Block Test 3 Revision

(*questions are non-calculator)

Algebraic Expressions

A1

1.* Multiply out the brackets and simplify:

(a) $(x-2)(x^2+4x+1)$ (b) $2x(x-3)^2$ (c) $(3x+2)^2-9(x^2-1)$

A2

1.* Factorise fully:

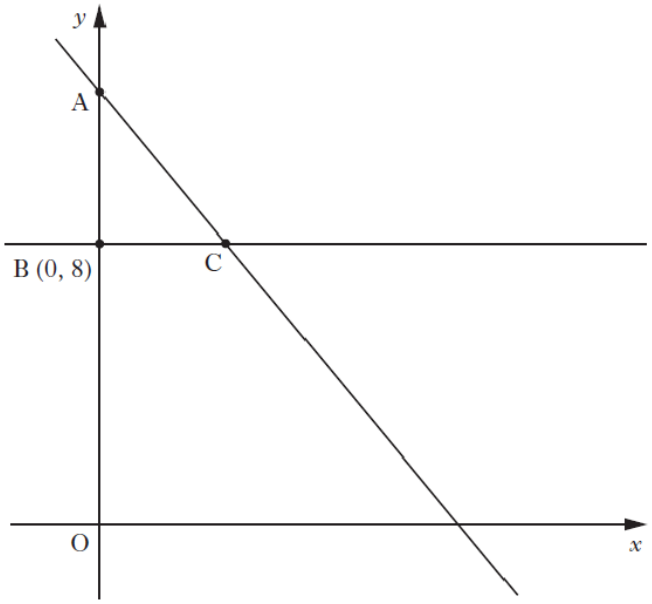
(a) $6pqr-15qs$ (b) t^2-36 (c) $p^2-2p-15$

(d) $3x^2-13x-10$ (e) $4x^2-20x+9$ (f) $3k^2-75$

(g) x^2-9x^4 (h) $4k^2-12k-40$ (i) x^3+7x^2-12x

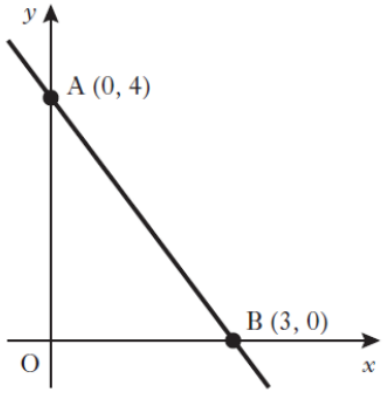
Straight Line

2.* The straight line with equation $4x + 3y = 36$ cuts the y-axis at A.



A6

1.* Find the equation of the straight line AB.

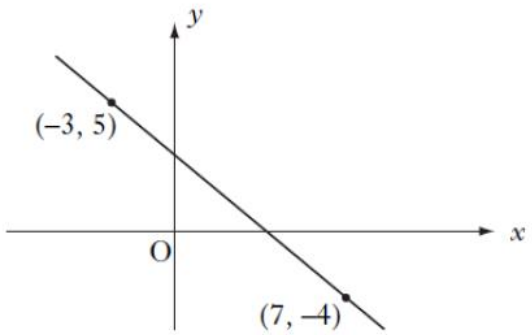


(*a*) Find the coordinates of A.

This line meets the line through B (0, 8), parallel to the x-axis, at C as shown above.

(*b*) Find the coordinates of C.

3.*



Calculate the gradient of the straight line passing through the points (–3, 5) and (7, –4).

Equations/Inqualities

A7

1.* Solve the following equations/inequations:

(a) $20-2(3x+8)=8-5x$

(b) $2-(6-4x)\leq 15-9(2x+7)$

(c) $2(1-5p)-12=10-6p$

(d) $5(2-x)-3(2-3x)\geq 2+3x$

(e) $13-4x<18-7(2-x)$

(f) $15-(3-6x)<9x+10$

(g) $\frac{1}{5}(4x+3)+\frac{1}{3}(2x+3)=6$

(h) $\frac{x+5}{3}=3+\frac{3x-2}{4}$

Simultaneous Equations

A8

1.* Solve algebraically the system of equations

$$2x - y = 10$$
$$4x + 5y = 6.$$

2. Solve algebraically the system of equations

$$2x - 5y = 24$$
$$7x + 8y = 33.$$

3. Three groups are booking a holiday. The first group consists of 6 adults and 2 children. The total cost of their holiday is £3148.

Let x pounds be the cost for an adult and y pounds be the cost for a child.

(*a*) Write down an equation in x and y which satisfies the above information.

The second group books the same holiday for 5 adults and 3 children. The total cost of their holiday is £3022.

(*b*) Write down a second equation in x and y which satisfies this information.

(*c*) The third group books the same holiday for 2 adults and 4 children. The travel agent calculates that the total cost is £2056.

Has this group been overcharged?

Justify your answer.

4. Alan is taking part in a quiz. He is awarded x points for each correct answer and y points for each wrong answer. During the quiz, Alan gets 24 questions correct and 6 wrong. He scores 60 points.

(*a*) Write down an equation in x and y which satisfies the above condition.

Helen also takes part in the quiz. She gets 20 questions correct and 10 wrong. She scores 40 points.

(*b*) Write down a second equation in x and y which satisfies this condition.

(*c*) Calculate the score for David who gets 17 correct and 13 wrong.

Change the Subject

A9

1.* Change the subject of the formula

$$a = 3b^2 + c$$

to b.

2.* A formula used to calculate lighting efficiency is

$$E = \frac{I}{D^2}.$$

Change the subject of this formula to D.

3.* Change the subject of the formula

$$P = 2(L + B)$$

to L.

4.* Change the subject of the formula

$$A = \frac{1}{2}h(a + b)$$

to h.

5.* Change the subject of the formula

$$p = q + \sqrt{a}$$

to a.

6.* Change the subject of the formula

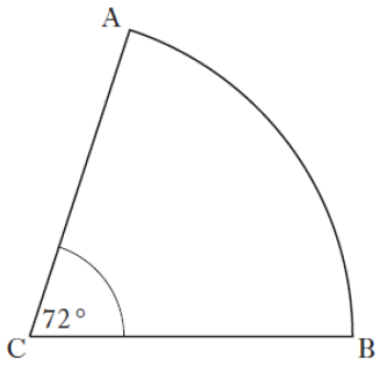
$$K = \frac{m^2 n}{p}$$

to m.

Arcs and Sectors

G2

1.* The diagram below shows a sector of a circle, centre C.

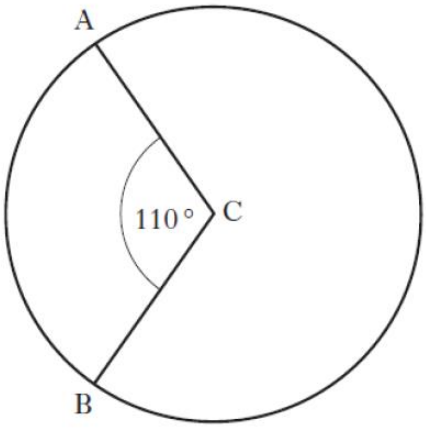


The radius of the circle is 5 centimetres and angle ACB is 72°.

Calculate the length of arc AB.

Take $\pi = 3{\cdot}14$.

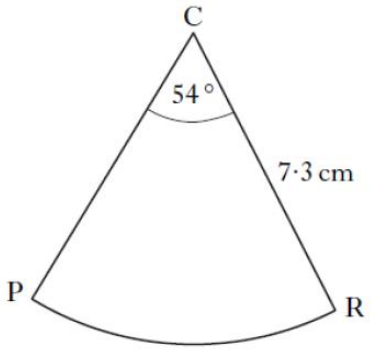
2. The diagram below shows a circle, centre C.



The circumference of the circle is 40·8 centimetres.

Calculate the length of the minor arc AB.

3. The diagram below shows a sector of a circle, centre C.



The radius of the circle is 7·3 centimetres and angle PCR is 54°.

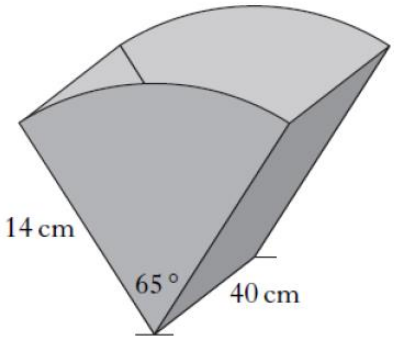
Calculate the area of the sector PCR.

4. The ends of a magazine rack are identical.

Each end is a sector of a circle with radius 14 centimetres.
The angle in each sector is 65°.

The sectors are joined by two rectangles, each with length 40 centimetres.

The exterior is covered by material.
What area of material is required?



Volume

G3

1. The Battle of Largs in 1263 is commemorated by a monument known as The Pencil.

This monument is in the shape of a cylinder with a cone on top.

The cylinder part has diameter 3 metres and height 15 metres.

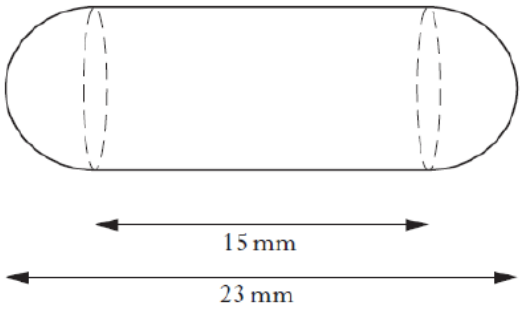
(*a*) Calculate the volume of the **cylinder** part of The Pencil.

The volume of the **cone** part of The Pencil is 5·7 cubic metres.

(*b*) Calculate the **total** height of The Pencil.

2. A health food shop produces cod liver oil capsules for its customers.

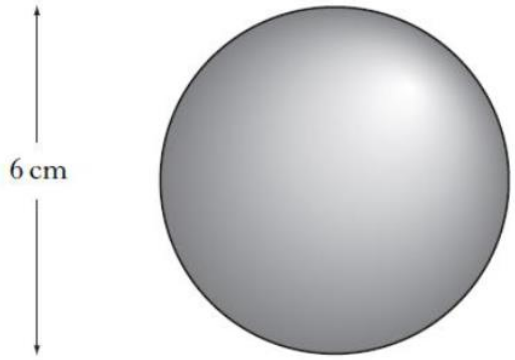
Each capsule is in the shape of a cylinder with hemispherical ends as shown in the diagram below.



The total length of the capsule is 23 millimetres and the length of the cylinder is 15 millimetres.

Calculate the volume of one cod liver oil capsule.

3.* The diagram below represents a sphere.



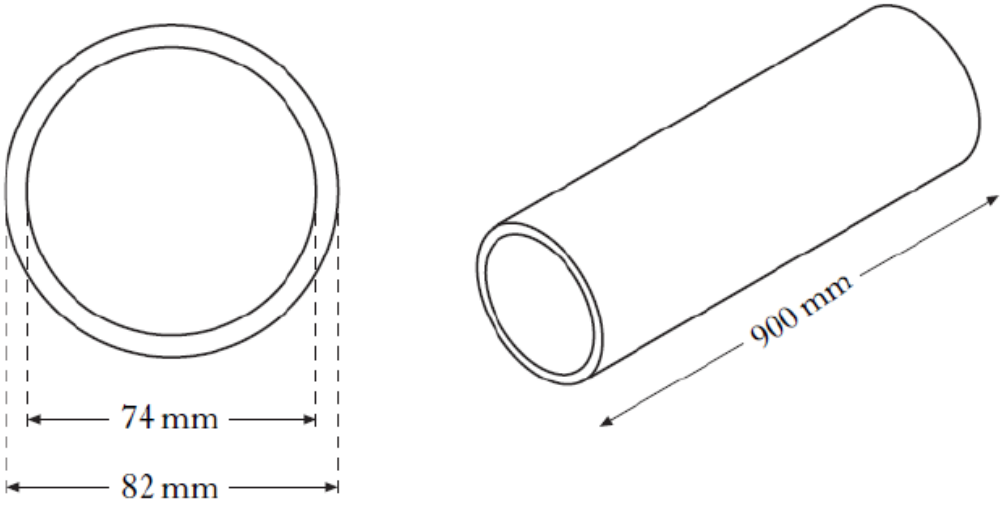
The sphere has a diameter of 6 centimetres.

Calculate its volume.

Take $\pi = 3{\cdot}14$.

4. A company manufactures aluminium tubes.

The cross-section of one of the tubes is shown in the diagram below.



The inner diameter is 74 millimetres.

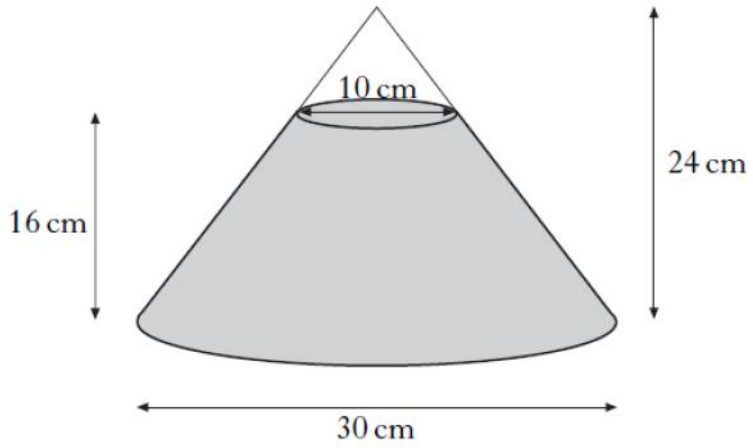
The outer diameter is 82 millimetres.

The tube is 900 millimetres long.

Calculate the volume of aluminium used to make the tube.

Give your answer correct to three significant figures.

5. A glass ornament in the shape of a cone is partly filled with coloured water.



The cone is 24 centimetres high and has a base of diameter 30 centimetres.

The water is 16 centimetres deep and measures 10 centimetres across the top.

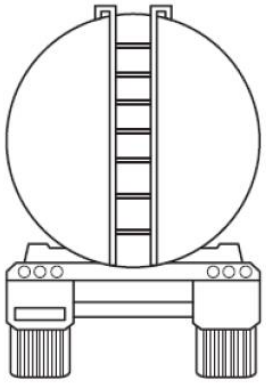
What is the volume of the water?

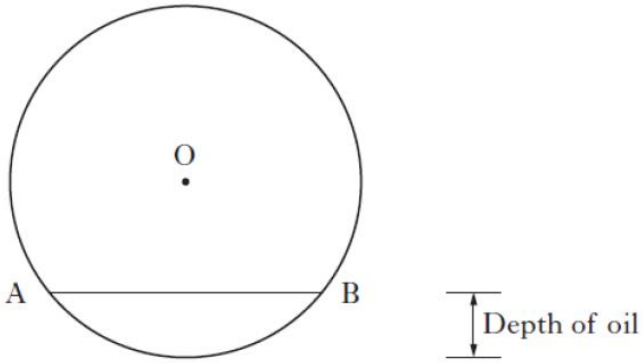
Give your answer correct to 2 significant figures.

Properties of Shapes

3. A tanker delivers oil to garages.

The tank has a circular cross-section as shown in the diagram below.



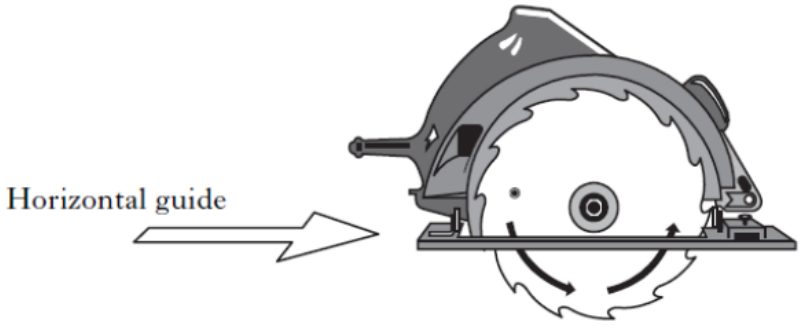


The radius of the circle, centre O, is 1·9 metres.

The width of the surface of the oil, represented by AB in the diagram, is 2·2 metres.

Calculate the depth of the oil in the tanker.

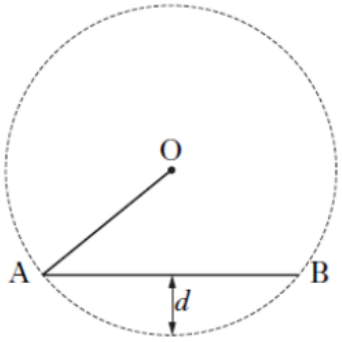
4. A circular saw can be adjusted to change the depth of blade that is exposed below the horizontal guide.



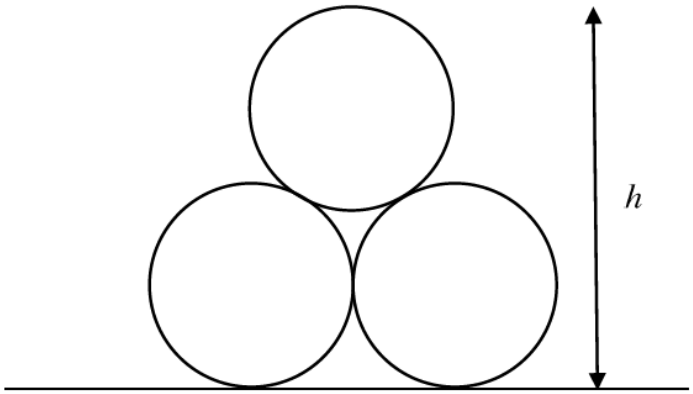
The circle, centre O, below represents the blade and the line AB represents part of the horizontal guide.

This blade has a radius of 110 millimetres.

If AB has length 140 millimetres, calculate the depth, d millimetres, of saw exposed.

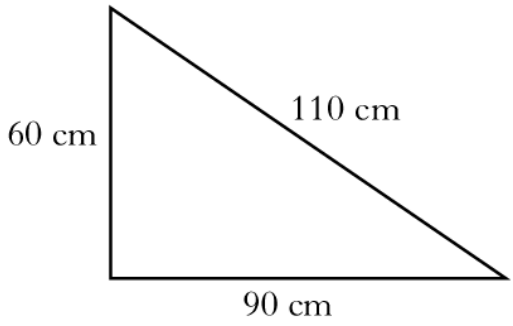


5. Three pipes are stored on horizontal ground as shown in the diagram.



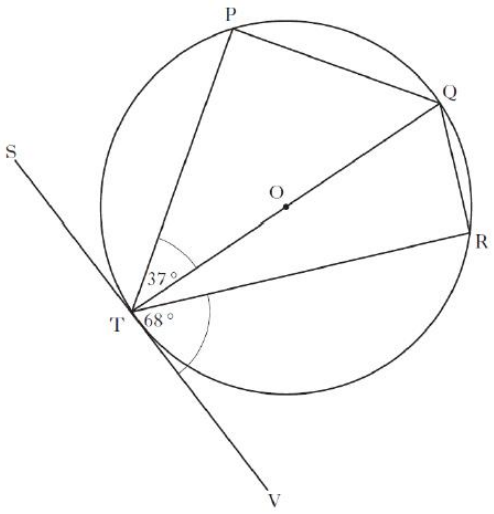
Each pipe has a circular cross-section of radius 1 metre.
Calculate the height, h, of the stacked pipes, giving your answer to **2 significant figures.**
[You may ignore the thickness of the pipes]

6. A triangular paving slab has dimensions as shown.

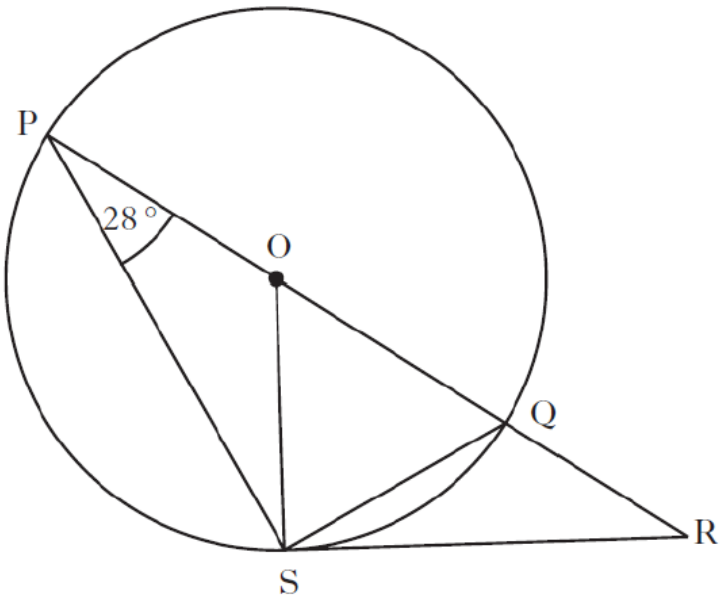


Is the paving slab in the shape of a right-angled triangle? **Explain your answer**.

7.* The tangent SV touches the circle, centre O, at T.
Angle PTQ is 37 ° and angle VTR is 68 °.
Calculate the size of angle PQR.



8.*

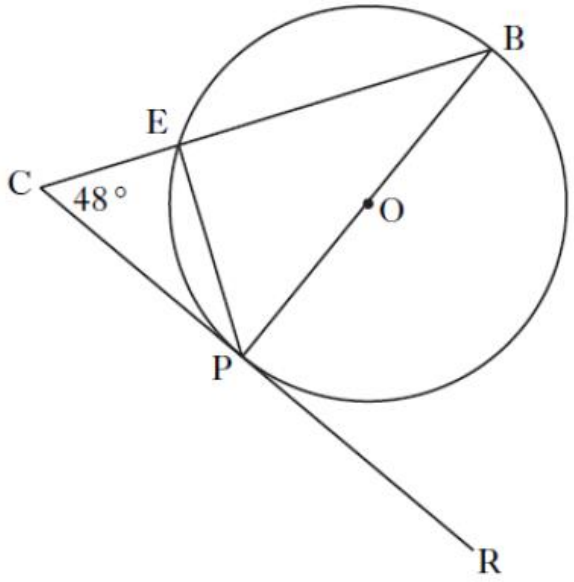


In the above diagram,

- O is the centre of the circle
- PQ is a diameter of the circle
- PQR is a straight line
- RS is a tangent to the circle at S
- angle OPS is 28 °.

Calculate the size of angle QRS.

9.* A circle, centre O, is shown below.



In the circle

- PB is a diameter
- CR is a tangent to the circle at point P
- Angle BCP is 48°.

Calculate the size of angle EPR.

Vectors

G7 – G9

1.* $\mathbf{p} = \begin{pmatrix} -2 \\ 1 \\ -1 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} -3 \\ -2 \\ 4 \end{pmatrix}$.

Calculate:

(a) $3\mathbf{p} - 2\mathbf{q}$

(b) $|\mathbf{p}|$

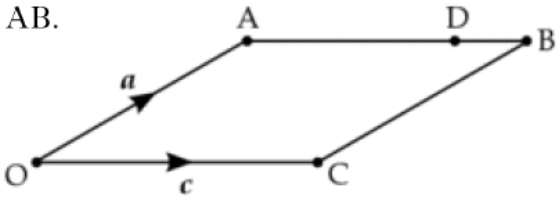
(c) $|\mathbf{p} + \mathbf{q}|$

2.* OABC is a parallelogram.

The sides OA and OC are represented by vectors **a** and **b** respectively.

D lies three-quarters of the way along AB.

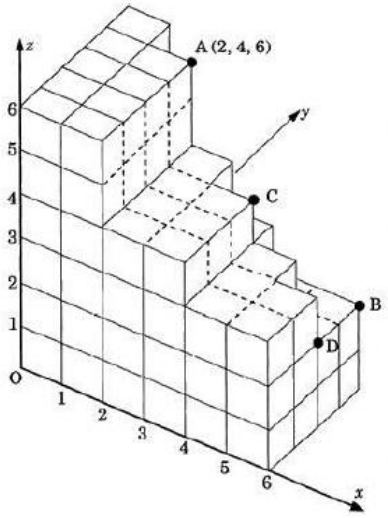
Express OD in terms of **a** and **b.**



3.* Relative to coordinates axes, the point A has coordinates (2, 4, 6).

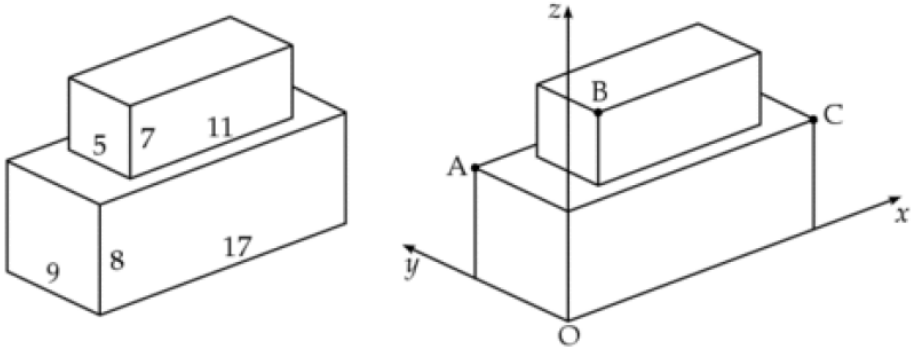
(a) Find the coordinates of C and D.

(b) Write down the coordinates of B.



4.* A cuboid measuring 11 cm by 5 cm by 7 cm is placed centrally on top of another cuboid measuring 17 cm by 9 cm by 8 cm.

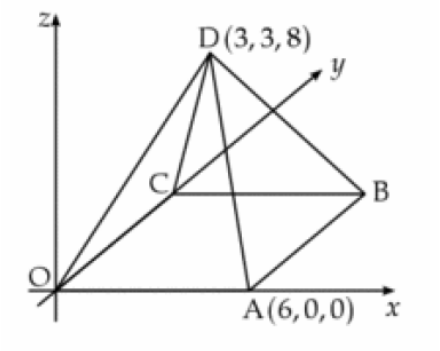
Coordinates axes are taken as shown.



The point A has coordinates $(0, 9, 8)$ and C has coordinates $(17, 0, 8)$.
Write down the coordinates of B.

5.* The diagram shows a square-based pyramid of height 8 units.

Square OABC has a side length of 6 units. The coordinates of A and D are (6, 0, 0) and (3, 3, 8)



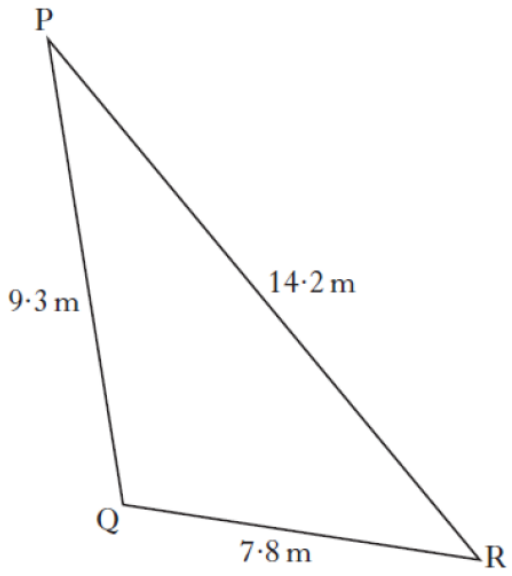
(a) Write down the coordinates of B

(b) M is the midpoint of AD. Write down the coordinates of M.

Trig Triangles

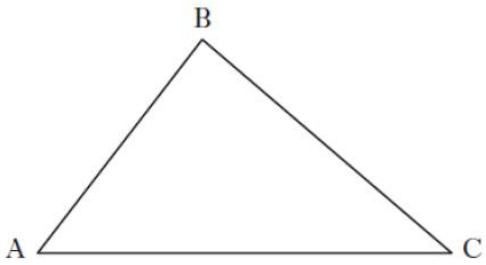
T3 – T5

1. Triangle PQR is shown below.



Calculate the size of angle QPR.

2.*

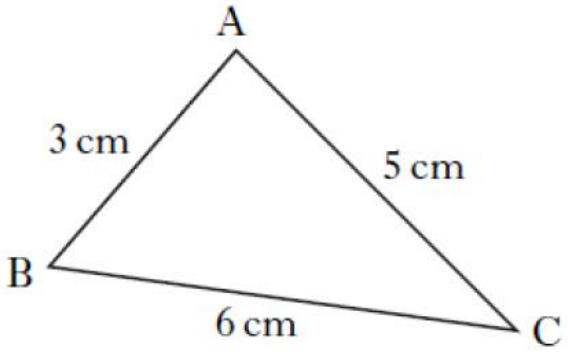


The area of triangle ABC is 20 square centimetres.

AC = 16 centimetres and $\sin C = \frac{1}{4}$.

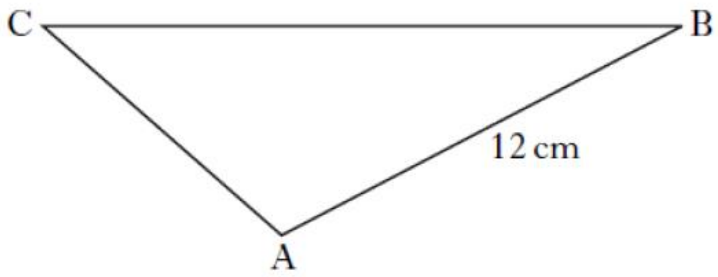
Calculate the length of BC.

4.*



In triangle ABC, show that $\cos B = \frac{5}{9}$.

6.*

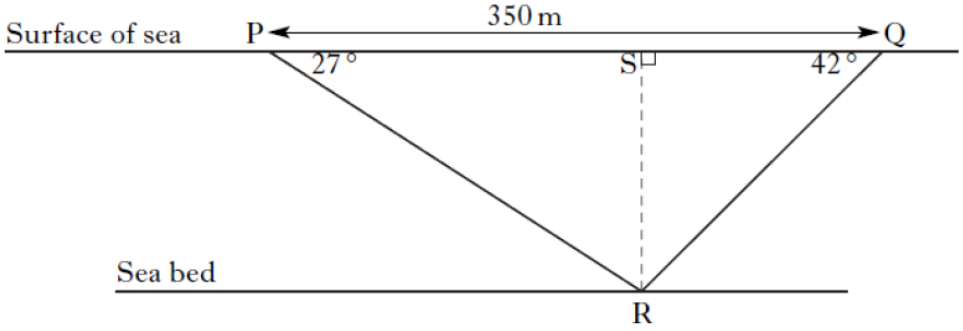


In triangle ABC, AB = 12 centimetres, $\sin C = \frac{1}{2}$ and $\sin B = \frac{1}{3}$.

Find the length of side AC.

7. Two ships have located a wreck on the sea bed.

In the diagram below, the points P and Q represent the two ships and the point R represents the wreck.



The angle of depression of R from P is 27°.
The angle of depression of R from Q is 42°.
The distance PQ is 350 metres.

Calculate QS, the distance ship Q has to travel to be directly above the wreck.

Do not use a scale drawing.

Percentages and Fractions

N3- N5

1. A company buys machinery worth £750 000.

   The value of the machinery depreciates by 20% per annum.

   The machinery will be replaced at the end of the year in which its value falls below half of its original value.

   After how many years should the machinery be replaced?

   You must explain your answer.

2. A lead **cube**, of side 10 centimetres, is melted down.

   During this process 8% of the metal is lost.

   The remaining metal is then made into a **cone**, with radius 8 centimetres.

   Calculate the height of this cone.

   Give your answer correct to 2 significant figures.

4. Due to the threat of global warming, scientists recommended in 2010 that the emissions of greenhouse gases should be reduced by 50% by the year 2050.

The government decided to reduce the emissions of greenhouse gases by 15% **every ten years**, starting in the year 2010.

Will the scientists' recommendations have been achieved by 2050?

You must give a reason for your answer.

5. It is estimated that house prices will increase at the rate of 3·15% per annum.

A house is valued at £134 750. If its value increases at the predicted rate, calculate its value after 3 years.

Give your answer correct to **four** significant figures.

6. Michael owns shares in a bank.

His shares are currently worth £5472. This is 4% less than they were worth a year ago.

Calculate how much Michael's shares were worth a year ago?

7* Calculate $2\frac{2}{5}\times\frac{5}{8}$.

8* Calculate $1\frac{7}{8}\div 3\frac{3}{4}$.

9* Calculate $\left(\frac{3}{5}\div\frac{1}{2}-\frac{3}{4}\right)\div\frac{1}{4}$.

10* Calculate $\left(\frac{3}{4}-\frac{1}{6}\right)$ of $\frac{3}{7}$.

11* Calculate $\left(3\frac{1}{3}+\frac{5}{6}\right)\div\frac{5}{12}$.

Statistics

2.* (*a*) The marks of a group of students in their October test are listed below.

41 56 68 59 43 37 70 58 61 47 75 66

Calculate:

(i) the median;
(ii) the semi-interquartile range.

(*b*) The teacher arranges extra homework classes for the students before the next test in December.

In this test, the median is 67 and the semi-interquartile range is 7.

Make **two** appropriate comments comparing the marks in the October and December tests.

3. The heights, in centimetres, of seven netball players are given below.

173 176 168 166 170 180 171

For this sample, calculate:

(*a*) the mean;

(*b*) the standard deviation.

Show clearly all your working.

4. A rugby team scored the following points in a series of matches.

13 7 0 9 7 8 5

(*a*) For this sample, calculate:

(i) the mean;

(ii) the standard deviation.

Show clearly all your working.

The following season, the team appoints a new coach.

A similar series of matches produces a mean of 27 and a standard deviation of 3·25.

(*b*) Make two valid comparisons about the performance of the team under the new coach.