Brilliant Maths Revision

GREEN PACK

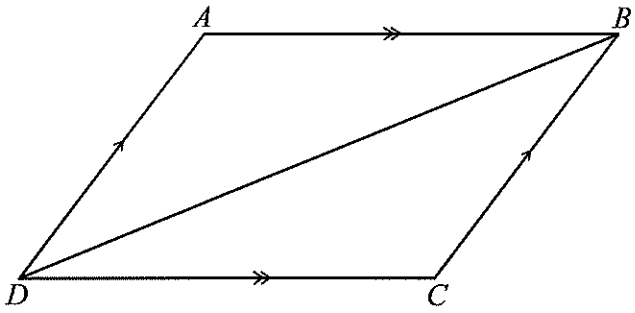
Grade 7

Name:

If you complete this pack, you can trade it in for the next grade up – ask your maths teacher

Congruent Triangles

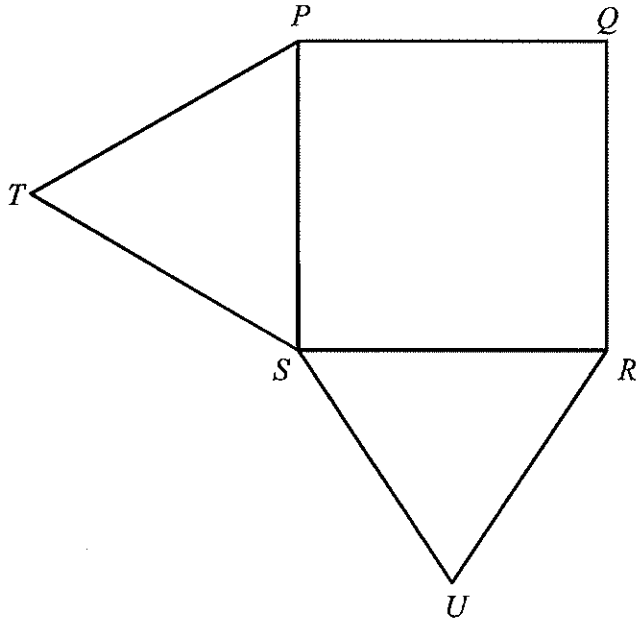
1) *ABCD* is a quadrilateral.



AB is parallel to *DC*.
DA is parallel to *CB*.

Prove that triangle *ABD* is congruent to triangle *CDB*.

2)



PQRS is a square.
PTS and *SUR* are equilateral triangles.

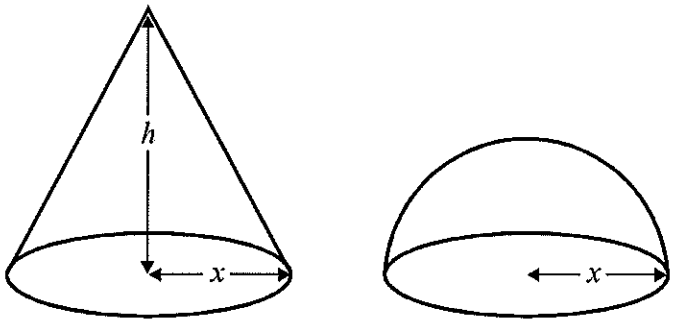
a) Prove that triangle *USP* is congruent to triangle *TSR*.

X is the point such that *RUXT* is a parallelogram.

b) Prove that *UP* = *UX*

Spheres and Cones

1)

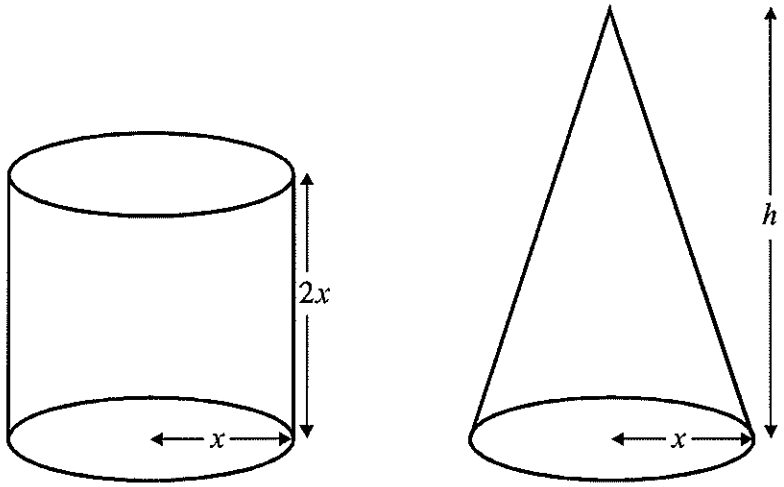


The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x.

2)



A cylinder has base radius x cm and height $2x$ cm.

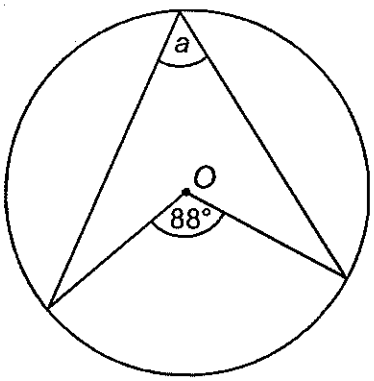
A cone has base radius x cm and height h cm.

The volume of the cylinder and the volume of the cone are equal.

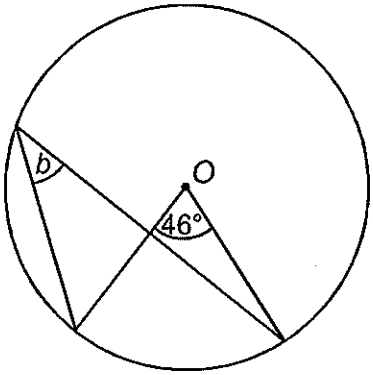
Find h in terms of x.
Give your answer in its simplest form.

Circle Theorems

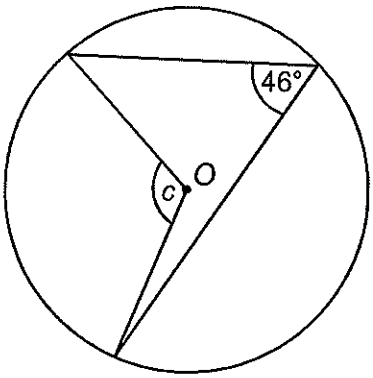
1) $a =$ ____



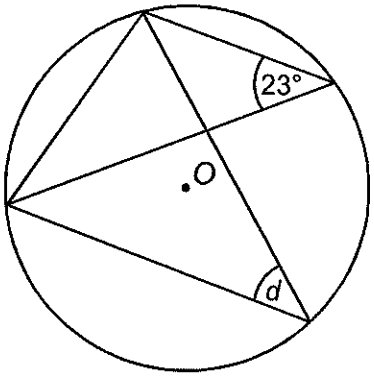
2) $b =$ ____



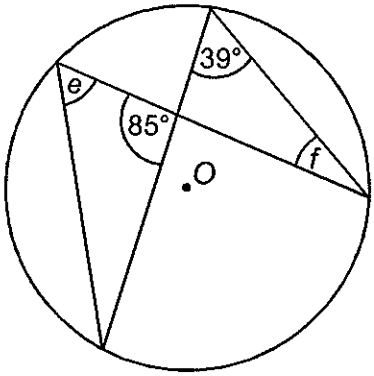
3) $c =$ ____



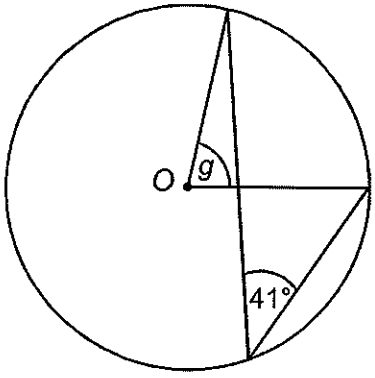
4) $d =$ ____



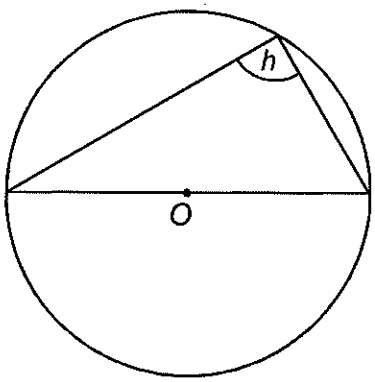
5) $e =$ ____ $f =$ ____



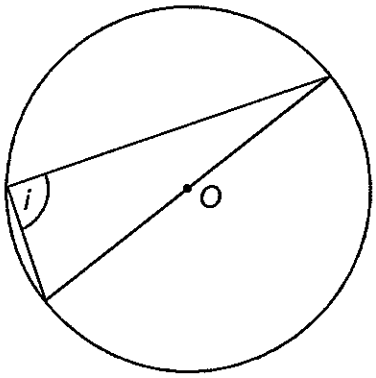
6) $g =$ ____



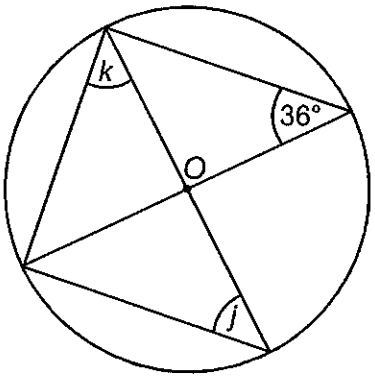
7) $h =$ ____



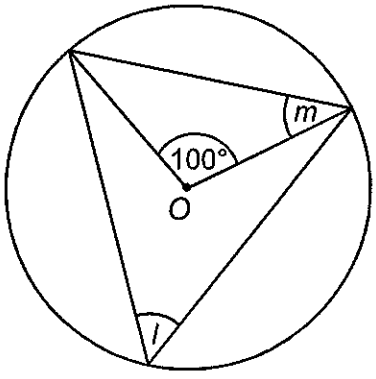
8) $i =$ ____



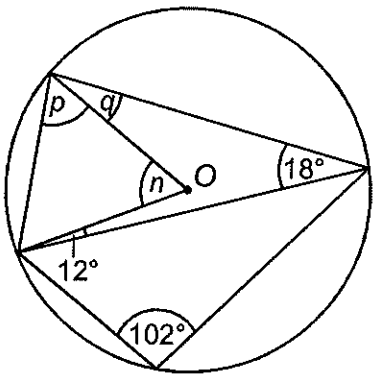
9) $j =$ ____ $k =$ ____



10) $l =$ ____ $m =$ ____

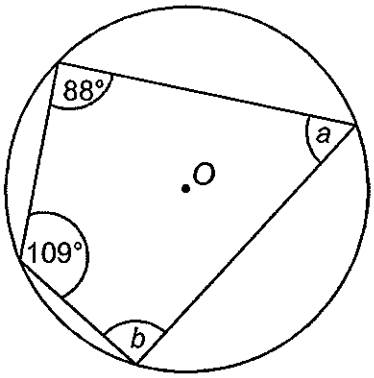


11) $n =$ ____ $p =$ ____ $q =$ ____

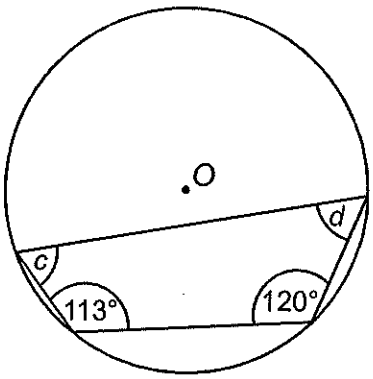


Circle Theorems

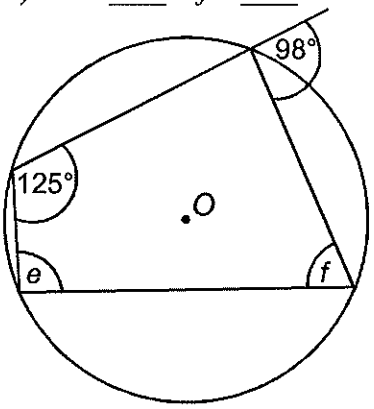
1) $a =$ ____ $b =$ ____



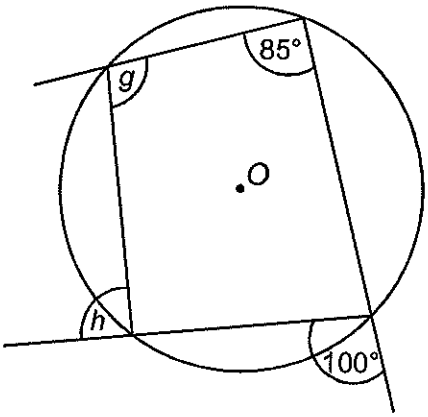
2) $c =$ ____ $d =$ ____



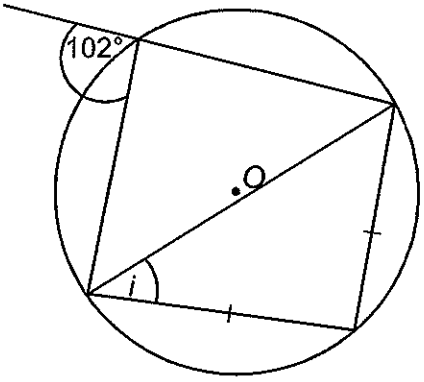
3) $e =$ ____ $f =$ ____



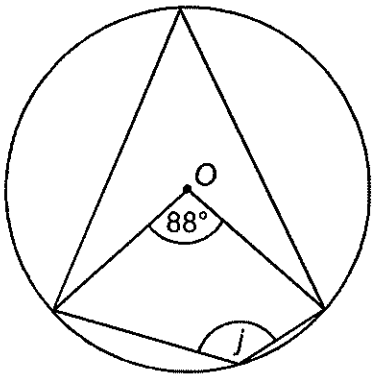
4) $g =$ ____ $h =$ ____



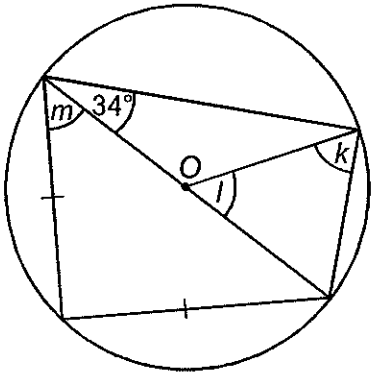
5) $i =$ ____



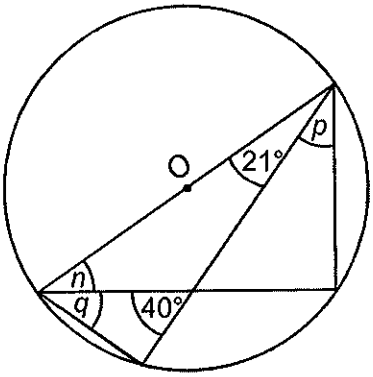
6) $j =$ ____



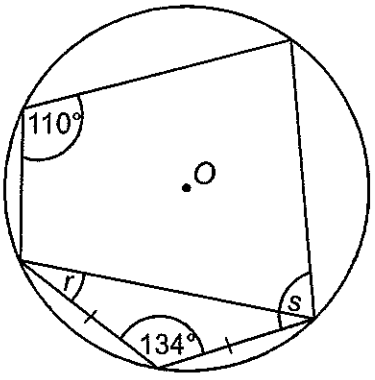
7) $k =$ ____ $l =$ ____ $m =$ ____



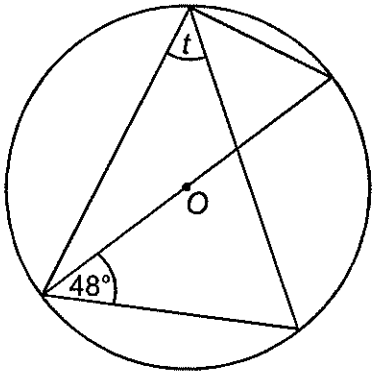
8) $n =$ ____ $p =$ ____ $q =$ ____



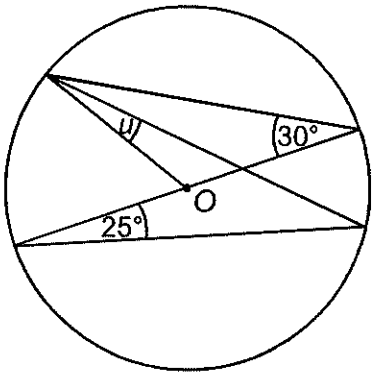
9) $r =$ ____ $s =$ ____



10) $t =$ ____

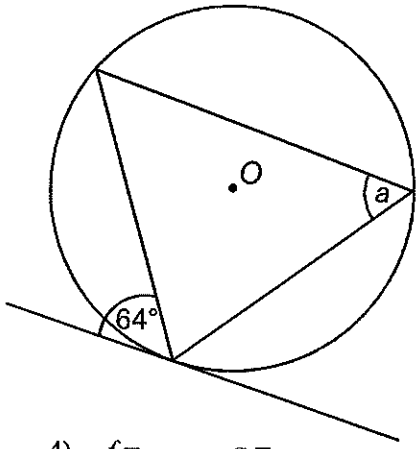


11) $u =$ ____

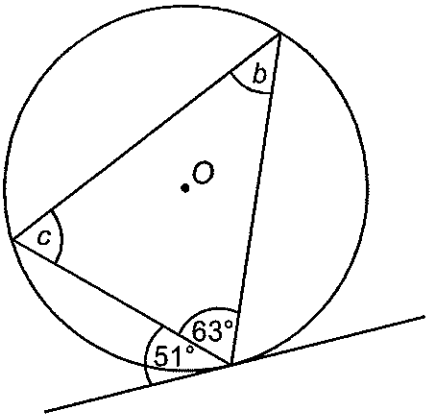


Circle Theorems

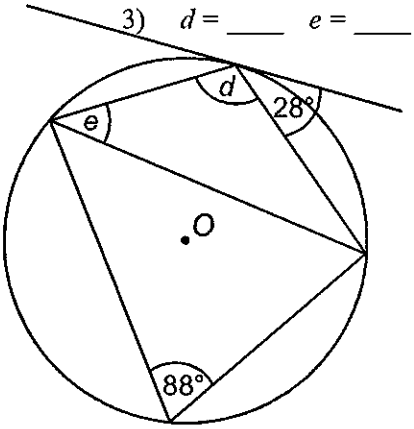
1) $a =$ ____



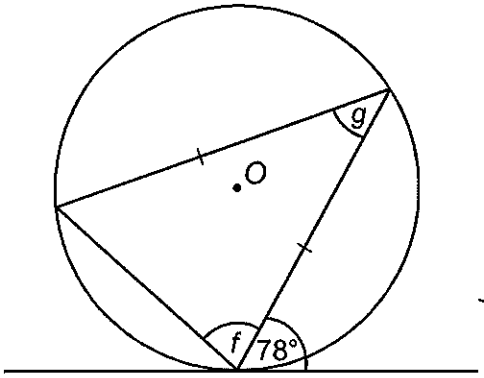
2) $b =$ ____ $c =$ ____



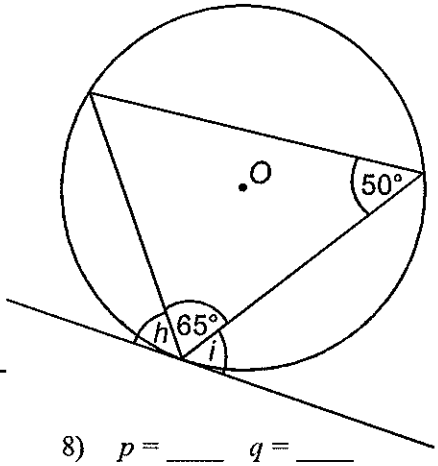
3) $d =$ ____ $e =$ ____



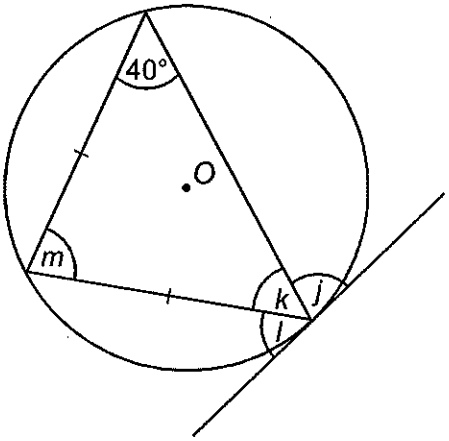
4) $f =$ ____ $g =$ ____



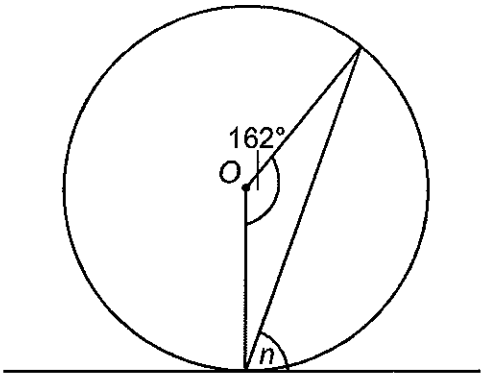
5) $h =$ ____ $i =$ ____



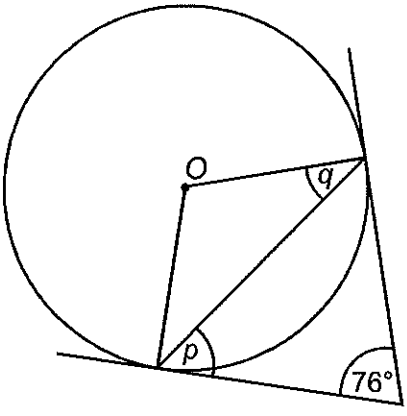
6) $j =$ ____ $k =$ ____ $l =$ ____ $m =$ ____



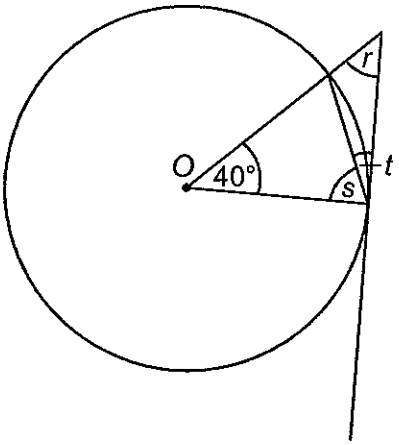
7) $n =$ ____



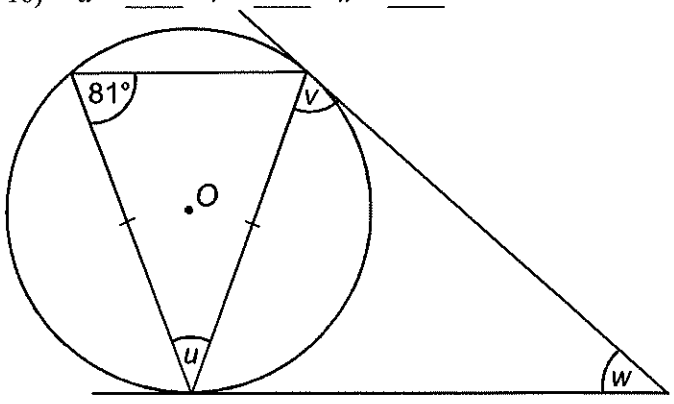
8) $p =$ ____ $q =$ ____



9) $r =$ ____ $s =$ ____ $t =$ ____



10) $u =$ ____ $v =$ ____ $w =$ ____



Fractional Indices

1) Simplify the following:

a) $y^4 \times y^5$

b) $x^2 \times x^6$

c) $(p^4)^5$

d) $(x^3)^2$

e) $(x^4)^{-2}$

f) $(x^{-3})^{-5}$

g) $x^7 \div x^2$

h) $\frac{t^5}{t^3}$

2) Work out the value of the following, leaving your answer in fraction form when necessary

a) 5^0

b) 4^{-2}

c) 5^{-3}

d) $49^{\frac{1}{2}}$

e) $8^{\frac{1}{3}}$

f) $32^{\frac{2}{5}}$

g) $16^{-\frac{1}{2}}$

h) $27^{-\frac{1}{3}}$

i) $64^{-\frac{2}{3}}$

3) $5\sqrt{5}$ can be written in the form 5^n.

Calculate the value of n.

4) $2\sqrt{8}$ can be written in the form 2^n.

Calculate the value of n.

5) $a = 2^x$, $b = 2^y$

Express in terms of a and b

(i) 2^{x+y}

(ii) 2^{2x}

(iii) 2^{x+2y}

Recurring Decimals - Proof

1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \frac{8}{11}$

2) a) Change $\frac{4}{9}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \frac{19}{33}$

3) a) Change $\frac{3}{11}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$

4) a) Change $\frac{1}{6}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{1}3\dot{5} = \frac{5}{37}$

5) a) Convert the recurring decimal $0.\dot{2}6\dot{1}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.2\dot{7} = \frac{5}{18}$

6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \frac{3}{22}$

Rearranging Difficult Formulae

1) Make c the subject of the formula.

$v = 2a + 3b + c$

2) Make t the subject of the formula.

$A = \pi t + 5t$

3) Make s the subject of the formula.

$R = 3s + \pi s + 2t$

4) $k = \dfrac{l}{m - l}$

a) Make l the subject of the formula.

b) Make m the subject of the formula.

5) $A = \dfrac{k(x+5)}{3}$

Make x the subject of the formula.

6) $R = \dfrac{u + v^2}{u + v}$

Make u the subject of the formula.

7) $\dfrac{3x+2}{5} = \dfrac{y}{10+y}$

Make y the subject of the formula.

8) $\sqrt{\dfrac{a-3}{5}} = 4b$

Rearrange this formula to give a in terms of b.

9) $S = 2\pi d\sqrt{h^2 + d^2}$

Rearrange this formula to make h the subject.

Solving Quadratics with the Formula

1) Solve the equation $x^2 + 4x + 1 = 0$
Give your answers correct to 3 decimal places.

2) Solve the equation $x^2 + 8x + 6 = 0$
Give your answers correct to 3 significant figures.

3) Solve the equation $x^2 - 3x - 2 = 0$
Give your answers correct to 3 significant figures.

4) Solve the equation $x^2 - 7x + 2 = 0$
Give your answers correct to 3 significant figures.

5) Solve the equation $2x^2 + 6x - 1 = 0$
Give your answers correct to 3 significant figures.

6) Solve the equation $3x^2 - 2x - 20 = 0$
Give your answers correct to 3 significant figures.

7) Solve the equation $x^2 - 14x - 161.25 = 0$

8) Solve the equation $17x^2 - 92x - 206 = 0$
Give your answers correct to 3 significant figures.

9) $x^2 + 10x = 300$
Find the positive value of x.
Give your answer correct to 3 significant figures.

10) $(x + 2)(x - 3) = 1$

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

b) Solve the equation $x^2 - x - 7 = 0$

Give your answers correct to 3 significant figures.

Algebraic Proof

1) Show algebraically that the sum of two consecutive numbers is always odd.

2) Show algebraically that the product of two even numbers is always a multiple of four.

3) Show algebraically that the square of an odd number is always odd.

4) Prove, using algebra, that the difference between the squares of any two consecutive even numbers is always a multiple of four.

5) n is an integer.

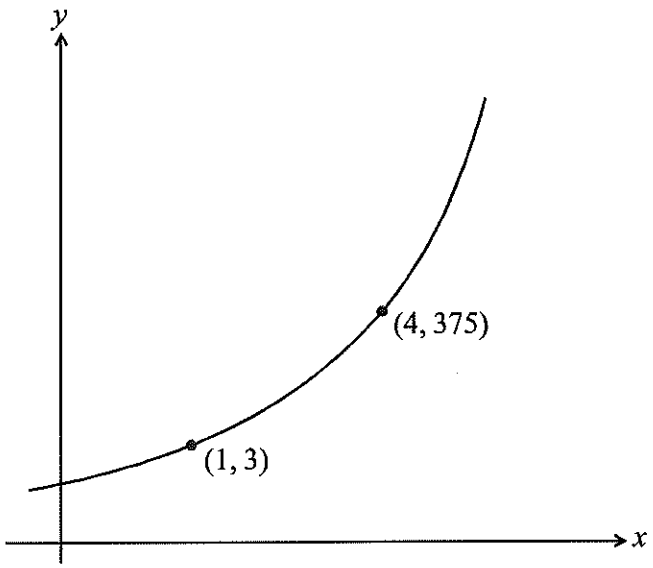
Prove that $(2n + 1)(n + 3) + (2n + 1)(n - 2)$ is not a multiple of 2.

6) Prove that $(4n + 1)^2 - (4n - 1)^2$ is a multiple of eight for all positive integer values of n.

7) Prove algebraically that the sum of the squares of any three consecutive even numbers is always a multiple of 4.

Exponential Functions

1)



The sketch-graph shows a curve with equation $y = pq^x$.

The curve passes through the points (1, 3) and (4, 375).

Calculate the value of p and the value of q.

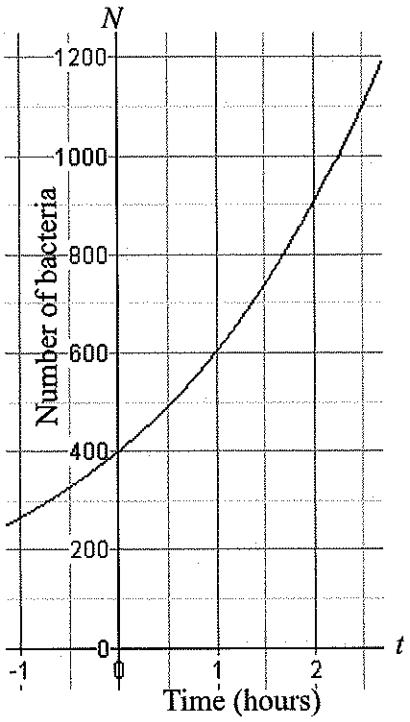
2) The graph shows the number of bacteria living in a petri dish.

The number N of bacteria at time t is given by the relation:

$N = a \times b^t$

The curve passes through the point (0, 400).

a) Use this information to show that $a = 400$.



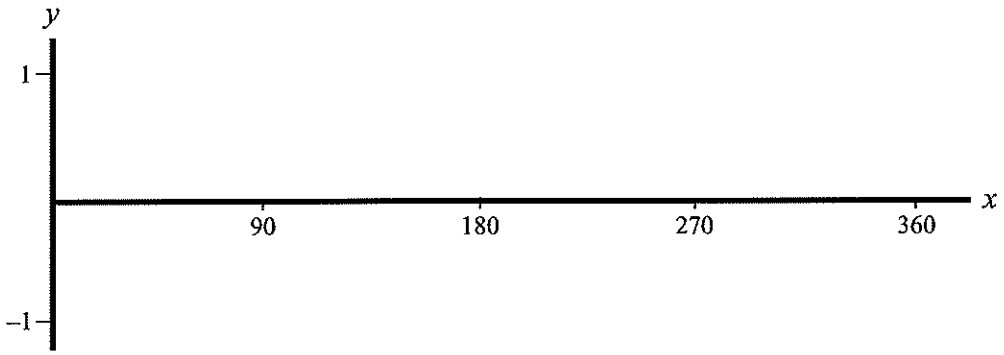
The curve also passes through (2, 900).

b) Use this information to find the value of b.

c) Work out the number of bacteria in the dish at time $t = 3$.

Trigonometric Graphs

1) On the axes below below, draw a sketch-graph to show $y = \sin x$

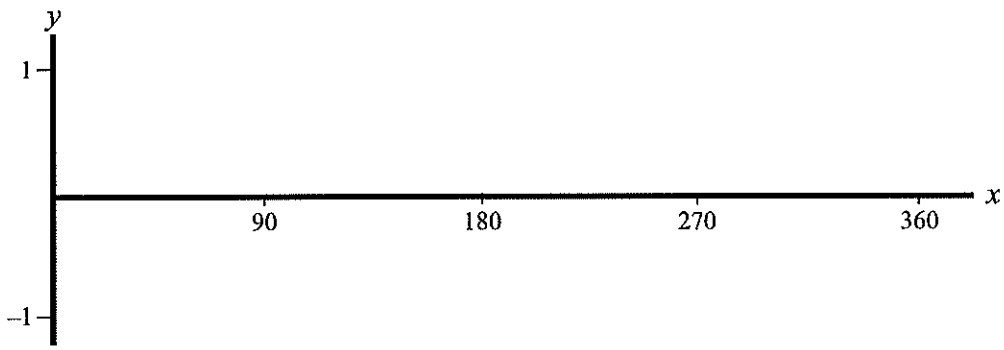


Given that $\sin 30° = 0.5$, write down the value of:

(i) $\sin 150°$

(ii) $\sin 330°$

2) On the axes below, draw a sketch-graph to show $y = \cos x$



Given that $\cos 60° = 0.5$, write down the value of:

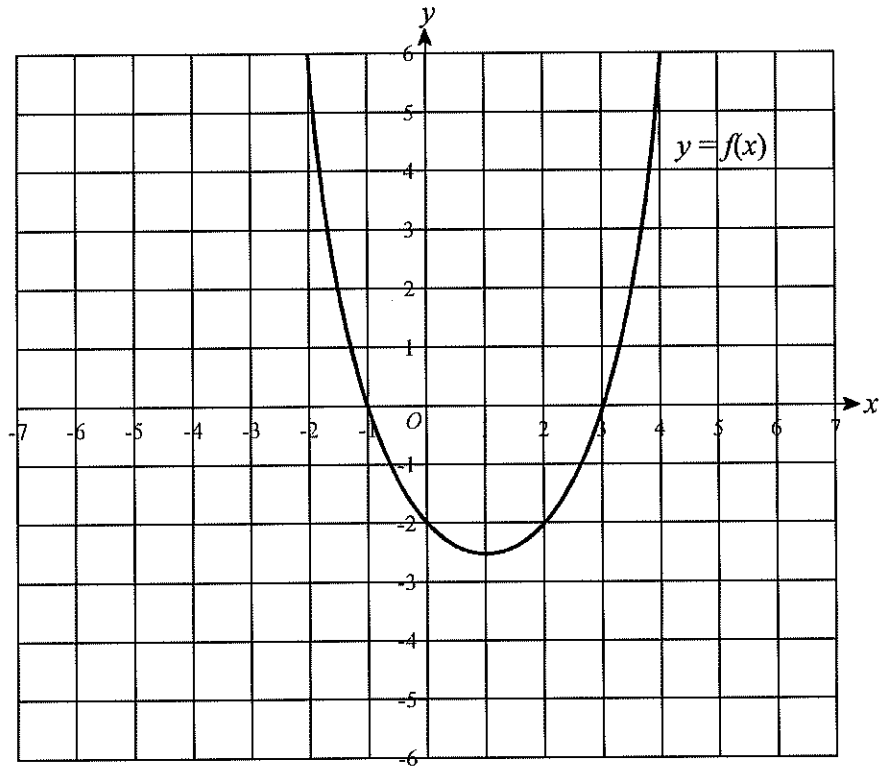
(i) $\cos 120°$

(ii) $\cos 240°$

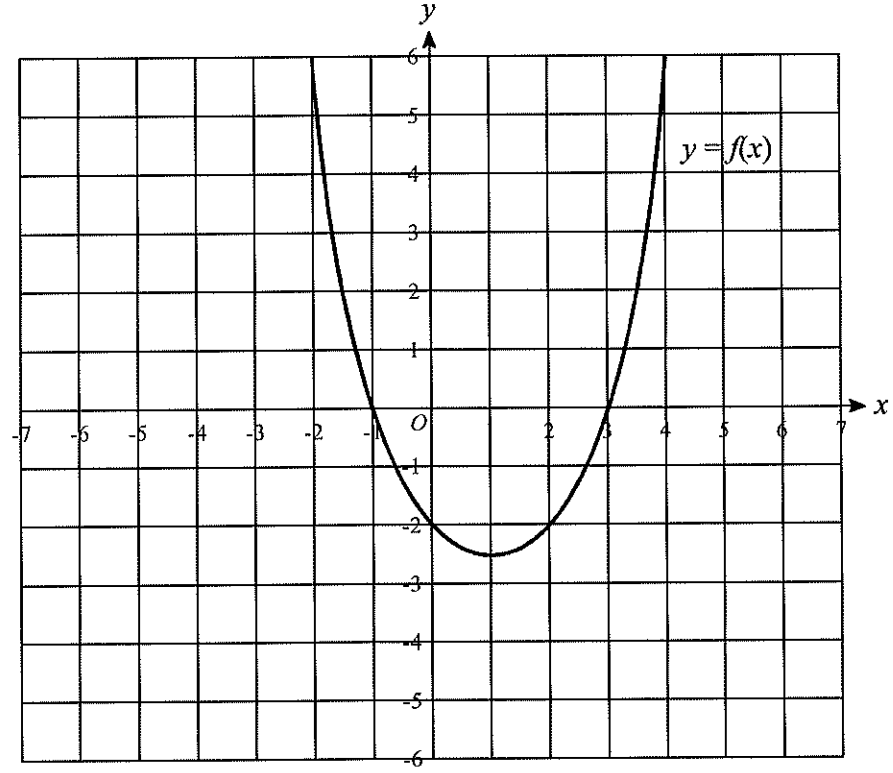
Transformation of Functions

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

a) On this grid, sketch the graph of $y = f(x-3)$

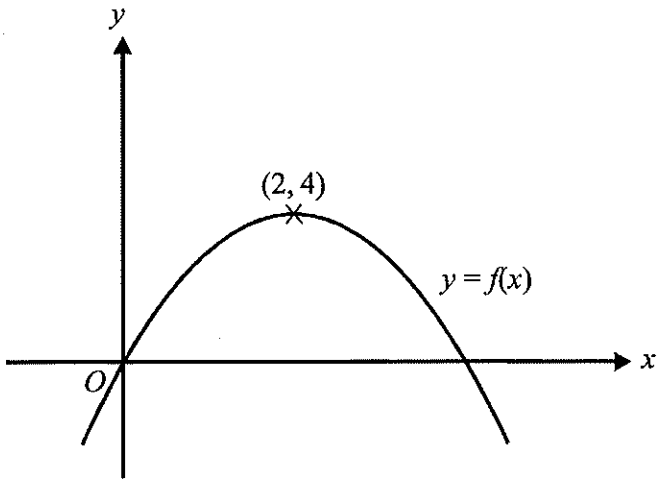


b) On this grid sketch the graph of $y = -f(x)$



Transformation of Functions

1)

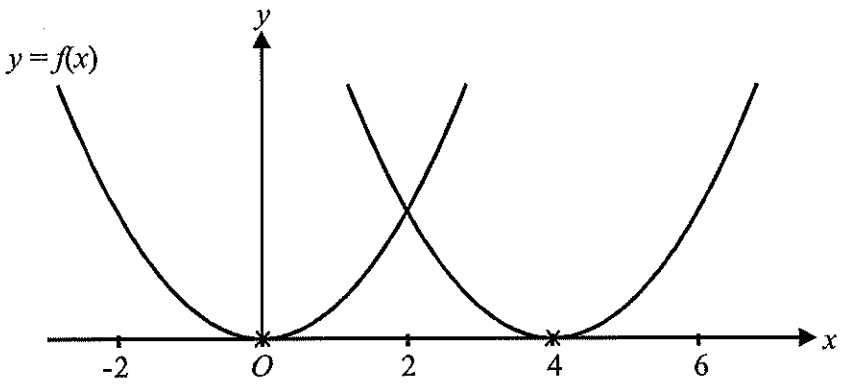


The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the maximum point of this curve are (2, 4).

Write down the coordinates of the maximum point of the curve with equation

$y = f(x - 2)$

2)

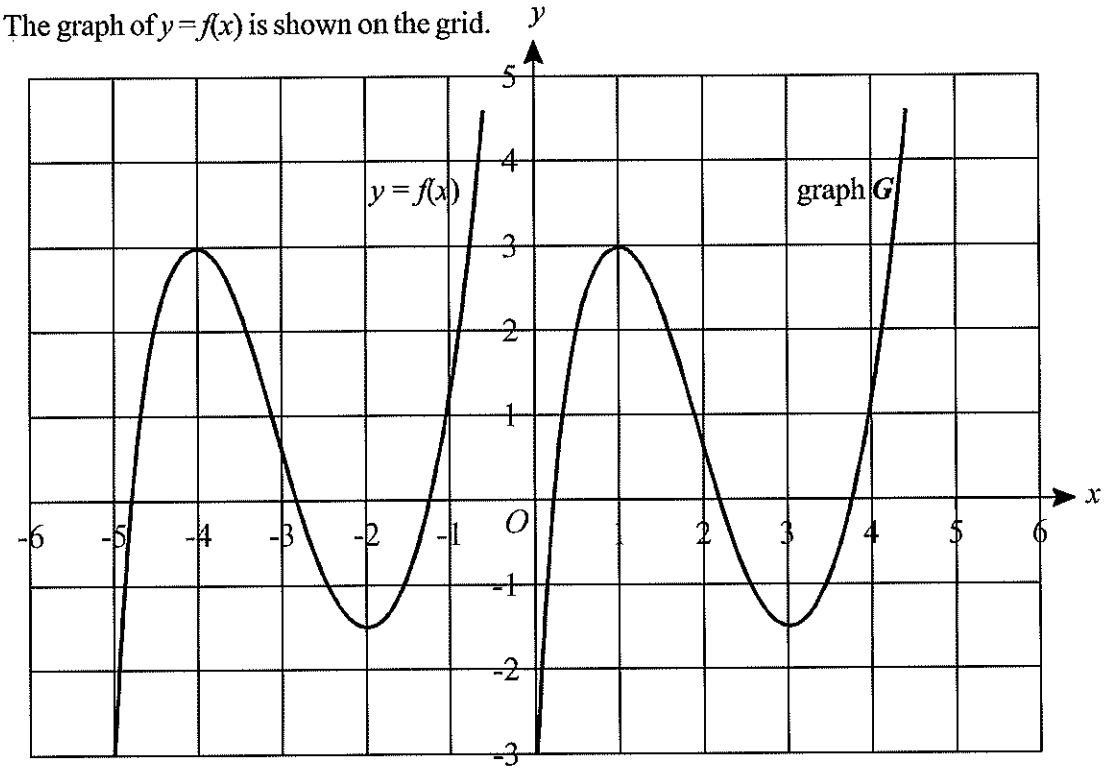


The curve with equation $y = f(x)$ is translated so that the point at (0, 0) is mapped onto the point (4, 0).

Find the equation of the translated curve.

Transformation of Functions

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



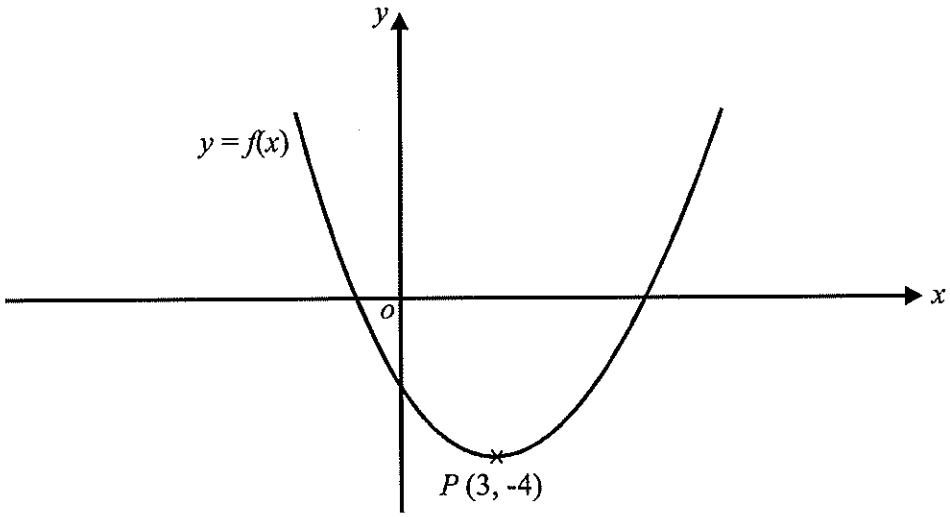
The graph ***G*** is a translation of the graph of $y = f(x)$.

a) Write down, in terms of f, the equation of graph ***G***.

The graph of $y = f(x)$ has a maximum point at (-4, 3).

b) Write down the coordinates of the maximum point of the graph $y = f(-x)$.

2) This is a sketch of the curve with the equation $y = f(x)$.
The only minimum point of the curve is at P (3, -4).

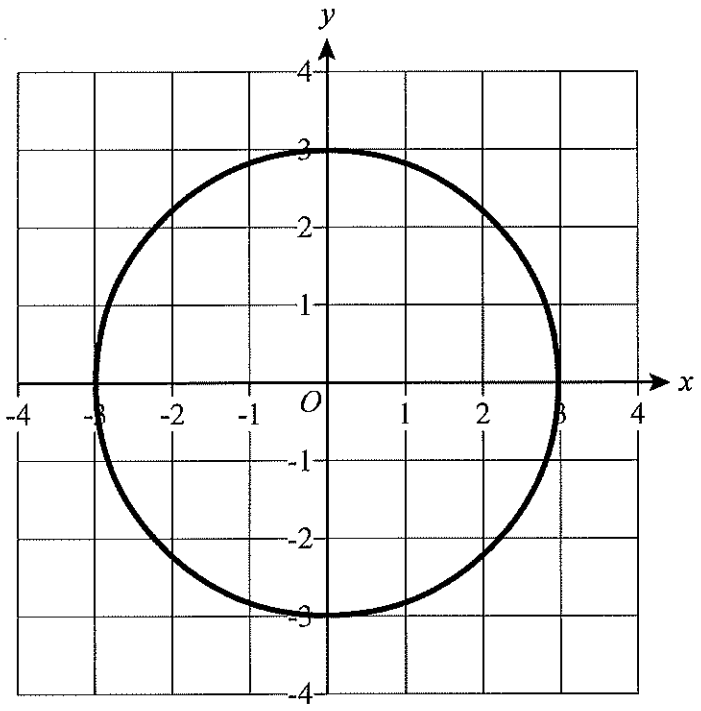


a) Write down the coordinates of the minimum point of the curve with the equation $y = f(x - 2)$

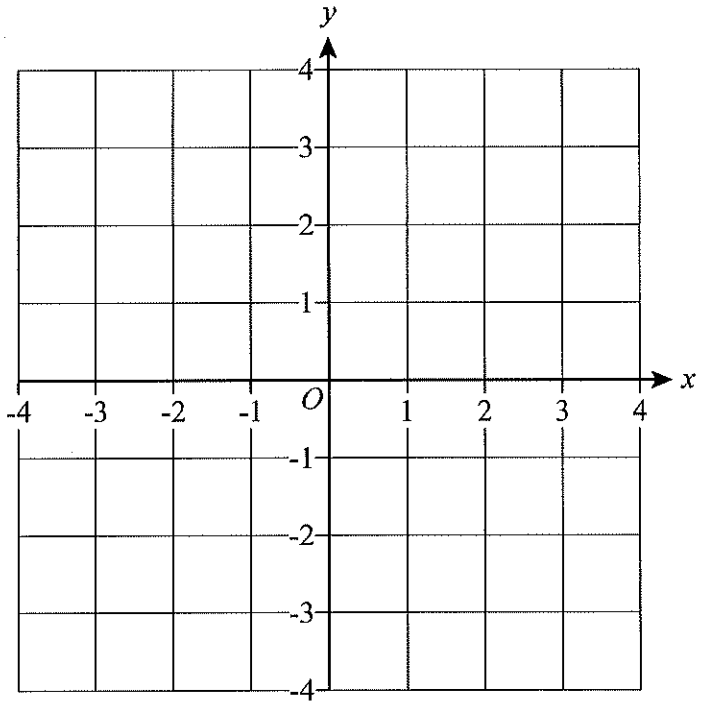
b) Write down the coordinates of the minimum point of the curve with the equation $y = f(x + 5) + 6$

Equation of a Circle

1) Find the equation of a circle with radius 3 and centre the origin.



2) a) Draw the graph of $x^2 + y^2 = 6.25$



b) By drawing the line $x + y = 1.5$, solve the equations

$x^2 + y^2 = 6.25$

$x + y = 1.5$

Direct and Inverse Proportion

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x.

b) Calculate the value of y when $x = 350$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V.

b) Calculate the value of P when $V = 2$

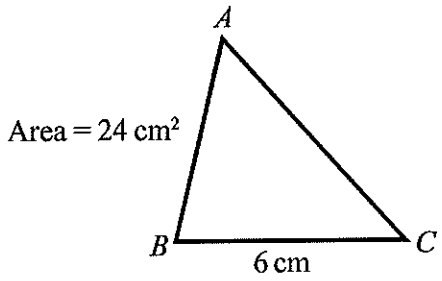
5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m^2, of the sphere.

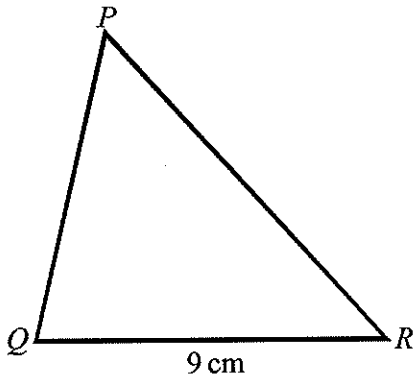
When $A = 100$, $T = 30$.

Find the value of T when $A = 60$.
Give your answer correct to 3 significant figures.

Similarity - Area and Volume

1) Triangle ABC is similar to triangle PQR.

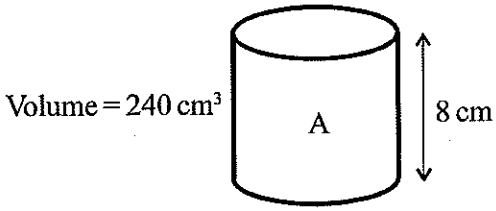


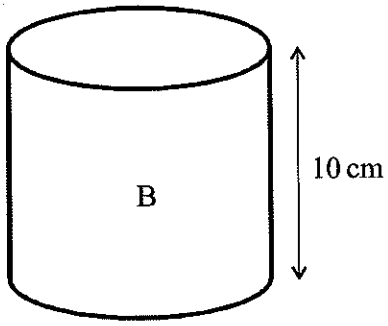


The area of triangle ABC is 24 cm^2.

Calculate the area of triangle PQR.

2) Cylinder A is mathematically similar to cylinder B.





The volume of cylinder A is 240 cm^3

Calculate the volume of cylinder B.

3) P and Q are two geometrically similar solid shapes.

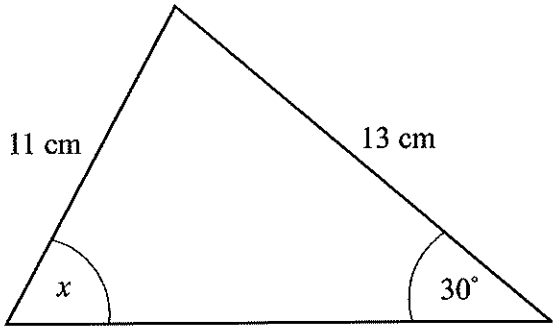
The total surface area of shape P is 540 cm^2.
The total surface area of shape Q is 2160 cm^2.

The volume of shape P is 2700 cm^3.

Calculate the volume of shape Q.

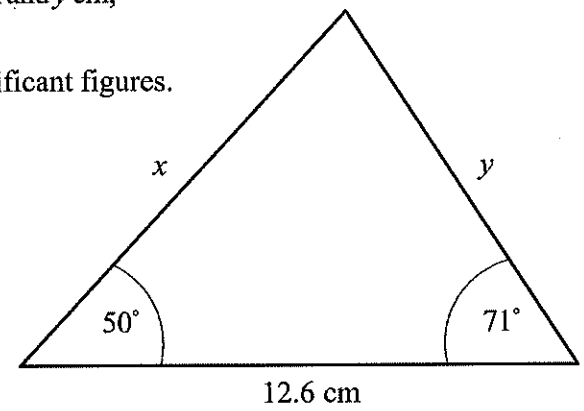
The Sine Rule

1) Work out the size of the angle marked x.
Give your answer correct to one decimal place.



2) Find the missing lengths, x cm and y cm, in this triangle.

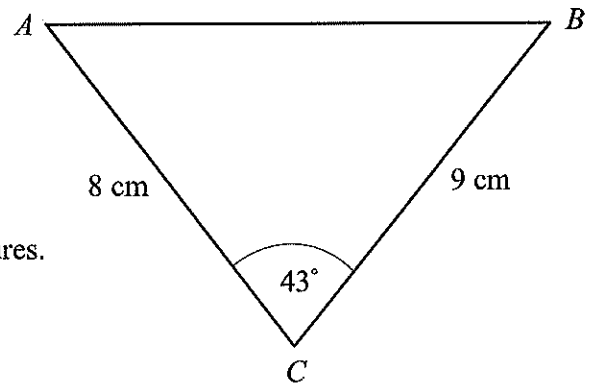
Give your answers to 3 significant figures.



The Cosine Rule

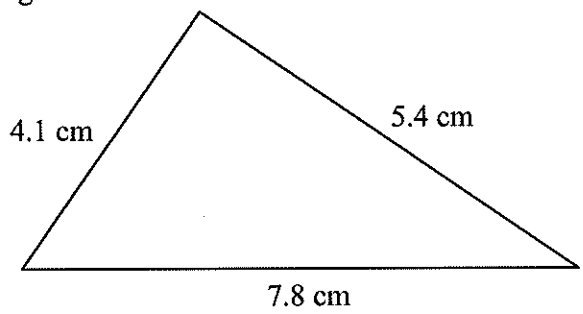
1) ABC is a triangle.
$AC = 8$ cm
$BC = 9$ cm
Angle $ACB = 43°$

Calculate the length of AB.
Give your answer correct to 3 significant figures.

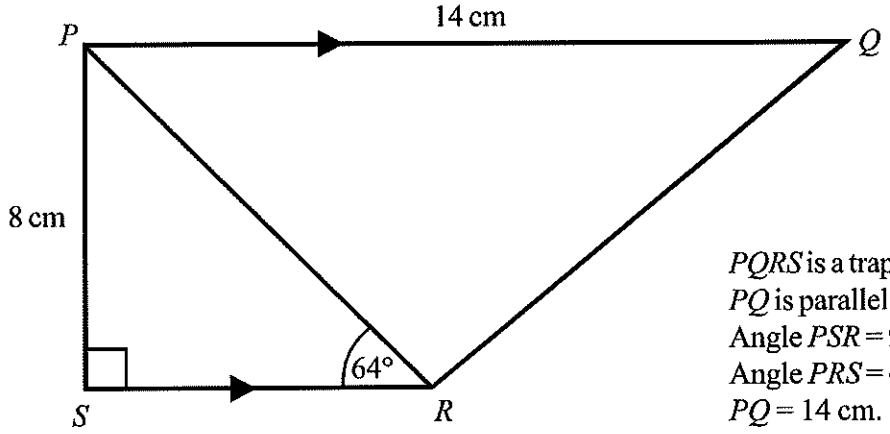


2) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

Calculate the size of the largest angle of the triangle.
Give your answer correct to 1 decimal place.



3)



$PQRS$ is a trapezium.
PQ is parallel to SR.
Angle $PSR = 90°$
Angle $PRS = 64°$
$PQ = 14$ cm.
$PS = 8$ cm.

a) Work out the length of PR.
Give your answer correct to 3 significant figures.

b) Work out the length of QR.
Give your answer correct to 3 significant figures.

Area of a Triangle Using Sine

1)

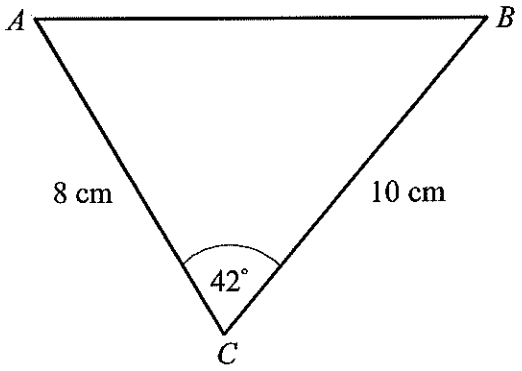


Diagram **NOT** accurately drawn.

ABC is a triangle.
$AC = 8$ cm.
$BC = 10$ cm
Angle $ACB = 42°$

Calculate the area of triangle ABC.
Give your answer correct to 3 significant figures.

2)

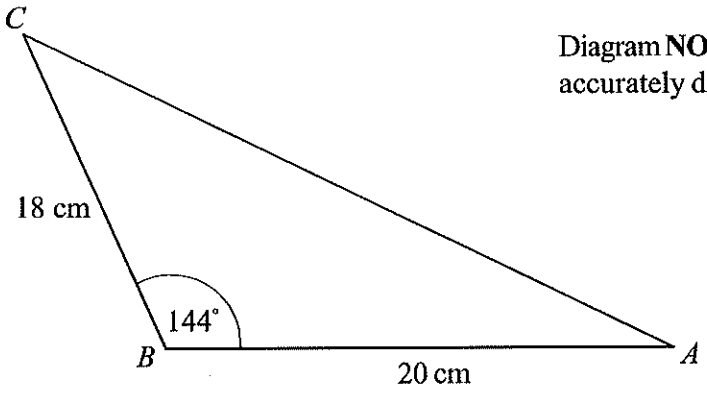


Diagram **NOT** accurately drawn.

ABC is a triangle.
$AB = 20$ cm.
$BC = 18$ cm
Angle $ABC = 144°$

Calculate the area of triangle ABC.
Give your answer correct to 3 significant figures.

3)

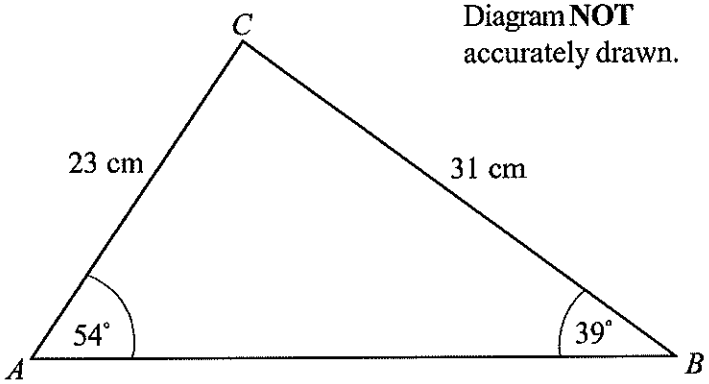


Diagram **NOT** accurately drawn.

ABC is a triangle.
$AC = 23$ cm.
$BC = 31$ cm
Angle $BAC = 54°$
Angle $ABC = 39°$

Calculate the area of triangle ABC.
Give your answer correct to 3 significant figures.

And and Or Probability Questions

1) Jordan designs a game for a school fair.
He has two 8-sided spinners.
The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour.

2) The probability that it will snow in Paris on Christmas day is 0.06.

a) Work out the probability that it will snow in Paris on **both** Christmas day 2015 **and** Christmas day 2016.

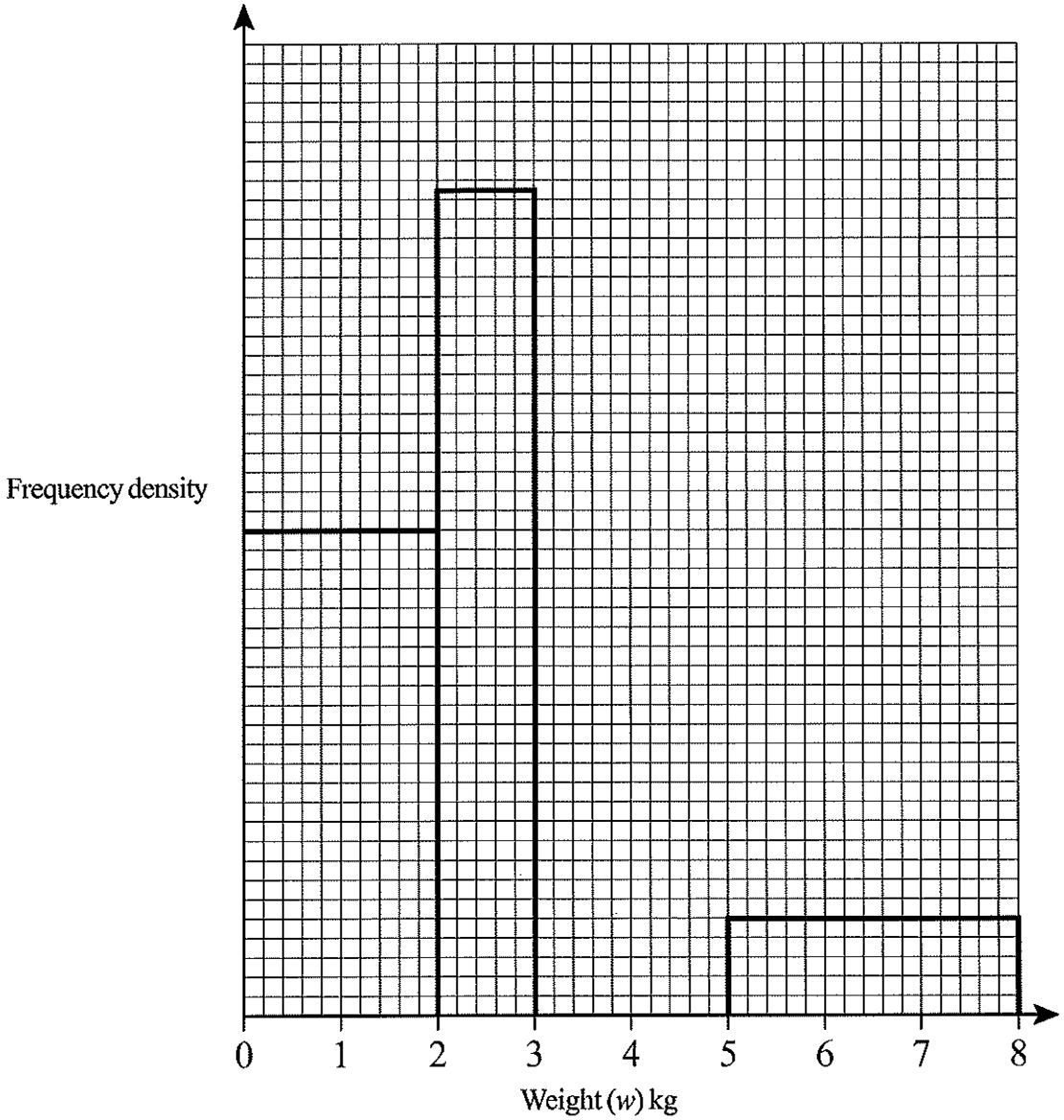
b) Work out the probability that it will snow in Paris on **either** Christmas Day 2015 **or** Christmas Day 2016, but **not** on both.

3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
Natalie takes a bead at random from the bag, records its colour and replaces it.
She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are the same colour.

Histograms

The table and histogram give some information about the weights of parcels received at a post office during one Thursday.



a) Use the histogram to complete the frequency table.

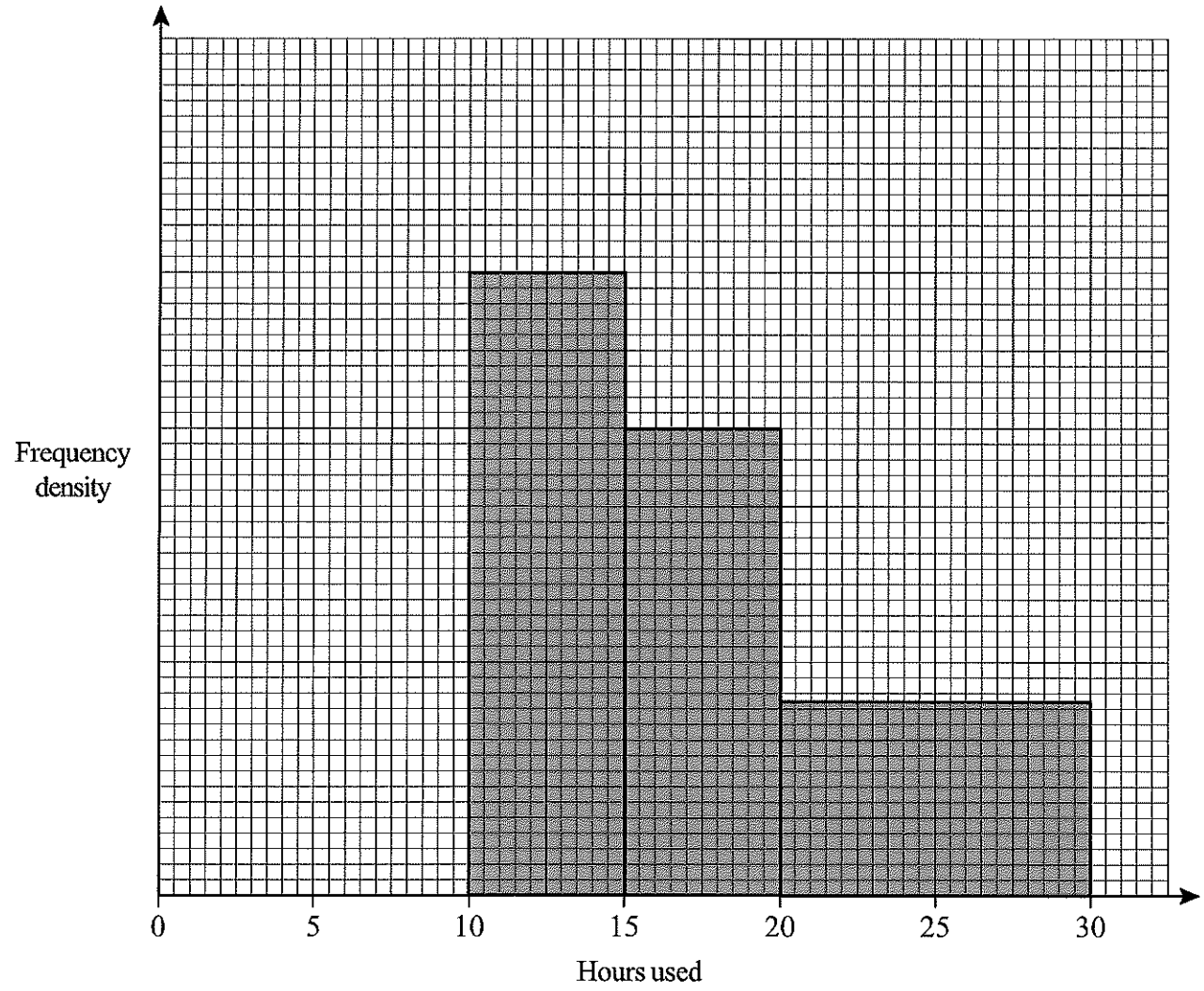
Weight (w) kg	Frequency
$0 < w \leqslant 2$	40
$2 < w \leqslant 3$	
$3 < w \leqslant 4$	24
$4 < w \leqslant 5$	18
$5 < w \leqslant 8$	

b) Use the table to complete the histogram.

Histograms

Paul asked the students in his class how many hours they used the internet for last week.

The incomplete histogram was drawn using his results.



Eight students used the internet for between 10 and 15 hours.
Six students used it for between 0 and 10 hours.

a) Use this information to complete the histogram.

No students used the internet for more than 30 hours.

b) Work out how many students Paul asked.

Finding the *n*th Term of a Quadratic

1) Find a formula for the *n*th term of this quadratic sequence:

3, 8, 15, 24, . . .

2) Find a formula for the *n*th term of this quadratic sequence:

3, 5, 9, 15, . . .

3) Find a formula for the *n*th term of this quadratic sequence:

3, 7, 13, 21, . . .

4) Find a formula for the *n*th term of this quadratic sequence:

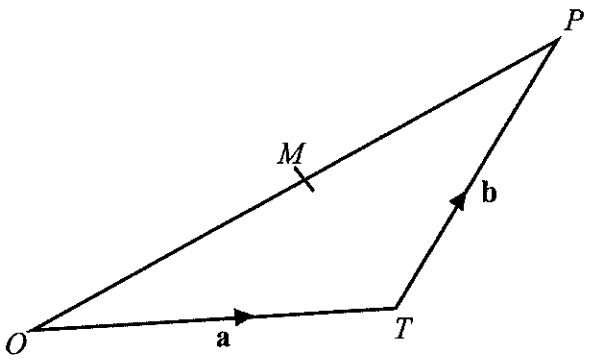
1, 4, 11, 22, . . .

5) Find a formula for the *n*th term of this quadratic sequence:

2, 7, 18, 35, . . .

Vectors

1)



OPT is a triangle.
M is the midpoint of OP.

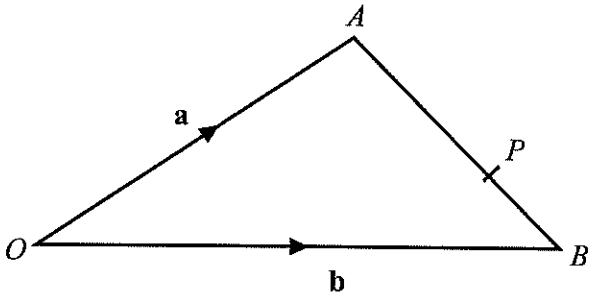
$\overrightarrow{OT} = \mathbf{a}$

$\overrightarrow{TP} = \mathbf{b}$

a) Express $\overrightarrow{OM}$ in terms of **a** and **b**.

b) Express $\overrightarrow{TM}$ in terms of **a** and **b**.
Give your answer in its simplest form.

2)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

a) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**.

P is the point on AB so that $AP : PB = 2 : 1$

b) Find the vector $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.