GCSE MATHEMATICS

S21-C300

With Calculator Assessment Resource M

Higher Tier

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

1.

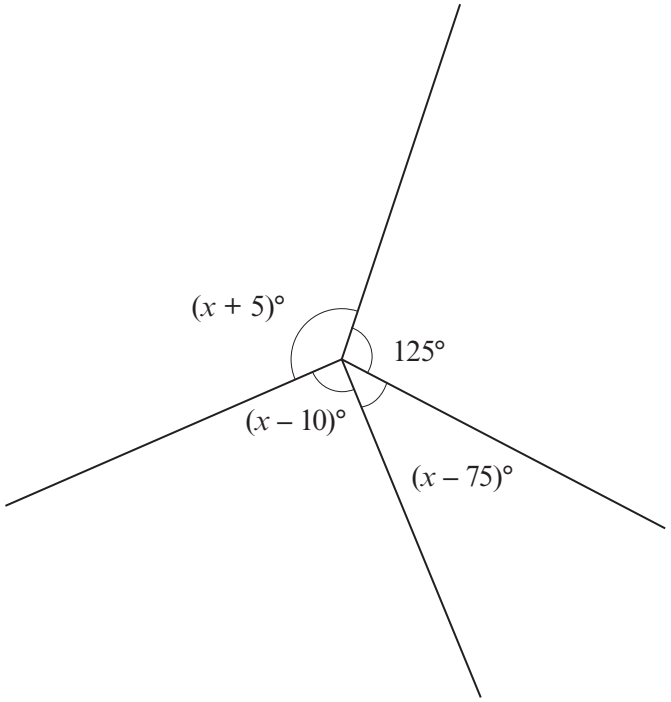

Diagram not drawn to scale

Write an equation in terms of x and solve it.
You must show all your working. [3]

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x = ...

2. *(a)* Expand and simplify $(2x - 7)(3x - 8)$. [3]

(b) Solve $w^2 + 8w - 33 = 0$. [3]

(c) Factorise $b^2 - 144$. [1]

(d) Rearrange the following to make e the subject.
Simplify your answer.

$$9e^2 = t^4$$ [2]

3. A square lawn has a side of length 8 m.
A builder is asked to make a path around the outside edge of the square lawn.

(a) The plan was for a path of width y metres with all the edges of the path being straight.

Find an expression for the area of this path in terms of y.
Give your answer in its simplest form. [4]

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(b) Before the builder started, the plan was updated and the following agreed:

- at each corner of the lawn the path should be a quarter circle,
- the width of the path is to be 1·5 m,
- the path is to be made of 8 cm thick concrete.

Calculate the volume of the concrete needed for the path. [5]

4. *(a)* Factorise and hence solve the following equation. [3]

$$4x^2 + 16x + 15 = 0$$

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(b) Find the nth term of the following sequence. [2]

7, 10, 15, 22, 31, 42, ...

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(c) Ali walks slowly from home through a forest and back home again.

He walks a total distance of $(3x + 1)$ km in a time of $(\frac{x}{2} + 6)$ hours.
Ali's average speed is 2 km/h.
He left home at 9 a.m.

At what time did Ali return home? [4]

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Ali returned home at .....

(d) The expression $x^2 + 18x + 2$ has a minimum value.
By **completing the square**, complete the statements below.
You must show all your working. [3]

'The minimum value of $x^2 + 18x + 2$ occurs when x = ...'

'The minimum value of $x^2 + 18x + 2$ is .....'

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5. *(a)* The volume of a cone is equal to the volume of a sphere.
The radius of the cone is four times the radius of the sphere.

Show that the perpendicular height of the cone is a quarter of the radius of the sphere. [4]

(b) The radii of two spheres are in the ratio 2 : 7.
The volume of the smaller sphere is $10{\cdot}4\,cm^3$.

Calculate the volume of the larger sphere. [3]