b) (i) Factorise your answer to part (a) (ii)
- (ii) Calculate the total area of the triangle and two rectangles, if  $x = 5$  cm and  $x + y + z = 28$  cm.

(NEAB)

7. (a) Solve the equation  $\frac{1}{2}x + 3 = 2x + 9$ .

- (b) Solve these simultaneous equations.

$$3x + y = 7$$

$$x + 2y = 1$$

(SEG)

8. (a) Multiply out and simplify:

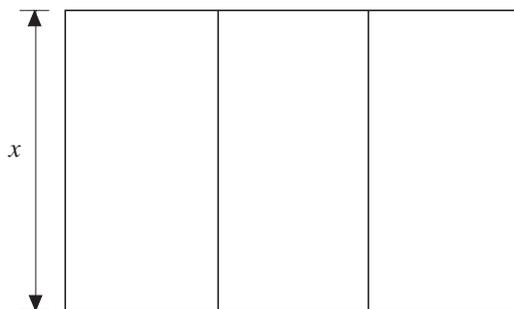
$$(3x + 4)(2x - 3)$$

- (b) Hence solve this equation for  $x$ .

$$(3x + 4)(2x - 3) = 5x$$

(NEAB)

9. A rectangular frame with two cross bars is to be made with 80 metres of metal.



The height of the frame is  $x$  metres and the total area inside the frame is  $150 \text{ m}^2$ .

- (a) Show that  $x$  must satisfy the equation

$$x^2 - 20x + 75 = 0.$$

- (b) Find the values of  $x$  which satisfy this equation.

(SEG)

- 10.

**Buy a BETTERPLUG.  
It will cut fridge freezer  
electricity costs by 15%.**

- (a) The average cost of the electricity needed to run a fridge freezer for one year is £65.

Calculate 15% of £65.

- (b) The price of a BETTERPLUG is £23.95.

How long will it take before the money spent on buying a BETTERPLUG is recovered by the saving in electricity?

Give your answer to a sensible degree of accuracy.

(NEAB)

11. Dipak's income is £25 546 per year. He does not pay tax on a pension contribution of  $17\frac{1}{2}\%$  of his income.

Dipak also has an allowance of £3155 on which he does not pay tax.

He then pays tax at 25% on the rest of his income.

Calculate the amount of tax which Dipak pays.

(SEG)

12. Scientists count the number of seals around the coast of Scotland.

They think that sea pollution is reducing the number of seals by 20% every year.

In May 1996 there were 13 000 seals.

- (a) How many seals do the scientists think there will be in
- May 1997,
  - May 1999?
- (b) If this reduction continues, in what year would the seal population first fall below 3000?

(NEAB)

13. In 1993 a "CHOCO EASTER EGG" cost £1.60.

- (a) In 1994 a "CHOCO EASTER EGG" cost 10% more.

How much more did one of these eggs cost in 1994?

- (b) In 1995 a "CHOCO EASTER EGG" cost £1.90.

Calculate the percentage increase in the price of one of these eggs from 1993 to 1995.

(SEG)

14. £ 1000 is invested in a bank account at a rate of  $r\%$  per annum. After  $n$  years the amount of money, £A in the account is given by the formula

$$A = 1000 \left( 1 + \frac{r}{100} \right)^n$$

- (a) Calculate A when  $r = 4$  and  $n = 3$ .
- (b) £1000 is invested in a bank account at a rate of  $r\%$  per annum. After three years the amount of money in the account is £1179.23.
- Show that the value of  $r$  is between 5 and 6.
  - By trial and improvement or otherwise, find the value of  $r$  correct to 2 decimal places.

(NEAB)

15. (a) Calculate the next term in the following sequences:

(i) 3, 10, 21, 36, ...

(ii) 5, 14, 27, 44, ...

- (b) The two sequences in (a) have been used to form the following number pattern:

$$3^2 + 4^2 = 5^2 \quad 3 \text{ terms}$$

$$10^2 + 11^2 + 12^2 = 13^2 + 14^2 \quad 5 \text{ terms}$$

$$21^2 + 22^2 + 23^2 + 24^2 = 25^2 + 26^2 + 27^2 \quad 7 \text{ terms}$$

$$36^2 + 37^2 + 38^2 + 39^2 + 40^2 = 41^2 + 42^2 + 43^2 + 44^2 \quad 9 \text{ terms}$$

Using your answers to (a), or otherwise, write down the next line of this number pattern.

- (c) The number of terms in each line of the number pattern form the sequence

$$3, 5, 7, 9, \dots$$

- (i) What is the 10th term of this sequence?  
 (ii) Write down an expression for the  $n$ th term of this sequence.

(NEAB)

16. A sequence of numbers is

$$\dots, a, 9, 3, 1, \frac{1}{3}, b, \dots$$

In the sequence two numbers are shown as  $a$  and  $b$ .

- (a) Describe how to find the number  $a$ .  
 (b) Describe how to find the number  $b$ .

(SEG)

17. The positive integers are arranged as shown.

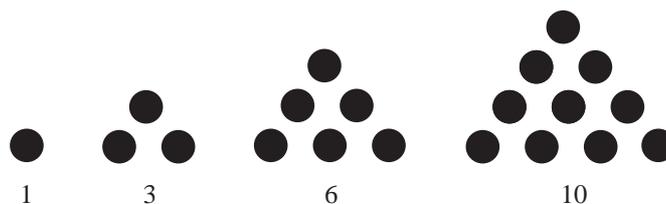
$$\begin{array}{cccccc} 1 & & & & & \\ 2 & 3 & & & & \\ 4 & 5 & 6 & & & \\ 7 & 8 & 9 & 10 & & \\ 11 & 12 & 13 & 14 & 15 & \\ 16 & 17 & 18 & 19 & 20 & 21 \end{array}$$

The numbers, 1, 3, 6, 10, 15, 21,  $\dots$ , formed by the last entry in each row are called triangular numbers.

- (a) Write down the next two triangular numbers in this sequence.  
 (b) The last number in each row can be found by using the formula  $kn(n+1)$ , where  $k$  is a constant and  $n$  is the number of the row.  
 (i) Use row 4 to show that  $k = \frac{1}{2}$ .  
 (ii) What is the last entry in row 100?  
 (iii) Find, by trial and improvement, the row in which the number 1996 appears.

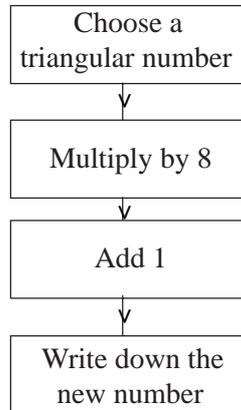
(NEAB)

18. Here are the first four triangular numbers.



- (a) Write down the next two triangular numbers.

- (b) Here is a rule for working out a new set of numbers.



- (i) Use this rule to complete the table below.  
The first two have been done for you.

|                   |   |    |   |    |
|-------------------|---|----|---|----|
| Triangular number | 1 | 3  | 6 | 10 |
| New number        | 9 | 25 |   |    |

- (ii) 9 and 25 are both odd numbers.  
What is the other special name given to these numbers?
- (iii) Write down an equation connecting the new numbers and the triangular numbers. Use  $N$  to stand for the new number and  $T$  to stand for the triangular number.

(NEAB)

19. (a) What is the  $n$ th term of the sequence  
1, 4, 9, 16, 25, ...
- (b) What is the  $n$ th term of the sequence  
4, 7, 10, 13, 16, ...
- (c) What is the  $n$ th term of the sequence

$$\frac{2}{3}, \frac{4}{7}, \frac{6}{11}, \frac{8}{15}, \dots$$

(NEAB)