

# UNITS 13 – 19

## Miscellaneous Exercises

1. The table shows the charge for using different numbers of units of electricity.

Units	0	200	500	700	900	1000
Charge (£)	10	34	70	94	118	130

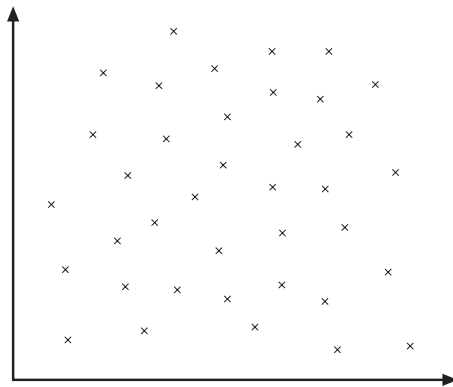
- (a) Plot these points on a suitable grid.
- (b) Use your graph to find
- the charge for using 600 units of electricity,
  - how many units of electricity you have used if you are charged £50.
2. There are three types of correlation.

Type A: Positive correlation

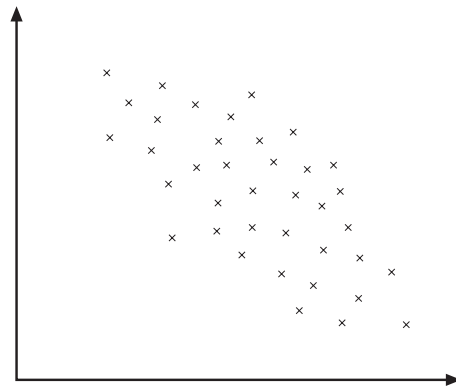
Type B: No correlation

Type C: Negative correlation

- (a) State which type of correlation is shown by each of these graphs.



Graph 1



Graph 2

- (b) One type of correlation is not illustrated.  
On axes, sketch a diagram to show this type of correlation.

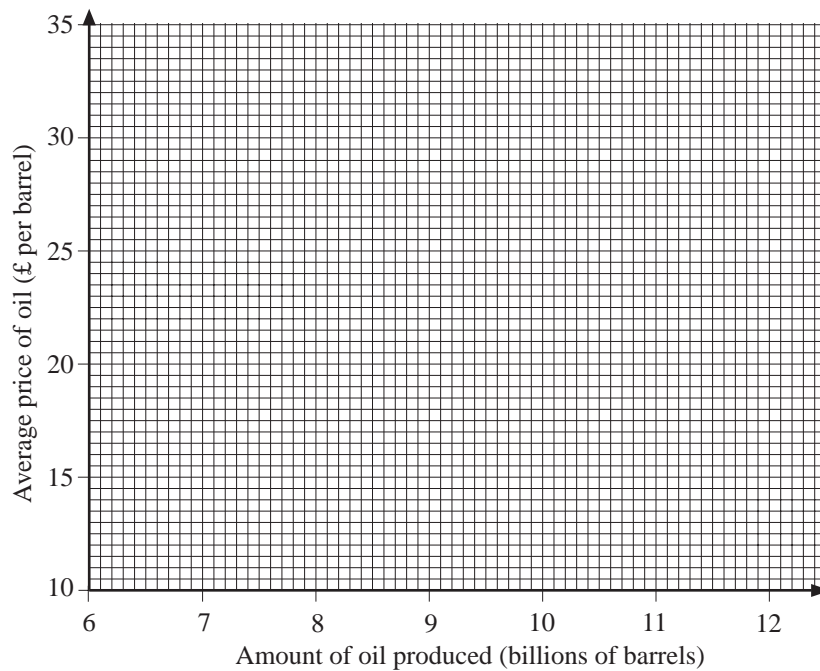
(NEAB)

3. Information about oil was recorded each year for 12 years.

The table shows the amount of oil produced (in billions of barrels) and the average price of oil (in £ per barrel).

Amount of oil produced (billions of barrels)	7.0	11.4	10.8	11.3	9.6	8.2	7.7	10.9	8.0	9.9	9.2	9.4
Average price of oil (£ per barrel)	34	13	19	12	23	33	30	12.5	28.5	13.5	26.5	15.5

- (a) On a copy of the following grid, draw a scatter graph to show the information in the table.



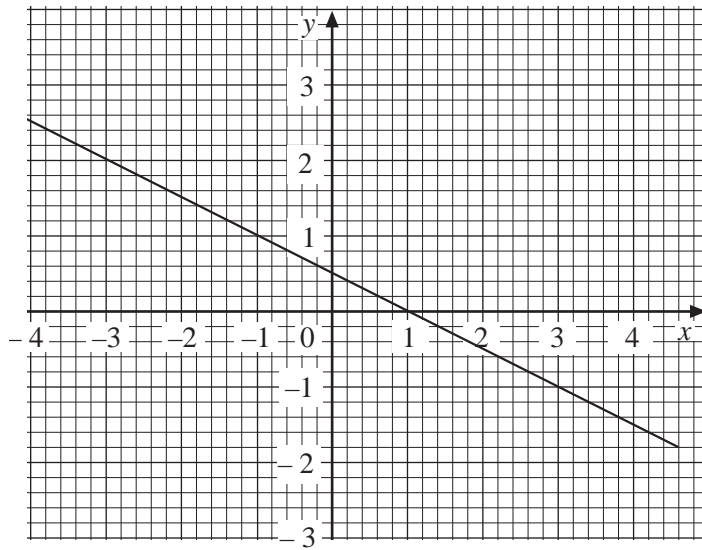
- (b) Describe the correlation between the average price of oil and the amount of oil produced.
- (c) Draw a line of best fit on the scatter graph.

In another year the amount of oil produced was 10.4 billion barrels.

- (d) Use your line of best fit to estimate the average price of oil per barrel in that year.

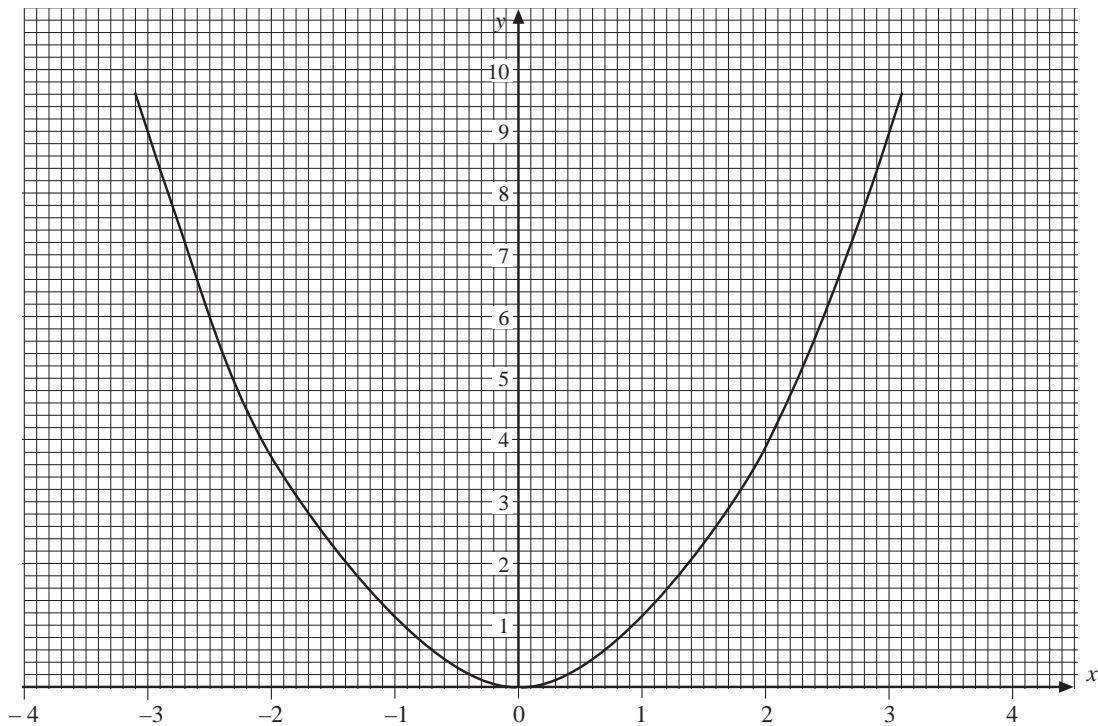
(LON)

4. What is the equation of this line?



(SEG)

5. (a) On a copy of the following graph, draw the line  $y = 4 - x$  for values of  $x$  from  $-4$  to  $+4$ .



- (b) What are the coordinates of the points where the graph  $y = 4 - x$  meets the curve?

(SEG)

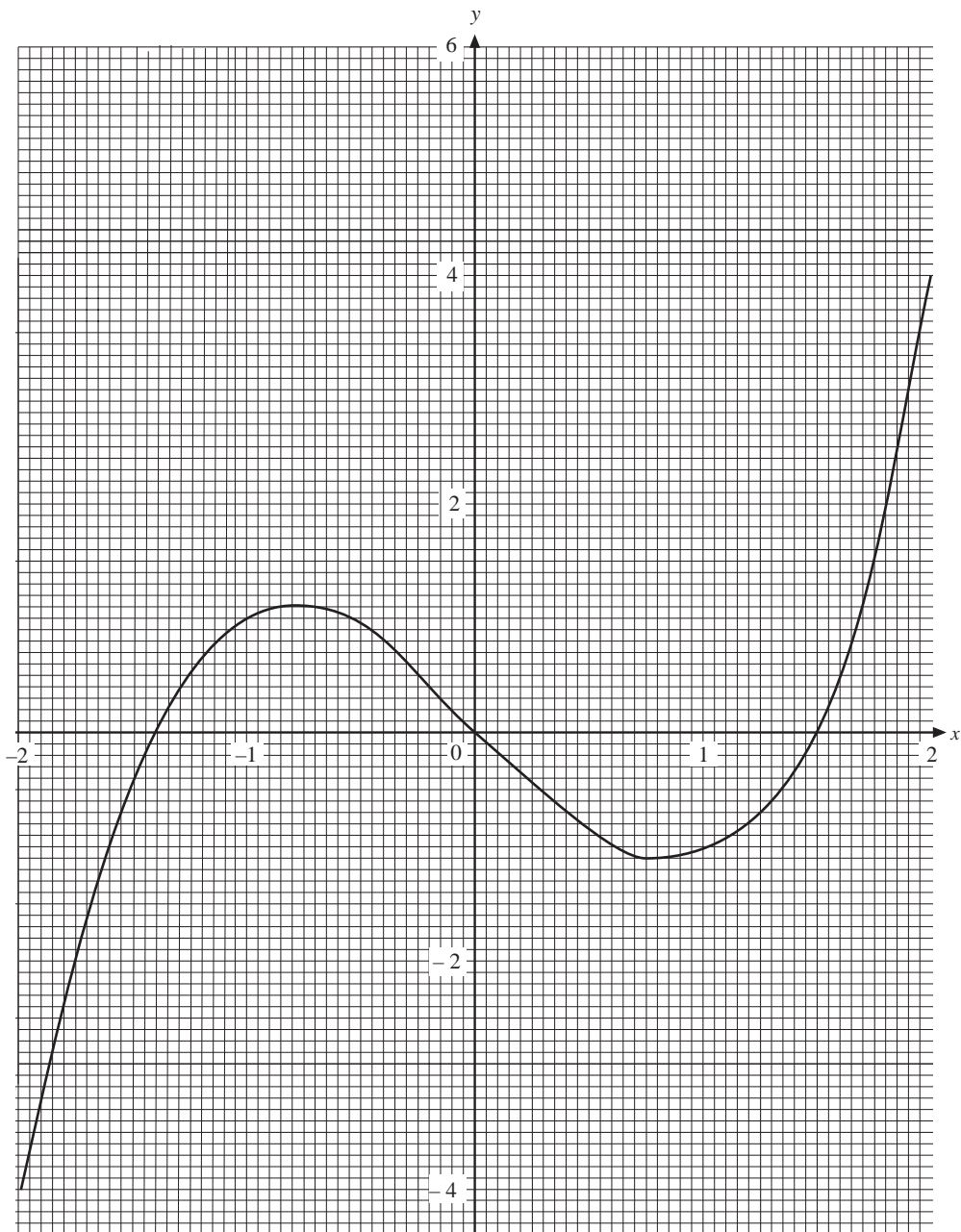
6. The graph of  $y = x^3 - 2x$  is drawn on the grid.

(a) Show how to use the graph to find the solution of  $x^3 = 2x + 3$ .

Write down a solution to this equation.

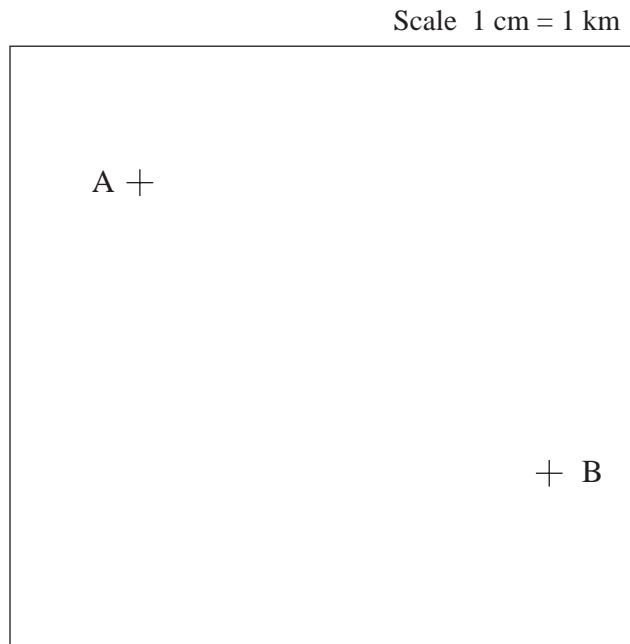
(b) By drawing a suitable straight line on a copy of the grid, use the graph to find all solutions of

$$x^3 = 3x - 1$$



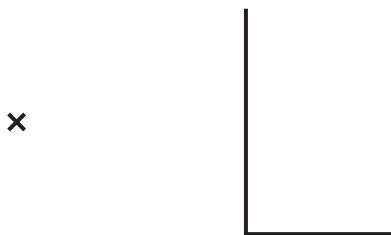
(SEG)

7. Two ships, A and B, both hear a distress signal from a fishing boat. The positions of A and B are shown on the map below. The map is drawn using a scale of 1 cm to represent 1 km. The fishing boat is less than 4 km from ship A and is less than 4.5 km from ship B. Use accurate construction on a copy of the diagram below to show the region which contains the fishing boat. Shade this region.



(NEAB)

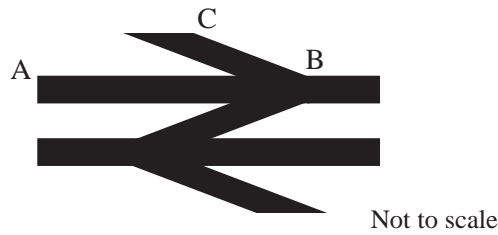
15. (a) The letter L is to be enlarged by the scale factor two. The centre of the enlargement is marked by a cross. Copy the figure below and construct accurately the new letter showing clearly all your construction lines.



- (b) The letter L is made from two perpendicular rods AB and BC.  $AB = 3 \text{ cm}$ ,  $BC = 2 \text{ cm}$ . The letter L is rotated through  $90^\circ$  clockwise about the point C. Draw accurately the locus of the point A.

(SEG)

9. (a) The British Rail logo shown below is to be enlarged for a new poster.

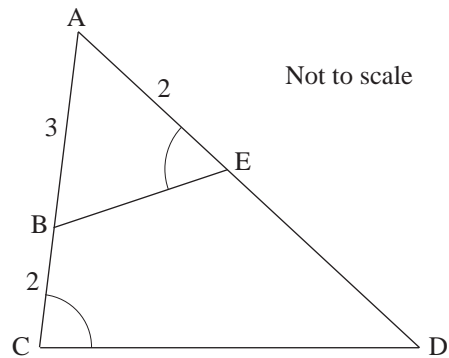


The distance AB is 3 cm on the original shape.  
 On the enlarged shape AB is 13.5 cm and BC is 7.8 cm.  
 What is the distance BC on the original shape?

- (b) In the diagram  $AB = 3$  cm,  $BC = 2$  cm and  $AE = 2$  cm.

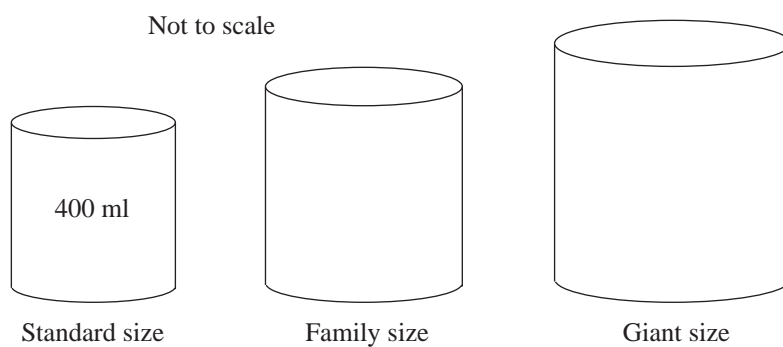
Angles AEB and ACD are equal.

- (i) Explain why triangle ABE is similar to triangle ADC.  
 (ii) Calculate the length of ED.



(SEG)

10. Tins of SUPER SOUP come in three sizes.



The height and radius of the family size tin are each 1.2 times the height and radius of the standard size tin.

- (a) The volume of the standard size tin is 400 ml.  
 Calculate the volume of a family size tin.

The height of the giant size tin is 1.2 times the height of the family size tin. The radius of the giant size tin is 1.5 times the radius of the family size tin.

- (b) Calculate the volume of the giant size tin

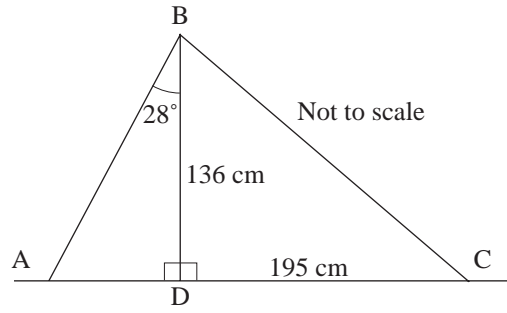
(SEG)

11. A design for a children's slide, ABCD, for a playground is shown.

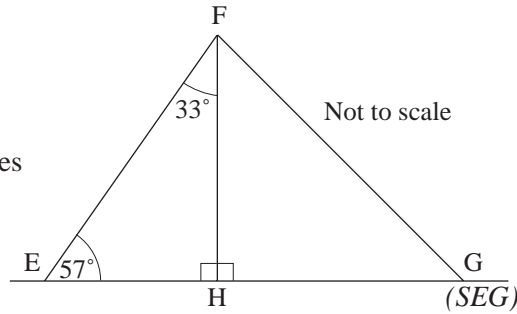
The height of the slide is 136 cm.

The distance DC is 195 cm.

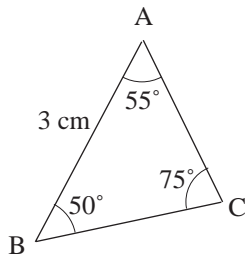
- (a) (i) Calculate the angle BCD.  
 (ii) Angle ABD is  $28^\circ$ .  
 Calculate the distance AB.



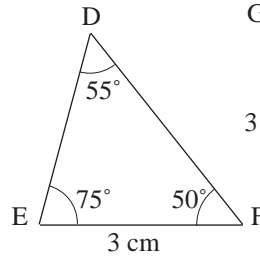
- (b) Another design of slide, EFGH, has angle FEH =  $57^\circ$ .  
 Triangle EFH is similar to triangle FGH but the two triangles are not the same size.  
 Find the size of angle HFG.



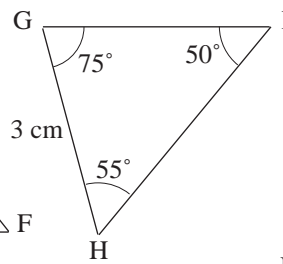
12. Pick out a pair of congruent triangles.



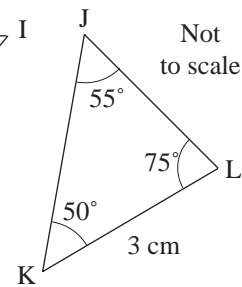
(a)



(b)



(c)



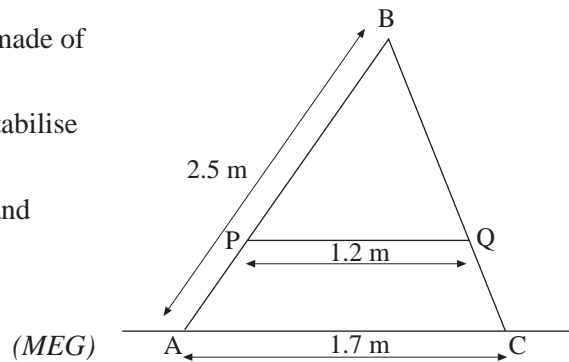
(d)

13. The diagram represents a stepladder made of two sections AB and BC.

A bar PQ, parallel to AC, is used to stabilise the ladder.

AB = 2.5 metres, PQ = 1.2 metres and AC = 1.7 metres.

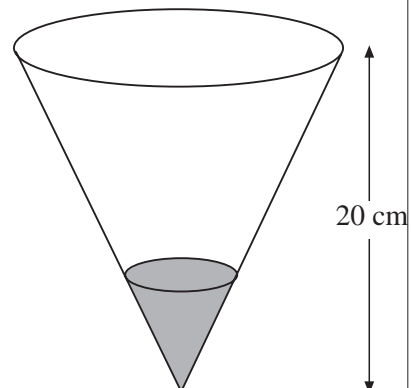
Calculate the length of BP.



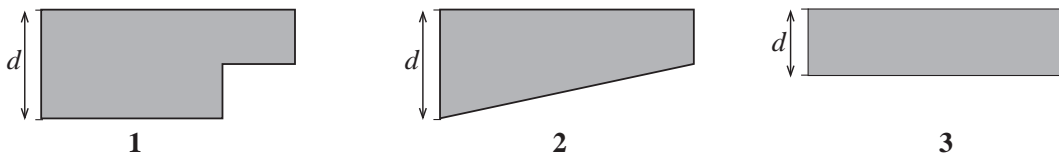
14. A cone of depth 20 cm has a capacity of  $250 \text{ cm}^3$ .

The cone contains  $100 \text{ cm}^3$  of water.

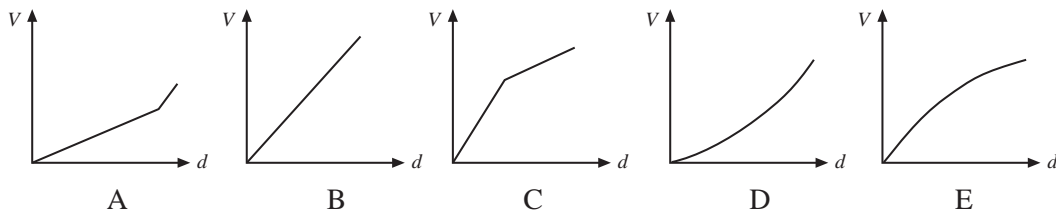
Calculate the depth of water in the cone.



15. The cross-sections of three swimming pools are shown below. Each swimming pool has a uniform cross-section.

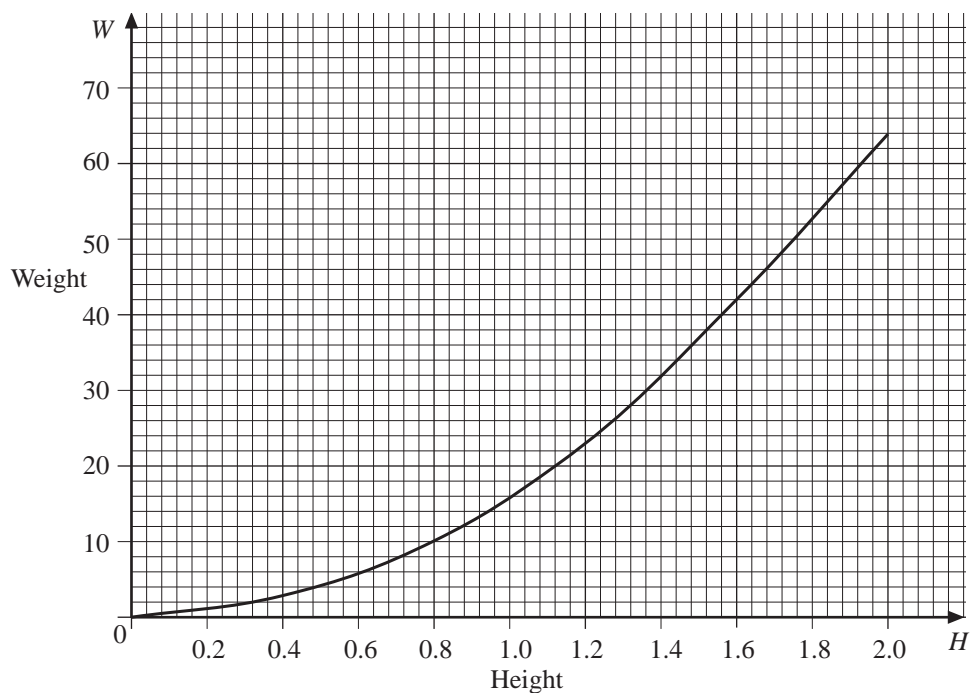


For each of these pools, choose the appropriate graph from those below which best illustrates the relationship between the volume of water in the pool,  $V$ , and the depth of water,  $d$ , measured from the deepest point in the pool.



16. A man's weight,  $W$  kilograms, is proportional to the square of his height,  $H$  metres. The constant of proportionality is called the body mass index,  $B$ .

- Write down a formula connecting  $W$ ,  $H$  and  $B$ .
- Ali is 1.8 m tall and weights 81 kg. Stephen is 2 m tall and has the same body mass index as Ali. What is Stephen's weight?
- The graph of  $W$  against  $H$  for people with a body mass index of 16 is drawn.
  - Find the gradient of the curve when  $H = 1.7$  m.
  - What are the units of the gradient?





17. (a) Draw two graphs to solve these simultaneous equations.

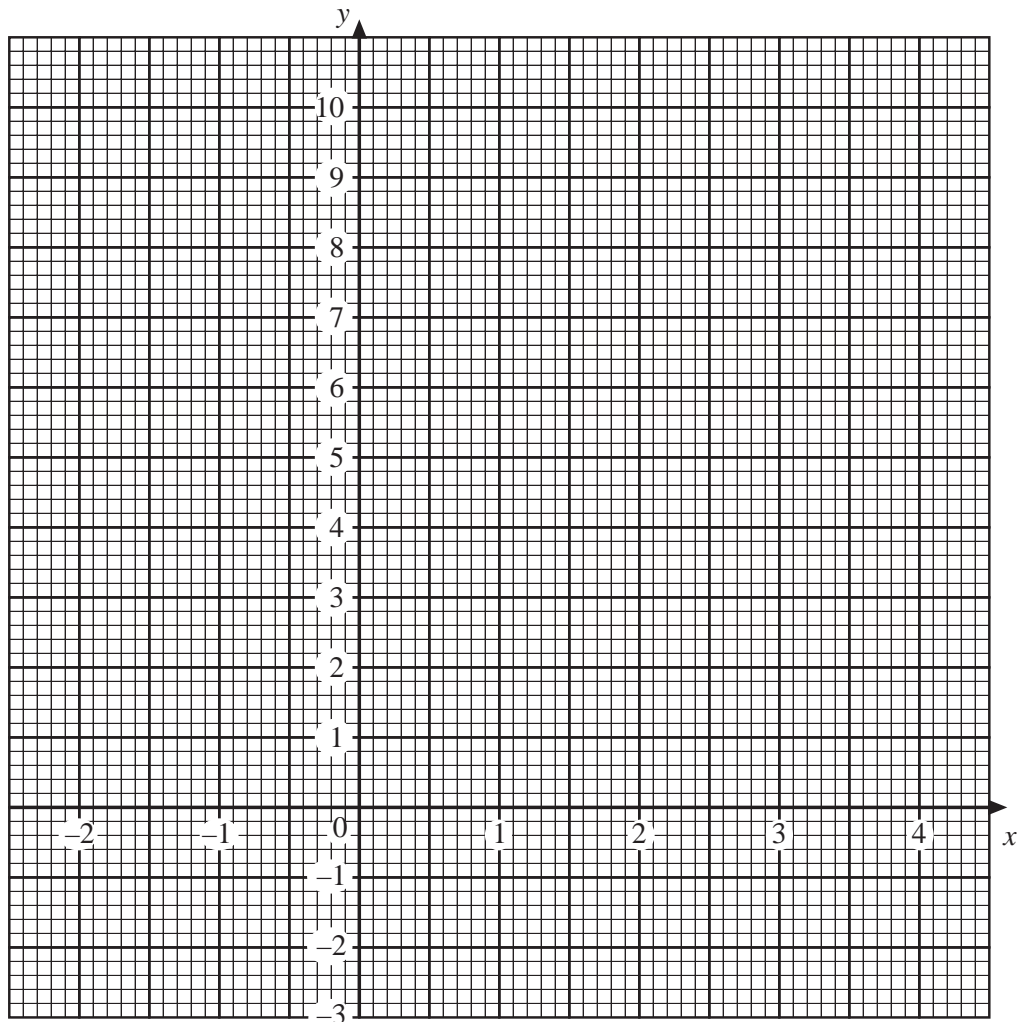
$$y - x = 2, \quad 3x + 4y = 24$$

- (b) (i) On your graph, label with the letter R the region where the inequalities  $y - x \geq 2$  and  $3x + 4y \leq 24$  are satisfied.  
 (ii) The values of  $x$  and  $y$  are whole numbers.

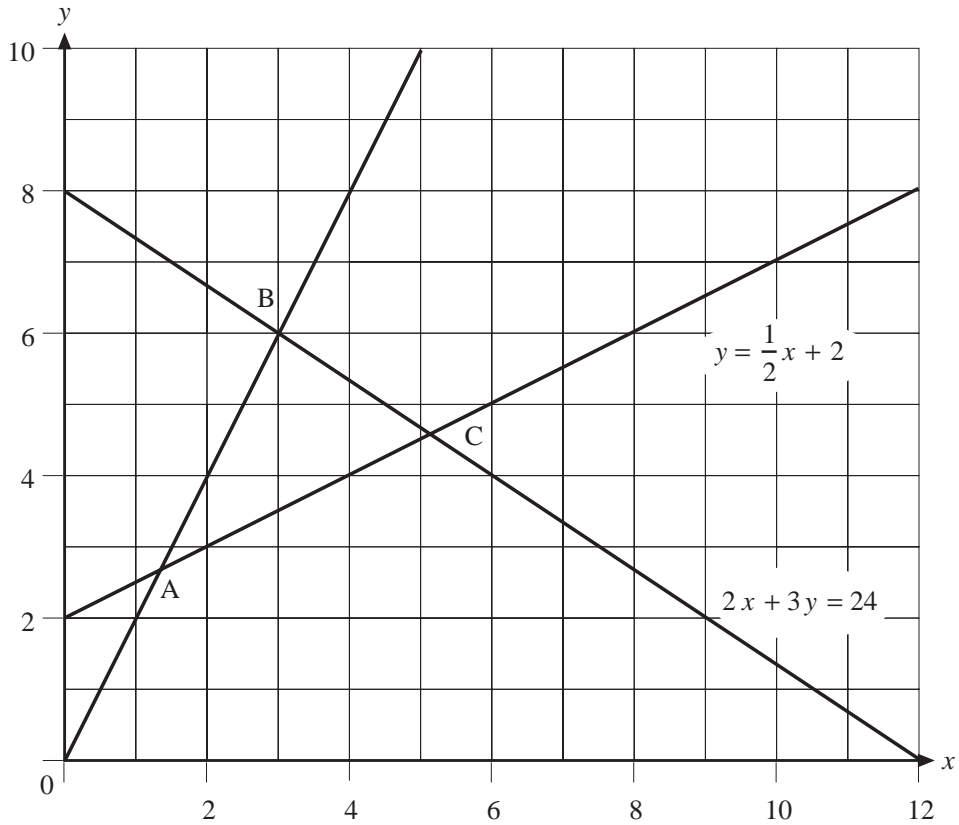
Write down one possible pair of values that satisfy these inequalities.

(SEG)

18. (a) On a copy of the following axes, draw the graph of  $y = x^2 - 3x$ .  
 (b) Use your graph to find the two solutions of the equation  $x^2 - 3x = -1$ .  
 (c) Using your graph, or otherwise, solve the inequality  $x^2 - 3x < 0$ .



19.

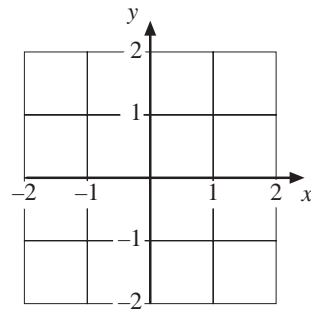


Write down three inequalities satisfied by points on the boundary of or inside the triangle ABC.

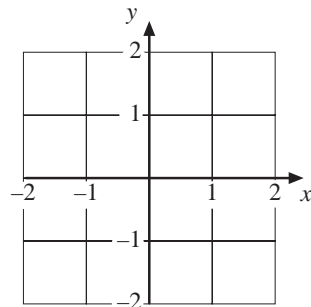
20. The function  $f(x)$  is defined by  $f(x) = \frac{1}{x}$  ( $x \neq 0$ ).

Sketch the following graphs on copies of the grids below.

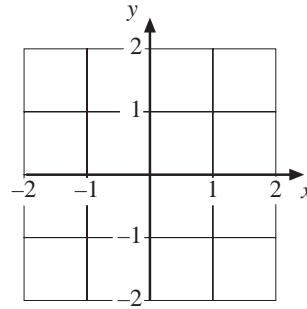
(a)  $y = f(2x)$



(b)  $y = f(x + 1)$

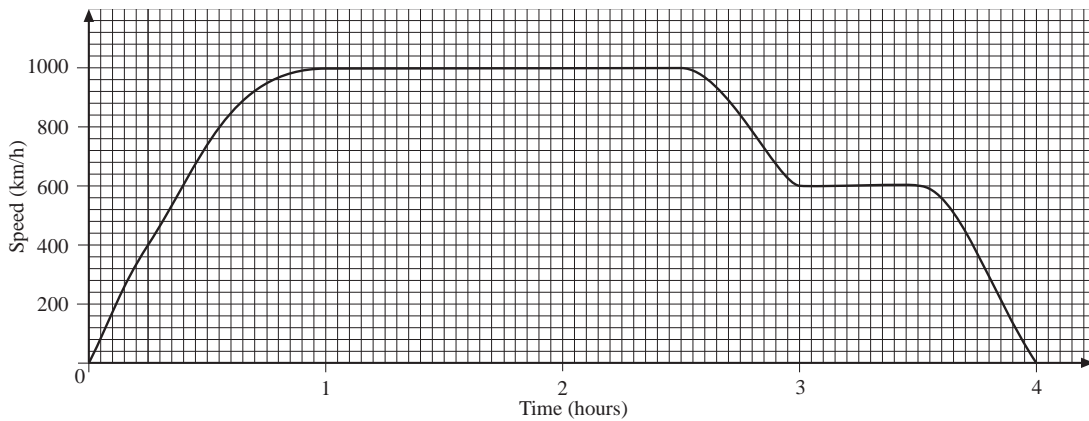


(c)  $y = f\left(\frac{1}{x}\right) + 1$



(SEG)

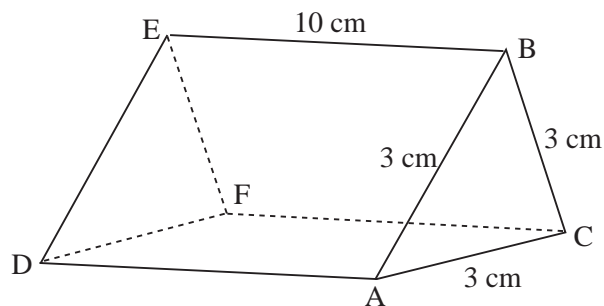
21. A speed-time graph of a plane travelling between two airports is illustrated below.



- (a) What is the maximum cruising speed of the plane?
- (b) Estimate the maximum acceleration of the plane.
- (c) Estimate the distance travelled by the plane in kilometres.

(SEG)

22. The diagram below shows a prism of length 10 cm.  
The cross-section is an equilateral triangle of side length 3 cm.



Not to scale

Calculate

- (a) the length DB,
- (b) the length CD,
- (c) the angle BDC.

23. Two tugs,  $A$  and  $B$  are pulling an oil tanker. Tug  $A$  is pulling with a force of 4000 N directly northwards, whilst tug  $B$  is pulling with a force of 3000 N directly eastwards.

What is the magnitude of the resultant force on the oil tanker?

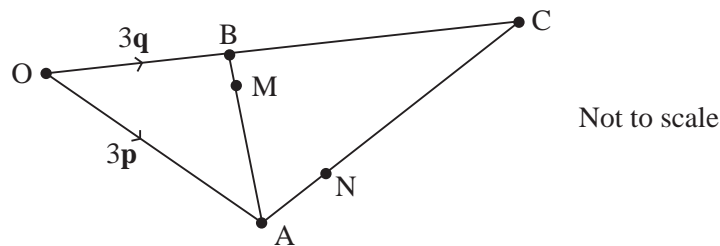
(SEG)

24. The vector  $\vec{OA} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ . The vector  $\vec{OB} = \begin{pmatrix} 1 \\ 7 \end{pmatrix}$ .  $M$  is the midpoint of  $AB$ .

- Calculate the vector  $\vec{AB}$ .
- Calculate the vector  $\vec{OM}$ .
- The point  $X$  is such that  $OAXB$  is a parallelogram.
  - Calculate the vector  $\vec{OX}$ .
  - Explain where the point  $M$  is, in relation to points  $O$  and  $X$ .

(SEG)

25.



- Given that  $\vec{OA} = 3\mathbf{p}$ , and  $\vec{OB} = 3\mathbf{q}$  and  $\vec{OC} = 4\vec{OB}$ , show that  $\vec{AC} = 12\mathbf{q} - 3\mathbf{p}$ .
- Given that  $\vec{AM} = \frac{2}{3}\vec{AB}$  and  $\vec{AN} = \frac{1}{3}\vec{AC}$  express  $\vec{ON}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ .
- Given that  $\vec{OM} = \mathbf{p} + 2\mathbf{q}$  what can you say about the points  $O$ ,  $M$  and  $N$ ?

(NEAB)