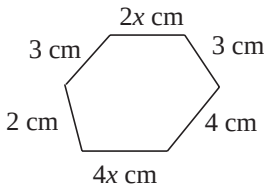
UNITS 10 – 12

Miscellaneous Exercises

Note

Starred* questions are for *Academic Route* only.

1.



Not to scale

(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*)

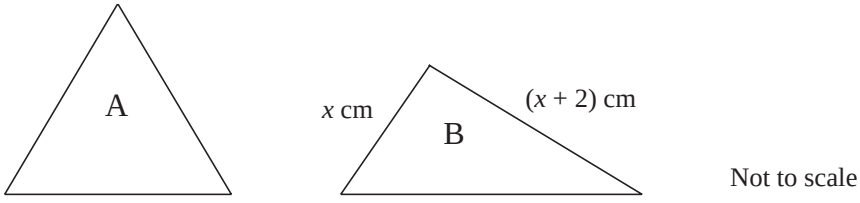
3. (a) The perimeter of a rectangle is $8x$ cm.

Not to scale

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.



Not to scale

(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. One day at St. George's Comprehensive,

$\frac{1}{2}$ of the pupils walked to school,

$\frac{2}{5}$ of the pupils came to school by bus,

the remaining 68 pupils came by car.

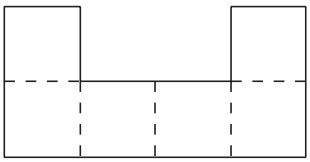
(a) Work out $\frac{1}{2} + \frac{2}{5}$.

(b) What fraction of the pupils came by car?

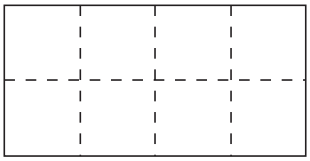
(c) How many pupils are there in the school?

(*NEAB*)

7. (a) Shade $\frac{1}{6}$ of this shape.



(b) Shade 25% of this shape.



(c) How much of this shape is shaded?
Give your answer as a decimal.

(*SEG*)

8. Rowlinson School has 540 pupils.

$\frac{2}{3}$ of the pupils stay at school for lunch.

Calculate how many pupils stay at school for lunch.

(*NEAB*)

9.

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*)

10. 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*)

* 11. 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

(i) May 1997,

(ii) May 1999?

(b) If this reduction continues, in what year would the seal population first fall below 3000?

(*NEAB*)

12. The selling price of a CD is £12.99.

The diagram below shows how the £12.99 is divided between the people who have been involved in the sale of a CD.

(a) What fraction of the selling price goes to the Record Company?

(b) How much money does the shopkeeper get from the sale of this CD?

(c) The artist receives 88p for each CD sold.

What percentage of the £12.99 is this?

(*NEAB*)

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

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

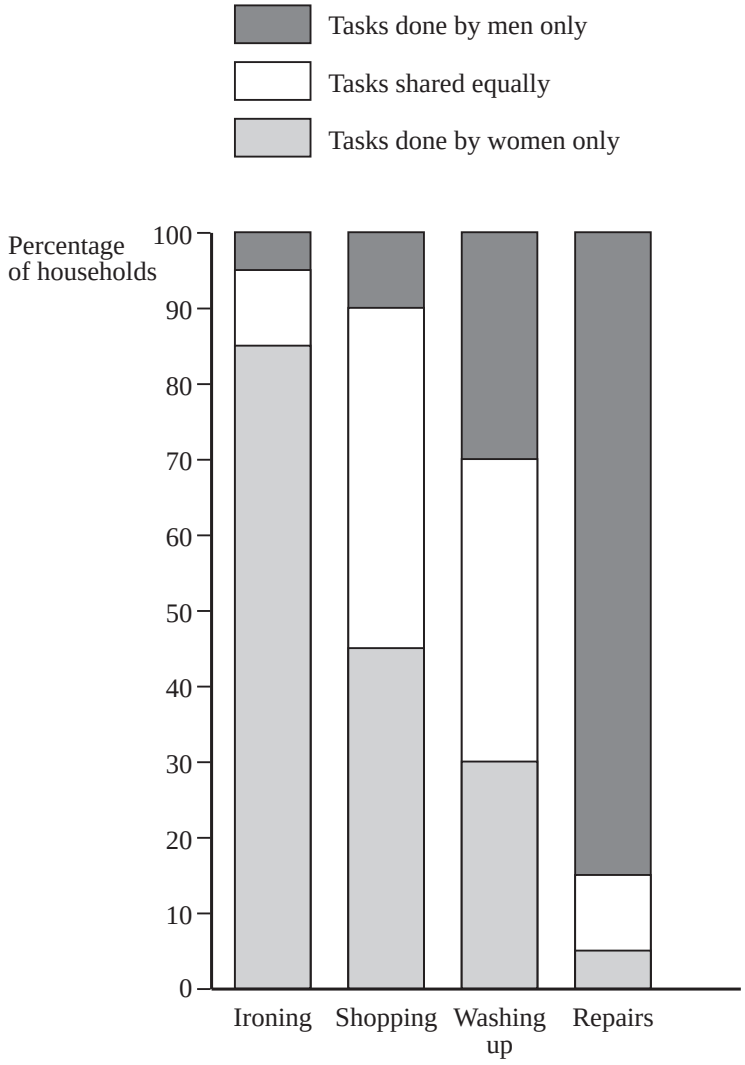
How much more did one of these eggs cost in 1994?

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

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

(*SEG*)

14. The diagram shows some of the results of a survey to find out which household tasks are done by women only, which are done by men only, and which are shared.



(a) Which of the four tasks is most likely to be done by

(i) women only,

(ii) men only?

(b) Shopping is done by women only in about 45% of households.
In what percentage of households is the shopping done by men only?

(c) Another question asked in the survey was:

Who cooks the evening meal?

The results were:	Women only:	70%
	Shared equally:	10%
	Men only:	20%

Show these results on a diagram similar to the one above.

(*NEAB*)

* 15. £ 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.

(i) Show that the value of r is between 5 and 6.

(ii) By trial and improvement or otherwise, find the value of r correct to 2 decimal places.

(*NEAB*)

16. (a) Write down

(i) all the prime numbers between 20 and 30,

(ii) the first five square numbers,

(iii) the cube of each of the first three positive whole numbers.

(b) The first three lines of a number pattern are

$$1 \times 8 + 1 = 9$$
$$12 \times 8 + 2 = 98$$
$$123 \times 8 + 3 = 987$$

Write down the next two lines of this number pattern.

(*NEAB*)

17. Here are the first five multiples of 3:

3 6 9 12 15

(a) Write down the first five multiples of 5.

(b) The number 15 is a multiple of both 3 and 5.

Write down two more numbers that are multiples of both 3 and 5.

(c) Find a number that is a multiple of both 3 and 5 and is also bigger than 100.

(*NEAB*)

* 18. (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:

$3^2 + 4^2 = 5^2$ 3 terms

$10^2 + 11^2 + 12^2 = 13^2 + 14^2$ 5 terms

$21^2 + 22^2 + 23^2 + 24^2 = 25^2 + 26^2 + 27^2$ 7 terms

$36^2 + 37^2 + 38^2 + 39^2 + 40^2 = 41^2 + 42^2 + 43^2 + 44^2$ 9 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, . . .

(i) What is the 10th term of this sequence?

(ii) Write down an expression for the nth term of this sequence.

(*NEAB*)

19. A sequence of numbers is

$$\ldots, \; a, \quad 9, \quad 3, \quad 1, \quad \tfrac{1}{3}, \quad b, \quad \ldots$$

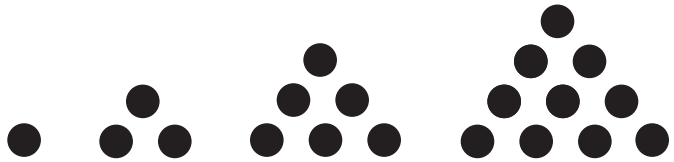
In the sequence two numbers are shown as a and b.

(a) Describe how to find the number a.

(b) Describe how to find the number b.

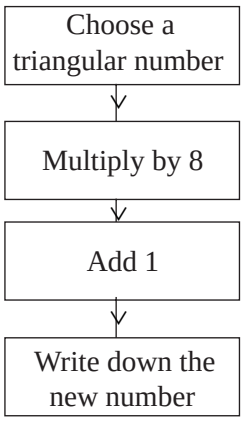
(*SEG*)

20. 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*)

21. The positive integers are arranged as shown.

1					
2	3				
4	5	6			
7	8	9	10		
11	12	13	14	15	
16	17	18	19	20	21

The numbers, 1, 3, 6, 10, 15, 21, . . . , 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*)