# GCSE   MATHEMATICS

S21-C300

## With Calculator Assessment Resource N

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:

$$\text{Curved surface area of a cone} = \pi r l$$

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

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

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

*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.** 25 years ago, Raveena's grandparents invested £500 for her in an account paying 3·4% compound interest per annum.
No extra money was paid in and no money was withdrawn during these 25 years.

Raveena has decided to withdraw all the money in the account after 25 years.

How much should Raveena receive?
Give your answer correct to the nearest penny.
You must show all your working. [3]

$$500 \left(1 + 0.034\right)^{25}$$
$$= 1153.409865$$
$$\approx £1153.41 \quad (\text{to the nearest penny})$$

**2.** *(a)* Shireen has a new shed.

The walls of the shed are vertical.
The shed stands on horizontal ground.
The uniform cross-section has one line of symmetry.

The diagram below shows some of the measurements of the cross-section.
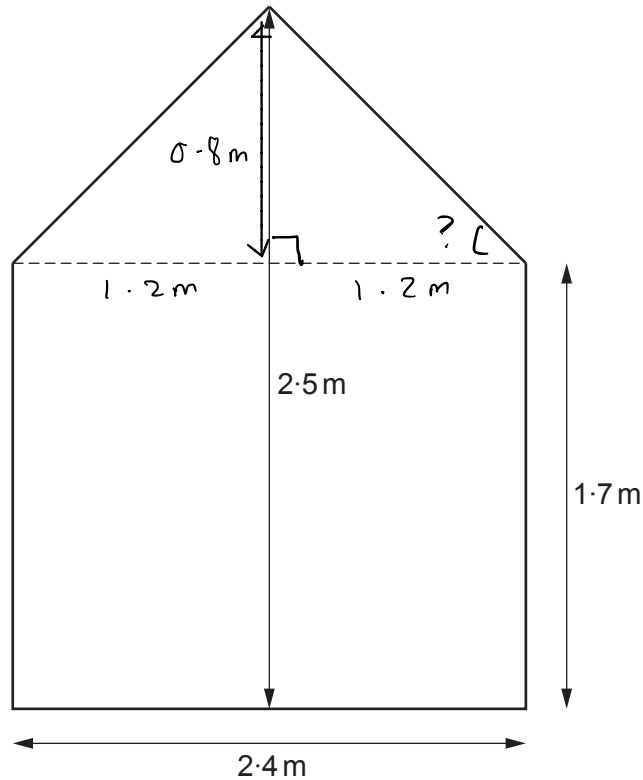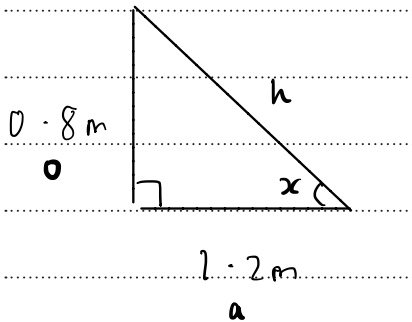


0·8 m

? ⌐

1·2 m        1·2 m

2·5 m

1·7 m

2·4 m

*Diagram not drawn to scale*

Calculate the size of the angle between the roof of the shed and the horizontal.        [4]

2·5 − 1·7 = 0·8



0·8 m

o

h

x ⌐

1·2 m

a

$\tan x = \dfrac{0·8}{1·2}$

$x = 33.69°$

so $? = 33.7°$

*(b)* Petra has a mathematically similar shed.



3 m

2·04 m

2·88 m

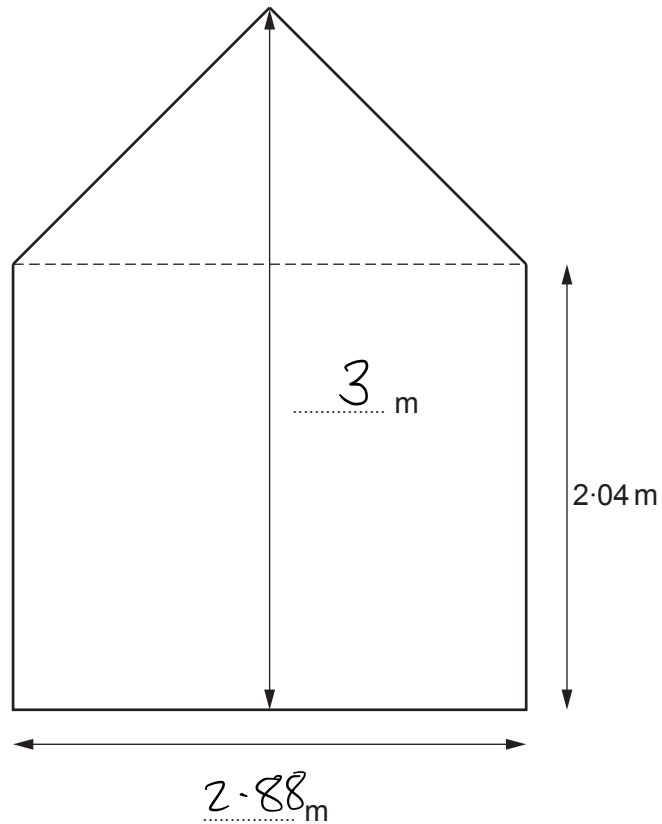*Diagram not drawn to scale*

Calculate the two missing measurements on the diagram above.
You must show all your working. [3]

$$x \frac{10}{17} \left( \begin{matrix} 1.7 & : & 2.04 \\ 1 & : & 1.2 \end{matrix} \right) x \frac{10}{17}$$

for 2.5 m ⟶ 1 : 1.2

2.5 : 2.5 × 1.2 = 3 m

for 2.4 m ⟶ 2.4 × 1.2 = 2.88

3. (a)

**Recipe for scones**

Ratio of ingredients

flour : butter : sugar

70 : 17 : 10

Nadeen has 102 g of butter and plenty of flour and sugar.
Nadeen uses all this butter to make scones.

Calculate the quantity of flour and sugar Nadeen needs. [3]

$$70 : 17 : 10$$

$$\frac{70}{17} : 1 : \frac{10}{17}$$

$\times 102$   $420 : 102 : 60$

Flour __420__ g

Sugar __60__ g

(b)

| Nutrition per scone | | | | |
|---|---|---|---|---|
| kcal | fat | carbohydrates | fibre | protein |
| 268 | 10 g | 41 g | 1 g | 6 g |

Nadeen has been recommended to eat 2200 kcal per day.
She eats two scones for lunch.
Her breakfast was 390 kcals.

What percentage of the recommended daily kcals does Nadeen have **left** for meals later in the day?
Give your answer correct to the nearest 0.01%. [4]

$$2200 - 390 - 2(268) = 1274$$

$$\frac{1274}{2200} \times 100 = \frac{687}{11} = 57.90909$$

$$\approx 57.91 \%$$

*(c)* Nadeen used a cutter to make her scones.
The cutter has a circular cross-section, with a diameter of 5 cm.
The depth of the scone mixture cut was 0·8 cm.

   (i)   Calculate the area of the top face of a scone.                      [3]

   diameter = 5 cm
   radius = 2.5 cm.

   $\pi r^2 = \pi (2.5)^2 = 6.25 \pi$
   $= 19.6349 5408$
   $\approx 19.6 \text{ cm}^2$

   (ii)  Calculate the total surface area of a scone.
         State any assumption you make.

         Assumption:                                                         [5]

   circumference $= \pi d = 5 \pi$ cm
   Total area $= 6.25 \pi + (5 \pi \times 0.8)$
   $= 6.25 \pi + 4 \pi$
   $= 10.25 \pi$
   $= 32.2013247$
   $\approx 32.2 \text{ cm}^2$

   Assumption: after baking the scone mixture,
   the scone would not increase in
   size. Hence it would have the
   same shape and size as when
   scone mixture was cut.

   Total surface area ......82.2...... cm²

**4.** The diagram shows quadrilateral *OABC*.
**OA** = 5**x**, **OB** = 12**x** + 6**y** and **OC** = 8**y**.
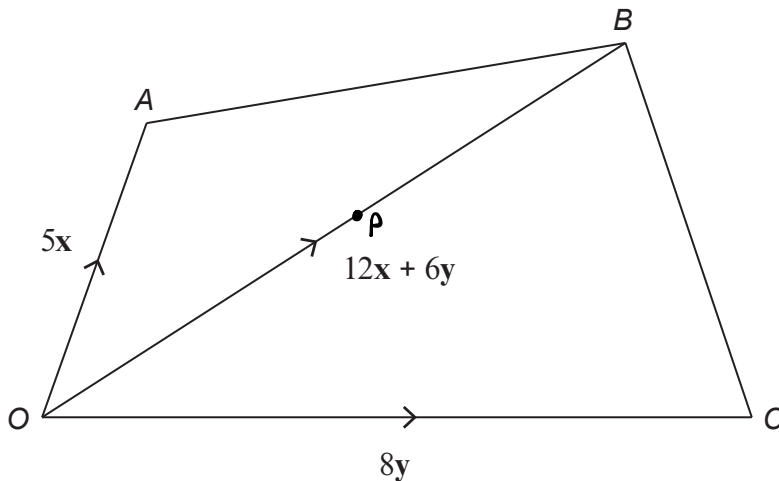


*Diagram not drawn to scale*

(a) Express **CA** in terms of **x** and **y**. [1]

$$5x - 8y$$

(b) *P* is the midpoint of *OB*.
Express each of the following in terms of **x** and **y**.
Give each of your answers in the simplest form.

(i) **OP** [1]

$$\frac{1}{2}(12x + 6y) = 6x + 3y$$

(ii) **PA** [1]

$$-(6x + 3y) + 5x$$
$$= -3y - x$$

(c) Does *P* lie on *CA*?

Yes ☐     No ☒

You must give a reason for your answer. [1]

If P lied on CA then PA and CA
must be parallel and PA should be on top of CA.
But their are not ~~v~~ scalar multiples of each other

**5.**
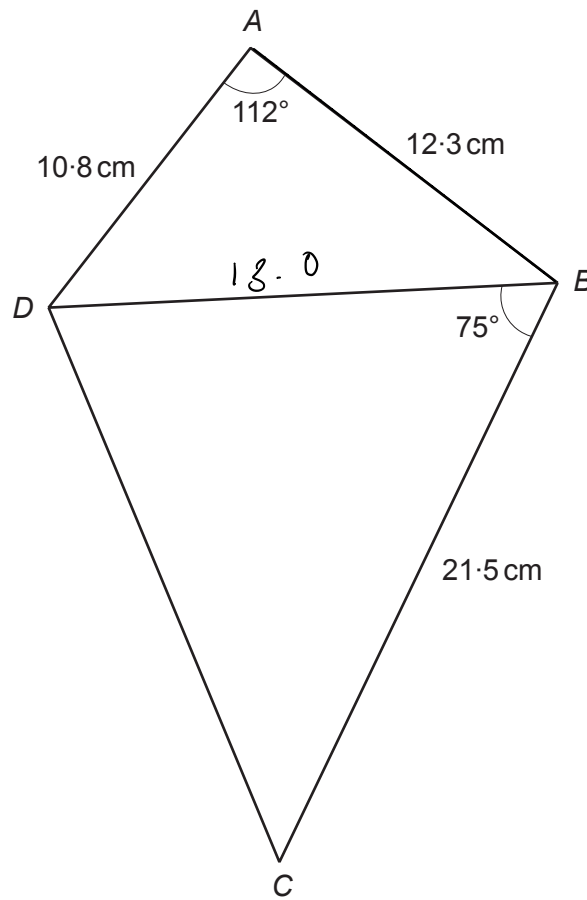


*Diagram not drawn to scale*

Calculate the area of *ABCD*. [6]

area of ABD = $\frac{1}{2}$ ab sin C

= $\frac{1}{2}$ × 10.8 × 12.3 × sin 112

= 61.583551162

finding DB

$a^2 = 10.8^2 + 12.8^2 + 2(10.8)(12.8) \cos 112$

$a^2 = 116.64 + 151.29 + 265.68 \cos 112$

$a^2 = 168.404...$

DB = a = 12.97707672 ≈ 13.0 (3sf)

Area of DBC = $\frac{1}{2}(13)(21.5) \sin 75$

= 134.9881342

total area:

134.9881342 + 61.583551162

= 196.57168 = 197 cm² (3sf)

**6.** The diagram shows a circle with centre *O*.
Points *A*, *B*, *C* and *D* all lie on the circumference of the circle.
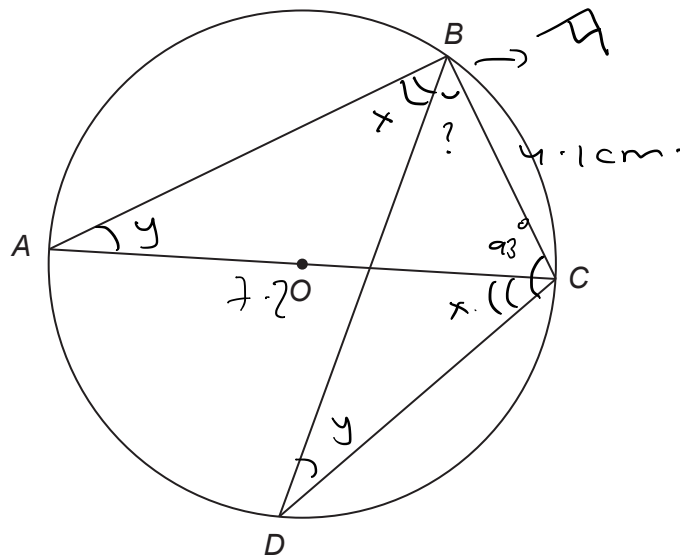


*Diagram not drawn to scale*

The radius of the circle is 3·6 cm, *BC* = 4·1 cm and $B\hat{C}D$ = 93°.
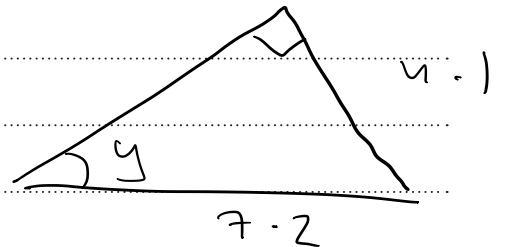
Prove that $D\hat{B}C$ = 52·3°, correct to 3 significant figures.
You must show all your working and give a reason for each stage of your proof. [4]

$90 - x = D\hat{B}C$

$180 - 93 - y = D\hat{B}C$

$\dfrac{\sin 90}{7 \cdot 2} \times 4 \cdot 1 = \sin y$

$y = 84 \cdot 71149426$

$180 - 93 - 84 \cdot 71149426 \ldots = 52 \cdot 2885\ldots$

$\approx 52 \cdot 3 \, (3sf)$

$\therefore \quad D\hat{B}C = 52 \cdot 3°$