1.

1 euro = 120 yen
£1 = 1.2 euros

Change £50 to yen.

2. (*a*) Factorise $14x - 35$

(*b*) Expand and simplify $3(2c - 5) - 2(c - 4)$

(*c*) Simplify $(4e^3)^2$

(*d*) Expand and simplify $(a + 5)(a - 1)$

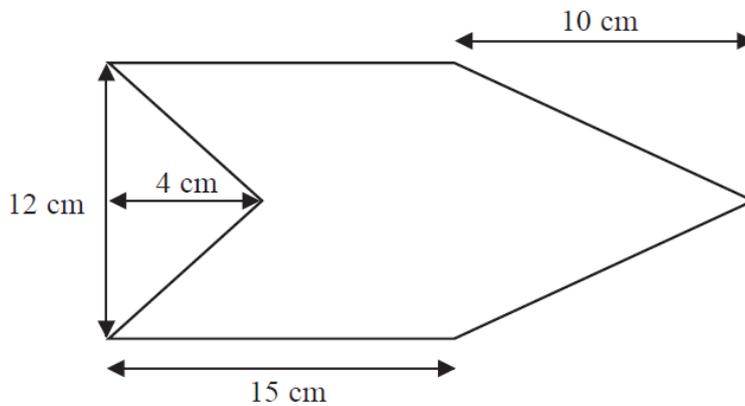**3.** The diagram shows a shape with one line of symmetry.

Diagram **NOT** accurately drawn

Work out the area of the shape.

4. A jar contains coloured beads.
Ajit takes at random a bead from the jar.
The probability that the bead is yellow is 0.08.
The probability that the bead is pink is 0.1.
The probability that the bead is blue is 0.25.

(a) (i) Find the probability that the bead is yellow or blue.

(ii) Find the probability that the bead is neither yellow nor pink.

Ajit replaces the first bead in the jar.
He then takes at random a second bead from the jar.

(b) Find the probability that the first bead is yellow and the second bead is blue.

A second jar contains 100 coloured beads.
20 of these beads are brown.

Ajit takes at random a bead from the jar.
He records the colour of the bead and then returns the bead to the jar.
He does this 60 times.

(*c*) Work out an estimate for the number of times Ajit records a brown bead.

5.   Solve $4(5y - 1) = 3(6y + 7)$
Show clear algebraic working.

6   Ali is *y* years old.
Bhavara is twice as old as Ali.
Ceris is 3 years younger than Ali.

The total of their ages is 125 years.

Work out the age of each person.
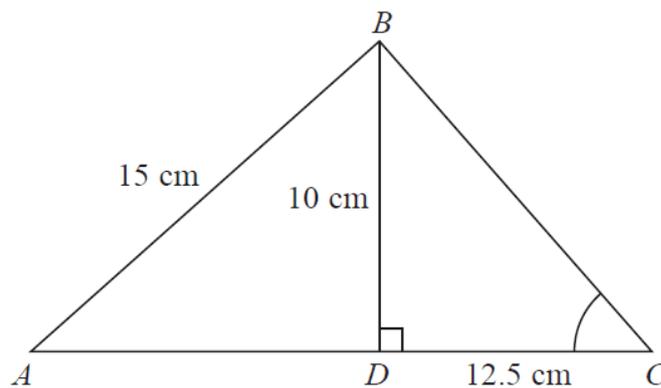

7.

Diagram **NOT**
accurately drawn

ABC is a triangle.
The point *D* lies on *AC*.
Angle *BDC* = 90°
BD = 10 cm, *AB* = 15 cm and *DC* = 12.5 cm.

(*a*) Calculate the length of *AD*.
Give your answer correct to 3 significant figures.

(*b*) Calculate the length of *AD*.
Give your answer correct to 1 significant figures.

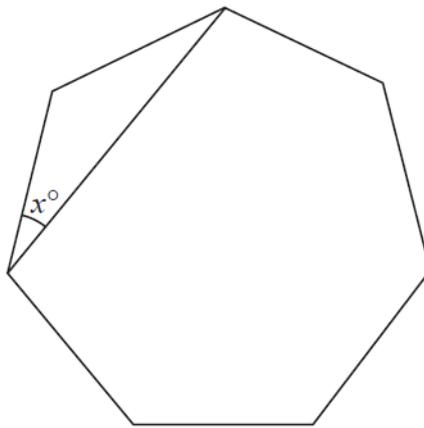**8.** (*a*) Find the sum of the interior angles of a polygon with 7 sides.

Diagram **NOT**
accurately drawn

The diagram shows a regular polygon with 7 sides.

(b) Work out the value of *x*.
Give your answer correct to 1 decimal place.

9. (a) Find the gradient of the line with equation $3y - 2x = 6$

(b) Find an equation of the line with gradient -3 that passes through the point (2, 5).

10.

$3780 = 2^2 \times 3^3 \times 5 \times 7$	$3240 = 2^3 \times 3^4 \times 5$

(*a*) Find the highest common factor (HCF) of 3780 and 3240.
Give your answer as a product of prime factors.

(*b*) Find the lowest common multiple (LCM) of 3780 and 3240.
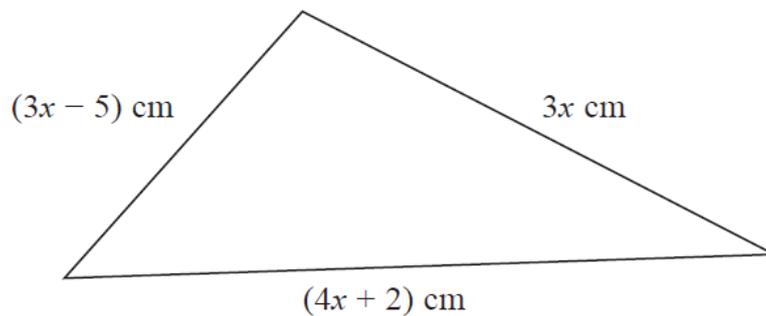Give your answer as a product of prime factors.

11. Solve the simultaneous equations

$$5y - 4x = 8$$
$$y + x = 7$$

Show clear algebraic working.

12. The diagram shows a triangle.

Diagram **NOT**
accurately drawn
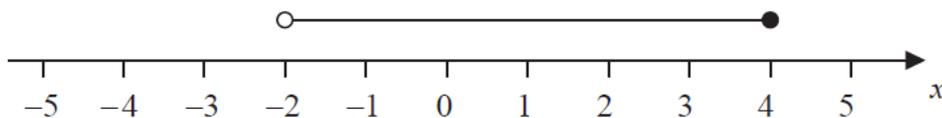

$(3x - 5)$ cm $3x$ cm

$(4x + 2)$ cm

The lengths of the sides of the triangle are $3x$ cm, $(3x - 5)$ cm and $(4x + 2)$ cm.

The perimeter of the triangle is 62 cm.

Work out the value of x.
Show clear algebraic working.

13. (a) Solve the inequality $3x + 8 < 35$
(b) Write down the inequality shown on the number line.

14. (a) Factorise $c^2 - 5c$

(b) Simplify $d^5 \times d^7$

(c) Factorise $x^2 + x - 30$

(d) Make b the subject of $P = \dfrac{1}{2}ab^2$

(e) Solve $\dfrac{2x+1}{3} + \dfrac{x-5}{2} = 4$

Show clear algebraic working.

15. (a) Write 0.000076 in standard form.

The area covered by the Pacific Ocean is 1.6×10^8 km^2.
The area covered by the Arctic Ocean is 1.4×10^7 km^2.

(b) Write 1.6×10^8 as an ordinary number.

The area covered by the Pacific Ocean is k times the area covered by the Arctic Ocean.

(c) Find, correct to the nearest integer, the value of k.

16. Kwo invests HK$ 40000 for 3 years at 2.5% per year compound interest.
Work out the value of the investment at the end of 3 years.

17. Here is the graph of $y = x^2 - 2x - 1$
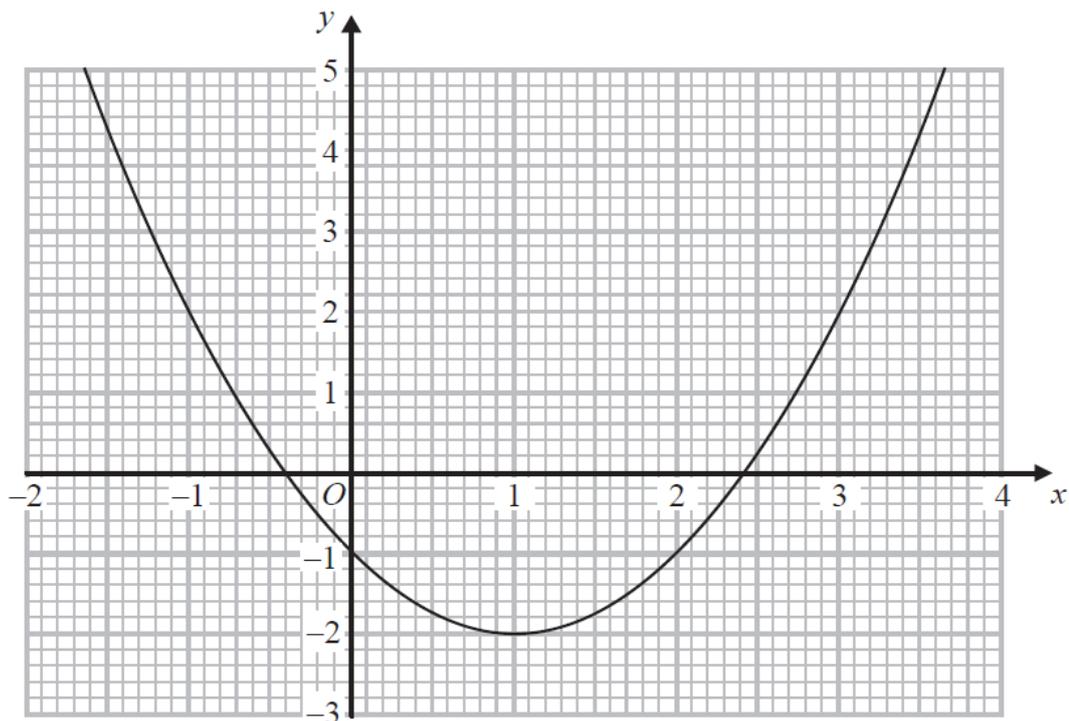
(*a*) Use the graph to solve the equation $x^2 - 2x - 1 = 2$

The equation $x^2 + 5x - 7 = 0$ can be solved by finding the points of intersection of the line $y = ax + b$ with the graph of $y = x^2 - 2x - 1$
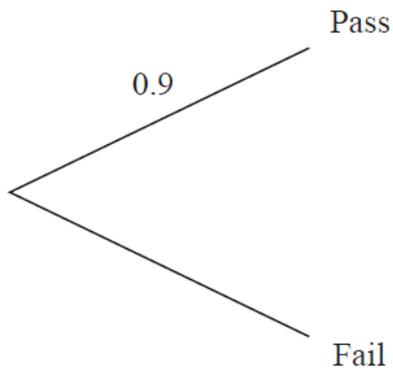
(*b*) Find the value of *a* and the value of *b*.

18. Chris and Sunil each take a driving test.

The probability that Chris passes the driving test is 0.9.
The probability that Sunil passes the driving test is 0.65.

(*a*) Complete the probability tree diagram.

Chris   **Sunil**

Pass

0.9

Fail

(b) Work out the probability that exactly one of Chris or Sunil passes the driving test.

17.

x cm

Diagram **NOT**
accurately drawn

$2x$ cm

$(x + 7)$ cm
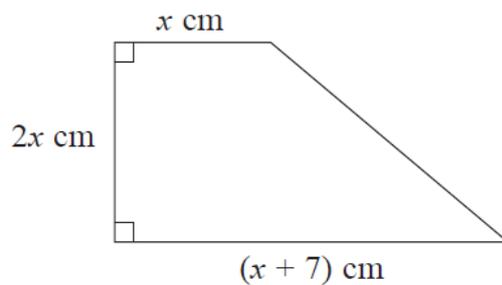
The diagram shows a trapezium.
The trapezium has an area of 17 cm^2.

(a) Show that $2x^2 + 7x - 17 = 0$

(b) Work out the value of x.
Give your answer correct to 3 significant figures.
Show your working clearly.

18. An athlete runs 400 metres, correct to the nearest metre.
The athlete takes 50.2 seconds, correct to the nearest 0.1 of a second.

Work out the upper bound of the athlete's average speed.
Give your answer correct to 3 significant figures.

19. $\mathbf{a} = \begin{pmatrix} 5 \\ -2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 1 \\ 7 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} -7 \\ 0 \end{pmatrix}$
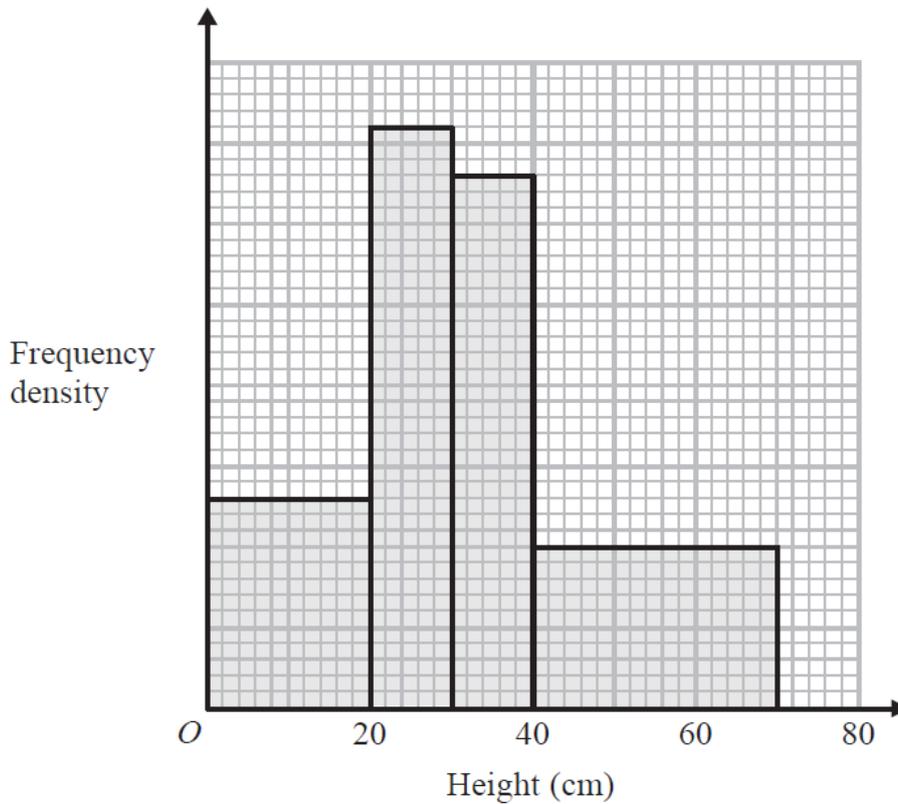
(*a*) Write, as a column vector, $2\mathbf{a}$

$$\begin{pmatrix} \\ \end{pmatrix}$$

(*b*) Write, as a column vector, $3\mathbf{b} - \mathbf{c}$

$$\begin{pmatrix} \\ \end{pmatrix}$$

20. The histogram shows information about the heights of some tomato plants.

Height (cm)

26 plants have a height of less than 20 cm.

Work out the total number of tomato plants.
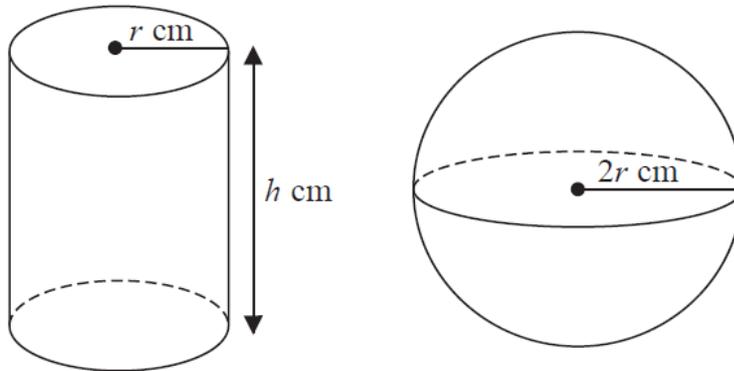
21. The diagram shows a cylinder and a sphere.

The cylinder has radius r cm and height h cm.
The sphere has radius $2r$ cm.

The volume of the cylinder is equal to the volume of the sphere.
Find an expression for h in terms of r.
Give your answer in its simplest form.

22. (*a*) Write $\dfrac{1}{32}$ as a power of 2.

(*b*) Show that $(4 + \sqrt{12})(5 - \sqrt{3}) = 14 + 6\sqrt{3}$
Show each stage of your working clearly.

23. Write $5 - (x + 2) \div \left(\dfrac{x^2 - 4}{x - 3} \right)$ as a single fraction.

Simplify your answer fully.

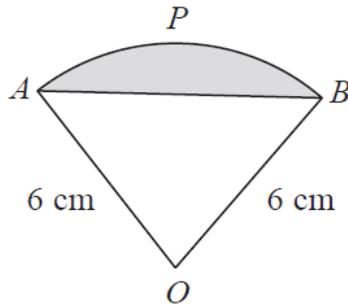**24.** The diagram shows a sector *OAPB* of a circle, centre *O*.

Diagram **NOT**
accurately drawn

AB is a chord of the circle.
OA = *OB* = 6 cm.

The area of sector *OAPB* is 5π cm².

Calculate the perimeter of the shaded segment.
Give your answer correct to 3 significant figures.

25. The cumulative frequency graph gives information about the intelligence quotients (IQ)
of a random sample of 100 adults.
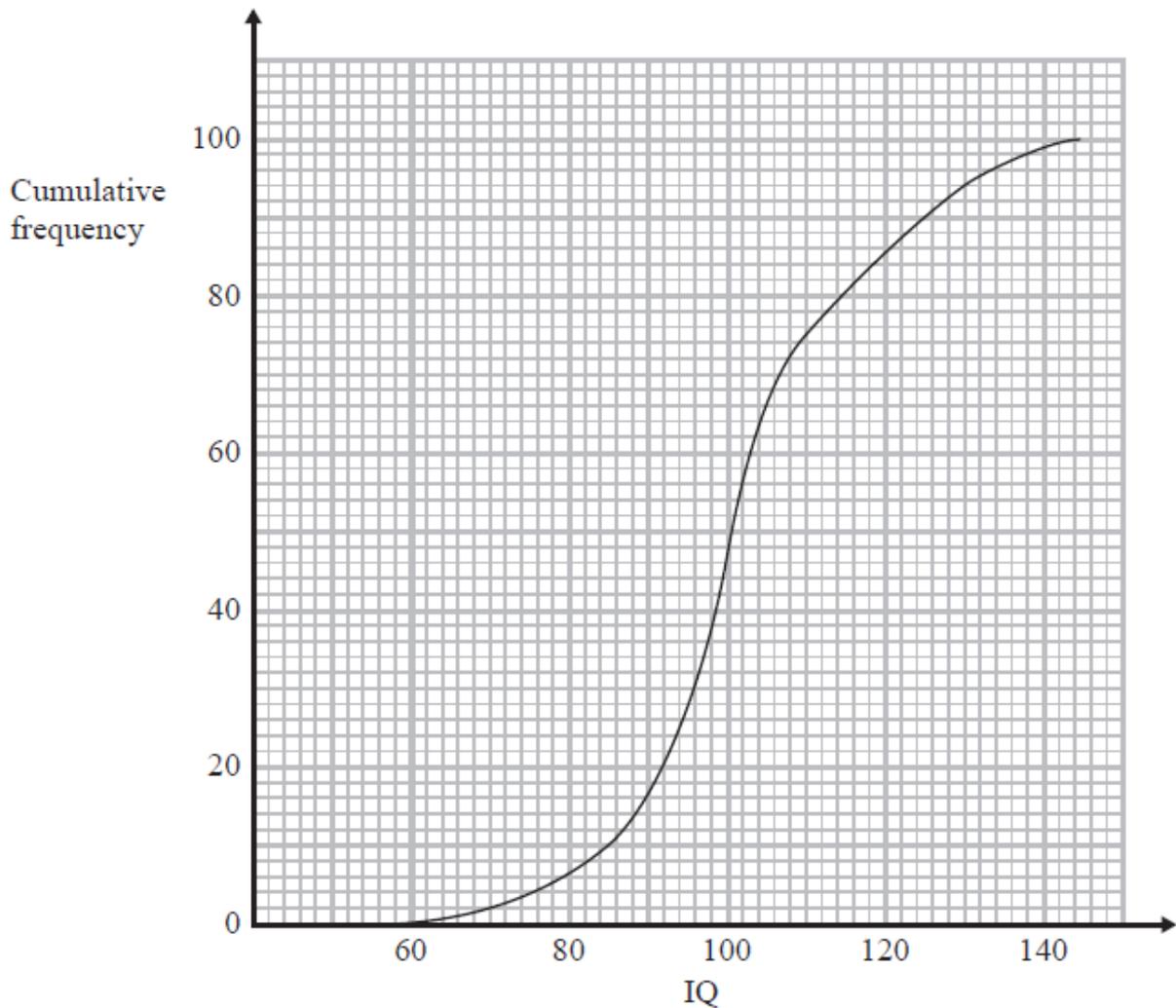
(*a*) Use the cumulative frequency graph to find an estimate for the number of adults in the sample who have an IQ between 85 and 115

(*b*) Find an estimate for the upper quartile of the IQ of adults in the sample.

26.

Diagram **NOT** accurately drawn

32 cm
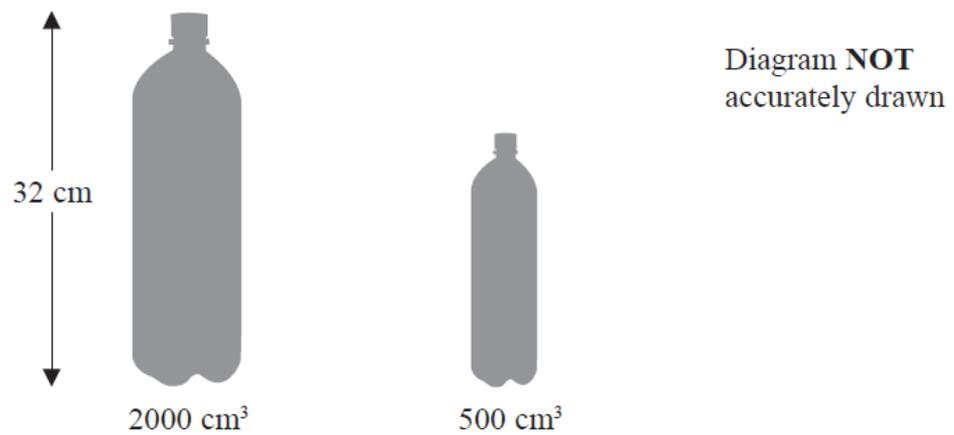
2000 cm³   500 cm³

Zane buys mineral water in large bottles and in small bottles.
The large bottles are mathematically similar to the small bottles.
Large bottles have a height of 32 cm and a volume of 2000 cm³.
Small bottles have a volume of 500 cm³.

Work out the height of a small bottle.
Give your answer correct to 3 significant figures.

27.
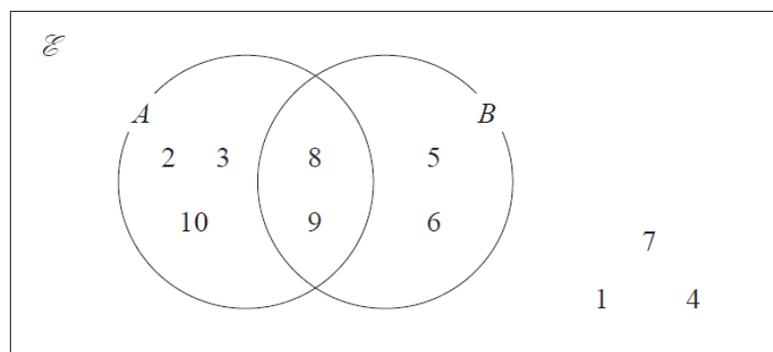
The Venn diagram shows all of the elements in sets *A*, *B* and *ℰ*.

(*a*) Write down the elements in *A'*

(b) Find n(A ∩ B)'

(c) Find the elements in (A ∩ B) ∪ (A ∪ B)'

A ∩ C = Ø

B ∪ C = {5, 6, 7, 8, 9}

n(C) = 3

(d) Write down the elements in C.

28.   f:x ↦ 2x² + 1   g:x ↦ $\dfrac{2x}{x-1}$ where x ≠ 1

   (a) Express the composite function gf in the form gf:x ↦ …
         Give your answer as simply as possible.

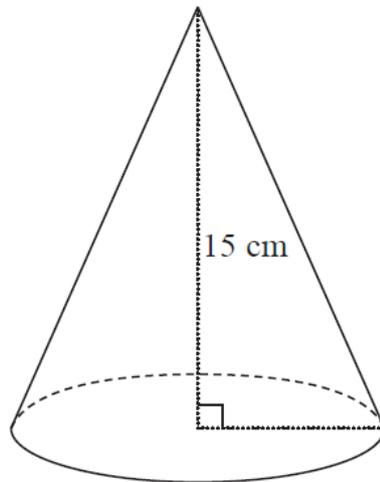   (b) Express the inverse function g⁻¹ in the form g⁻¹: x ↦ …

29.

Diagram **NOT**
accurately drawn

15 cm

A solid cone has a height of 15 cm.
The volume of the cone is 320π cm³.

Work out the curved surface area of the cone.
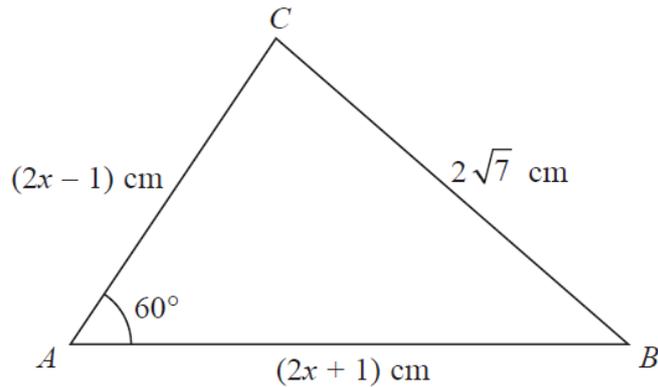Give your answer correct to 3 significant figures.

30.

Diagram **NOT** accurately drawn

The diagram shows a triangle ABC.

$AB = (2x + 1)$ cm, $AC = (2x - 1)$ cm and $BC = 2\sqrt{7}$ cm.
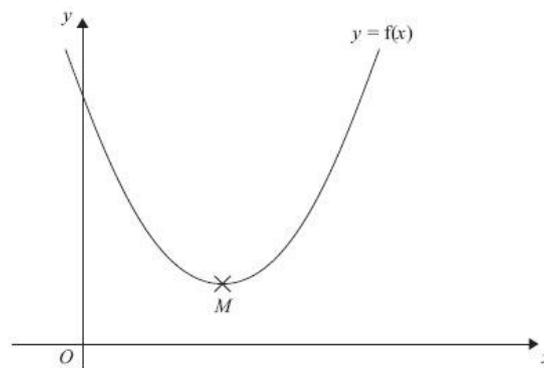
Angle $BAC = 60°$

Work out the value of x.

Show clear algebraic working.

31. The expression $x^2 - 3x + 8$ can be written in the form $(x - a)^2 + b$ for all values of x.

(i) Find the value of a and the value of b.

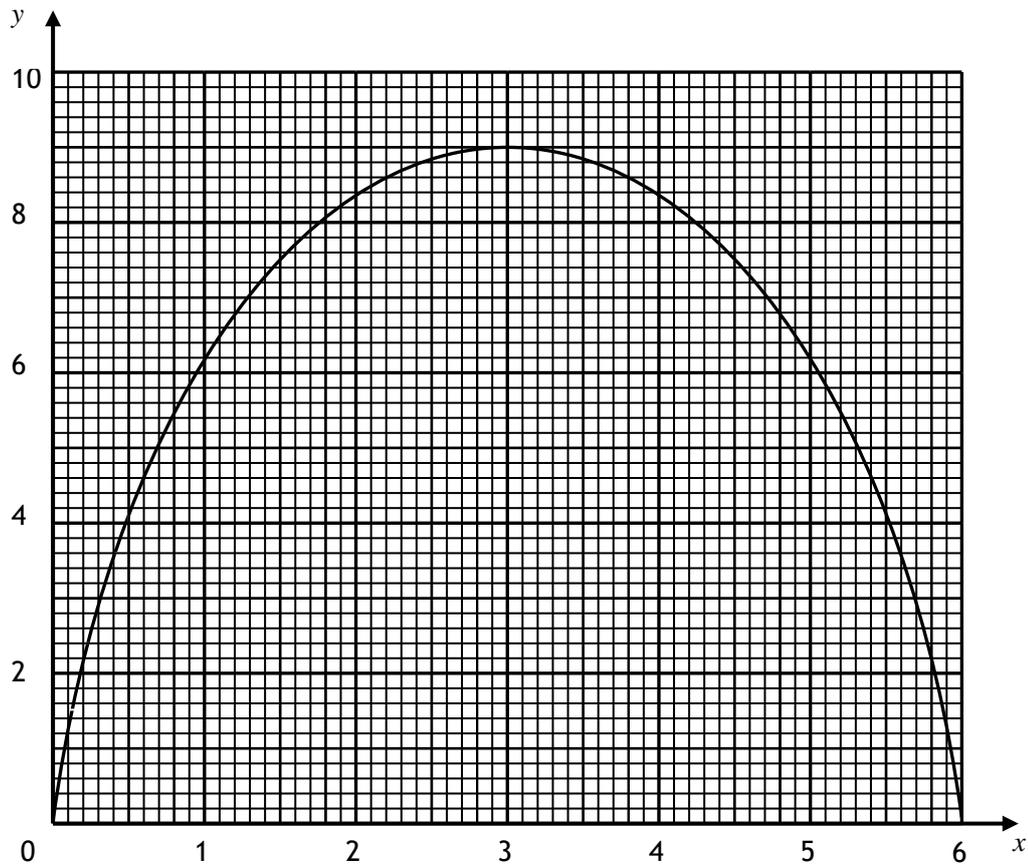The equation of a curve is $y = f(x)$ where $f(x) = x^2 - 3x + 8$

The diagram shows part of a sketch of the graph of $y = f(x)$.

The minimum point of the curve is M.

(ii) Write down the coordinates of M.

32.. The diagram shows the graph of $y = 6x - x^2$

(a) Use 3 equal strips on the graph to estimate the area under the curve between $x = 1$ and $x = 4$

(b) Is the answer to part (a) an over-estimate or an under-estimate? Justify your answer.

32. (a) show that $x = 1 + \dfrac{11}{x - 3}$ is a rearrangement of the equation $x^2 - 4x - 8 = 0$

(b) Use the iterative formula $x_{n+1} = 1 + \dfrac{11}{x_n - 3}$ together with a starting value of $x_0 = -2$

to obtain a solution of the equation $x^2 - 4x - 8 = 0$ correct to 1 decimal place.

33. A tennis ball is dropped from a height of 20 feet.
After the ball hits the floor, it rebounds to 85% of its previous height.

(a) How high will the ball rebound after its third bounce?

(b) Write down a general formula for this sequence.

34. Here are the first 5 terms of a quadratic sequence

3   9   17   27   39
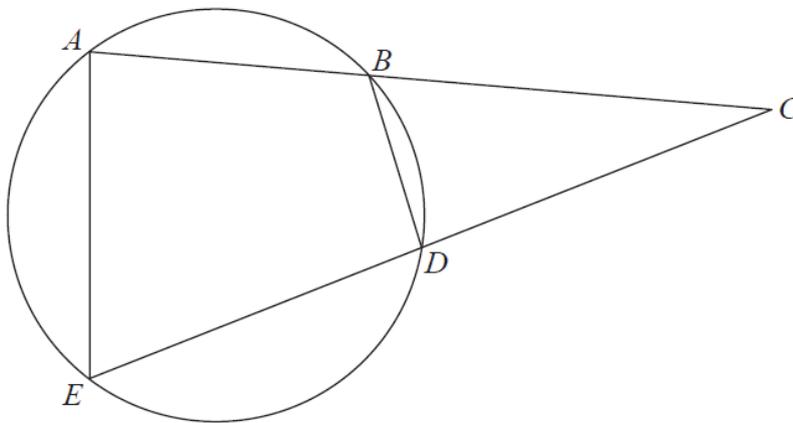
Jean says that 161 is a term of this sequence.

(a) Is Jean correct? Give a reason for your answer.

Nav says that all the terms in the sequence are odd numbers.

(b) Is Nav correct? Give a reason for your answer.

*35

Diagram **NOT**
accurately drawn

A, *B*, *D* and *E* are points on a circle.
ABC and *EDC* are straight lines.

Prove that triangle *BCD* is similar to triangle *ECA*.
You must give reasons for your working.

36   Manchester airport is on a bearing of 330° from a London airport.
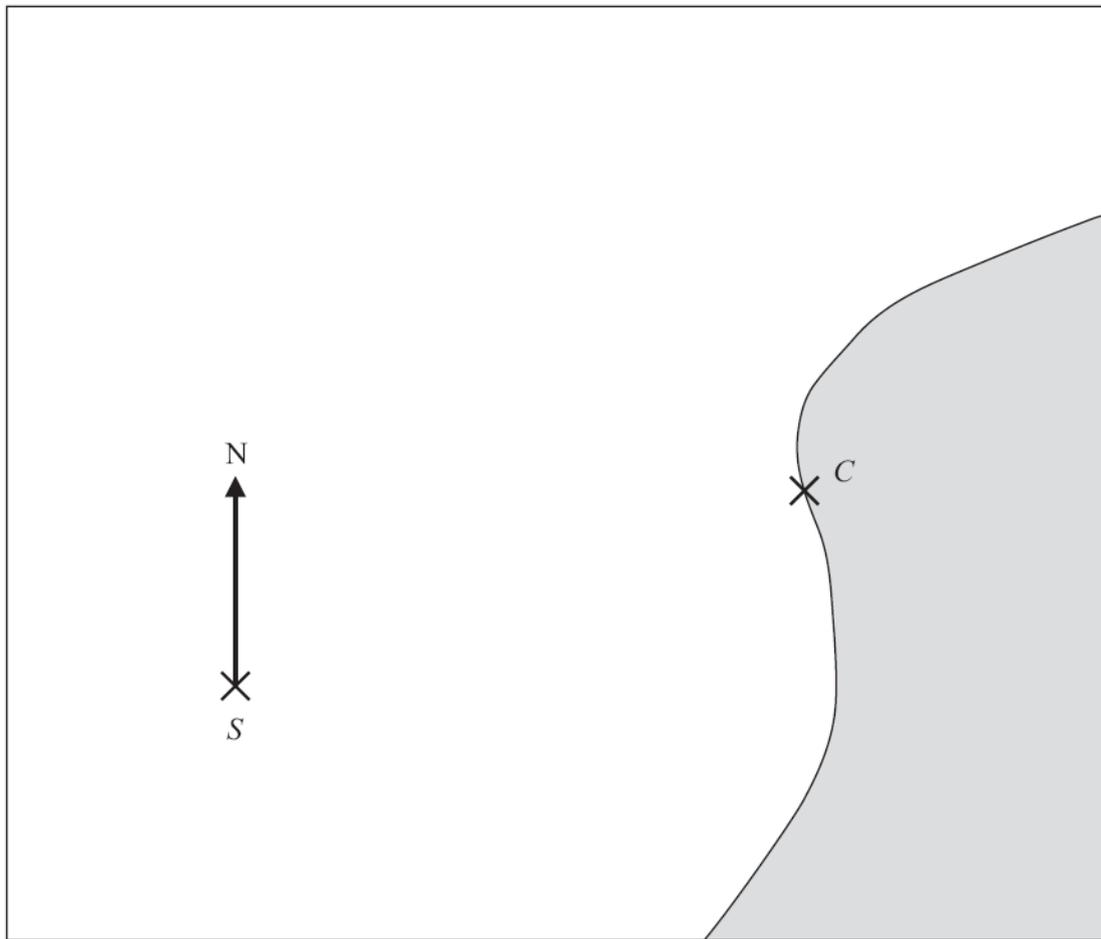
(*a*) Find the bearing of the London airport from Manchester airport.

The London airport is 200 miles from Manchester airport.

A plane leaves Manchester airport at 10 am to fly to the London airport.
The plane flies at an average speed of 120 mph.

(*b*) What time does the plane arrive at the London airport?

37. Here is a map.
The position of a ship, S, is marked on the map.

Scale   1 cm represents 100 m

Point C is on the coast.
Ships must not sail closer than 500 m to point C.

The ship sails on a bearing of 037°

Will the ship sail closer than 500 m to point C?
You must explain your answer.

38

$$A \text{————————————} B$$

Use ruler and compasses to **construct** the perpendicular bisector of the line segment *AB*.
You must show all your construction lines.

39. The normal price of a television is reduced by 30% in a sale.

The sale price of the television is £350

Work out the normal price of the television.
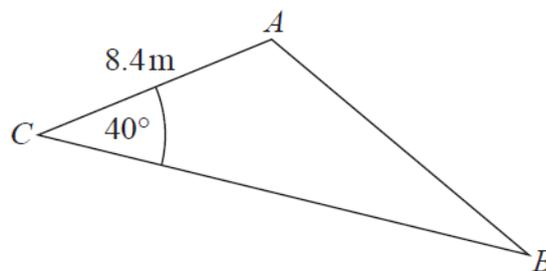
40 *ABC* is a triangle.

8.4 m

40°

C

A

B

Diagram **NOT**
accurately drawn

AC = 8.4 m
Angle *ACB* = 40°

The area of the triangle = 100 m².

Work out the length of *AB*.
Give your answer correct to 3 significant figures.
You must show all your working.

41 148 students went to Brighton.

Each student went to the Aquarium or the Brighton Wheel or the Royal Pavilion.

The table gives information about these students.

	Aquarium	**Brighton Wheel**	**Royal Pavilion**
Male	16	15	22
Female	36	35	24

The teacher takes a sample of 40 of these students.
The sample is stratified by gender and by place visited.

Work out the number of students in the sample who are female and went to the Brighton Wheel.

42 Alison is using the quadratic formula to solve a quadratic equation.
She substitutes values into the formula and correctly gets

$$x = \frac{-7 \pm \sqrt{49 - 32}}{4}$$

Work out the quadratic equation that Alison is solving.
Give your answer in the form $ax^2 + bx + c = 0$, where a, b and c are integers.

43 The box plot shows information about the number of countries competing in each Winter Olympic Games since 1948.

Number of countries in the Winter Olympics
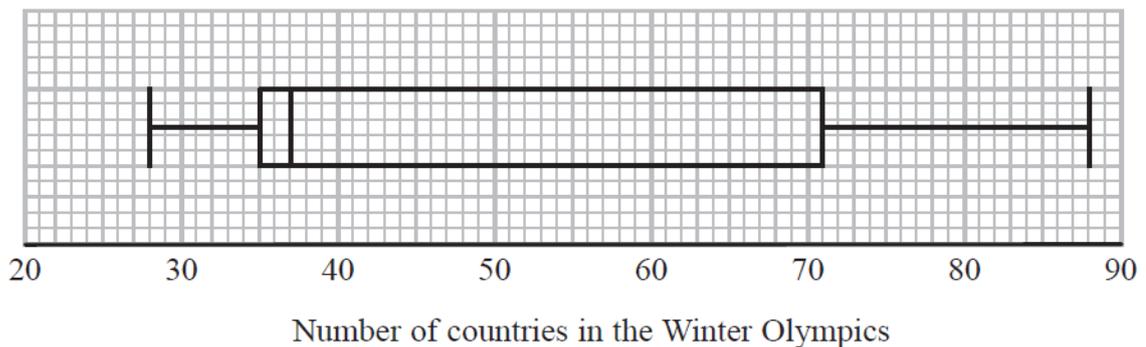
(*a*) Write down the median.

 (*b*) Work out the interquartile range.

The table below shows information about the number of countries competing in each Summer Olympic Games since 1948.

	Smallest	Lower Quartile	Median	Upper Quartile	Largest
Number of countries	59	83	121	199	204

*(*c*) Compare the two distributions.

44. (*a*) Given that *x* and *y* are integers such that

$$3 < x < 7$$
$$4 < y < 9$$
$$\text{and } x + y = 13$$

find all the possible values of *x*.

 (*b*) On the grid below show, by shading, the region defined by the inequalities

$$y \geq -1 \qquad y \geq 4 - x \qquad y \geq 3x - 1$$

Mark this region with the letter R.
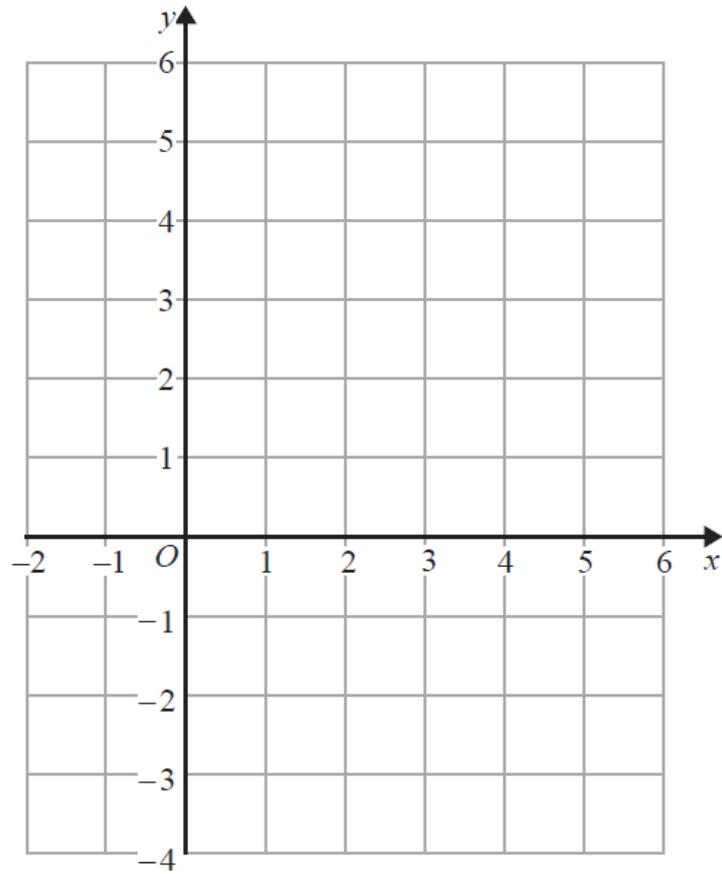
45. Solve the simultaneous equations $x^2 + y^2 = 9$
$$x + y = 2$$

Give your answers correct to 2 decimal places.

46. Solve the equation $5x^2 + 8x - 6 = 0$

Give each solution correct to 2 decimal places.
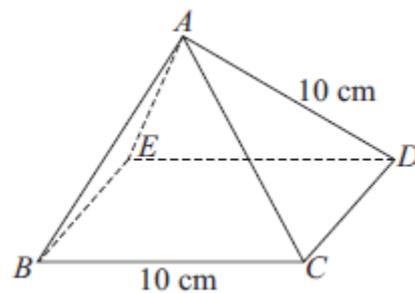
47. The diagram shows a pyramid.

Diagram **NOT**
accurately drawn

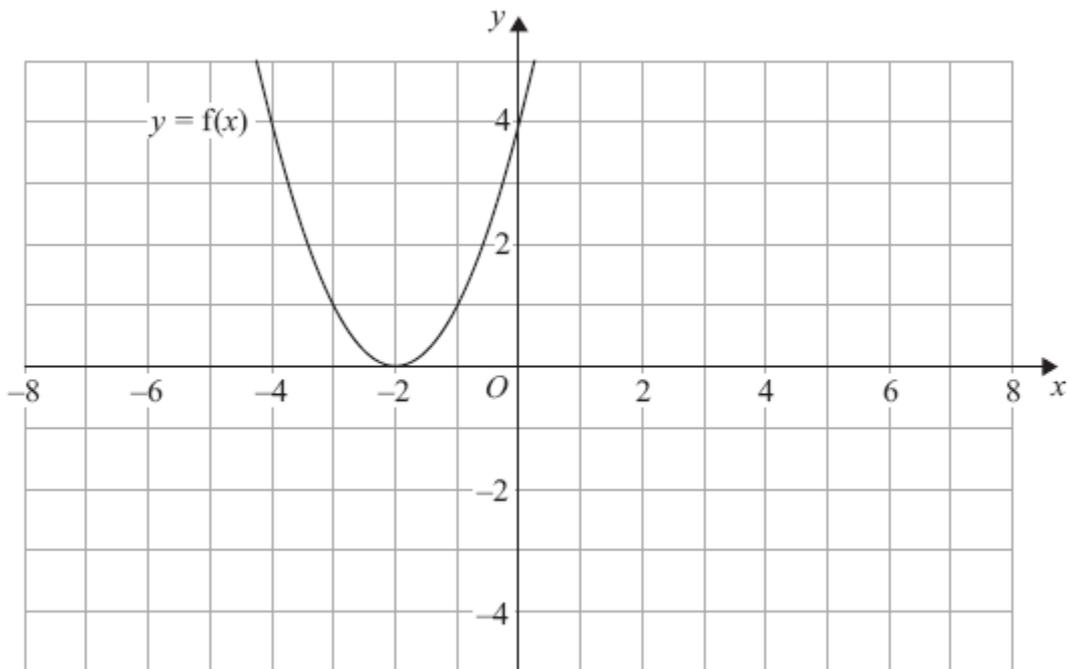*BCDE* is a square with sides of length 10 cm.
The other faces of the pyramid are equilateral triangles with sides of length 10 cm.

(a) Calculate the volume of the pyramid.
    Give your answer correct to 3 significant figures.

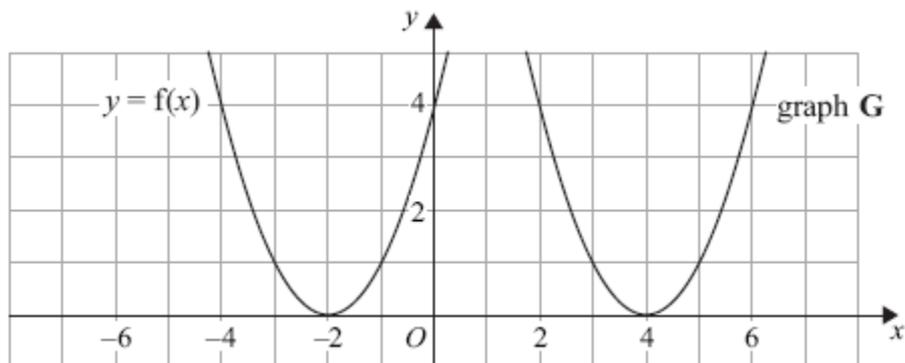(b) Find the size of angle *DAB*.

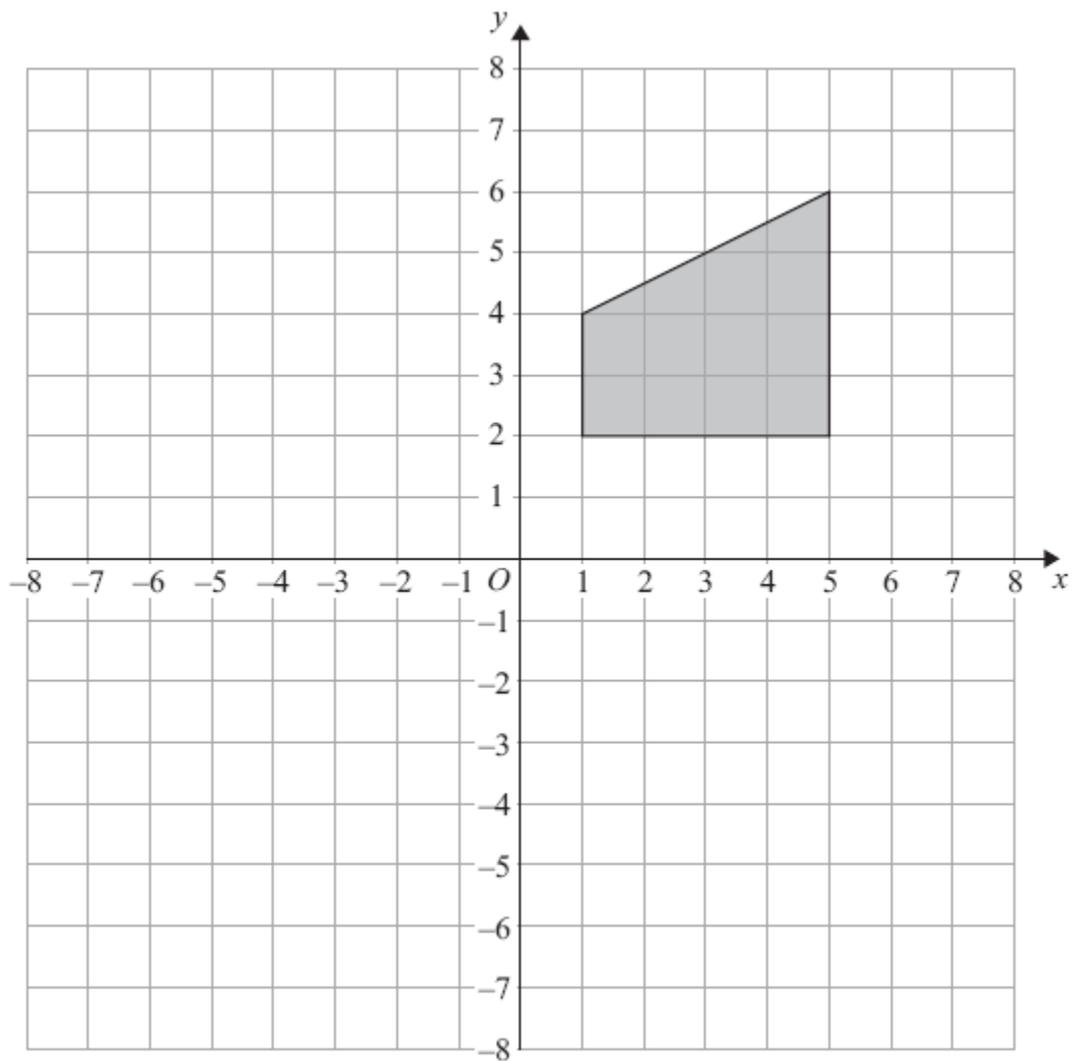**48.** $y = f(x)$

The graph of $y = f(x)$ is shown on the grid.

(a) On the grid above, sketch the graph of $y = -f(x)$.

The graph of $y = f(x)$ is shown on the grid.

The graph **G** is a translation of the graph of $y = f(x)$.

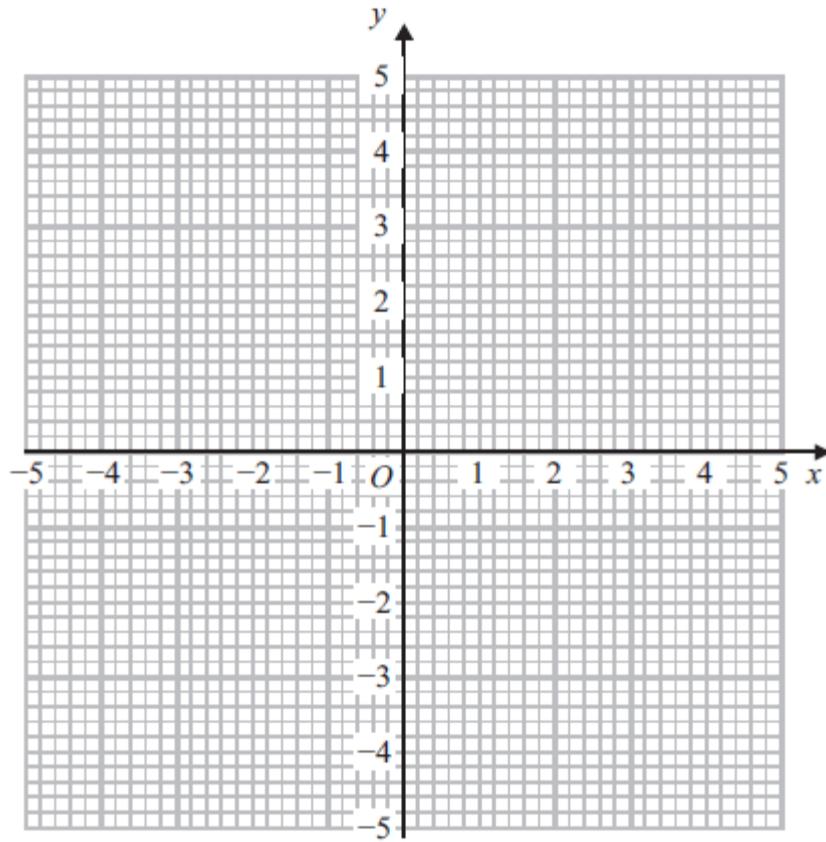(b) Write down the equation of graph **G**.

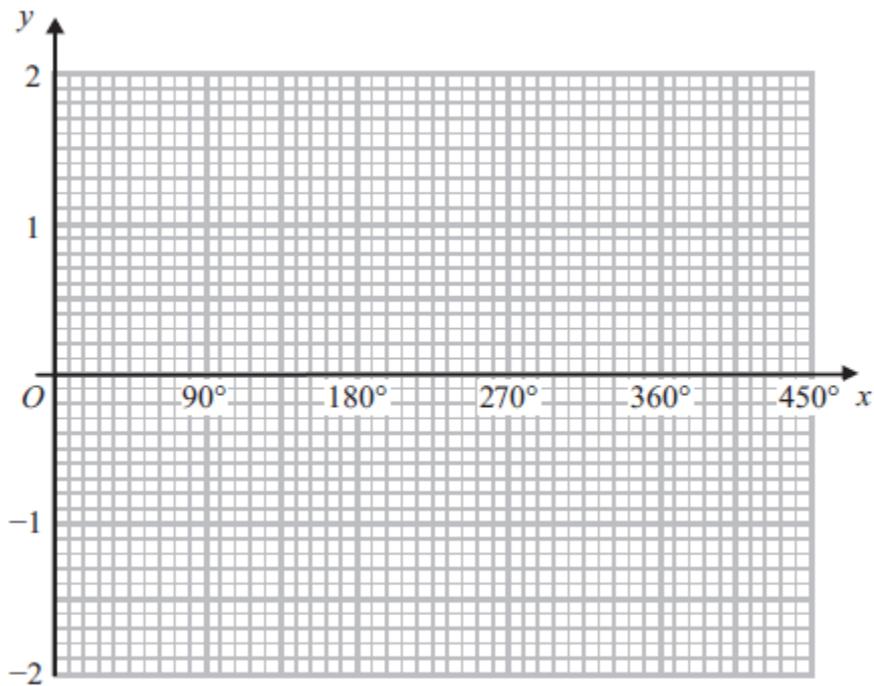Enlarge the shaded shape by scale factor $-\dfrac{1}{2}$ with centre $(-1, -2)$.

49. Make t the subject of the formula

$$p = \frac{3 - 2t}{4 + t}$$

50.

(a) On the grid, draw the graph of $x^2 + y^2 = 4$

(b) On the grid, sketch the graph of $y = \cos x$ for $0° \le x \le 360°$