Higher Maths Summer 2019 P2 Q14

The diagram shows a triangle *ABC* and a circle with centre *A*.
The points *B* and *D* lie on the circumference of the circle.

The radius of the circle is 8 cm.
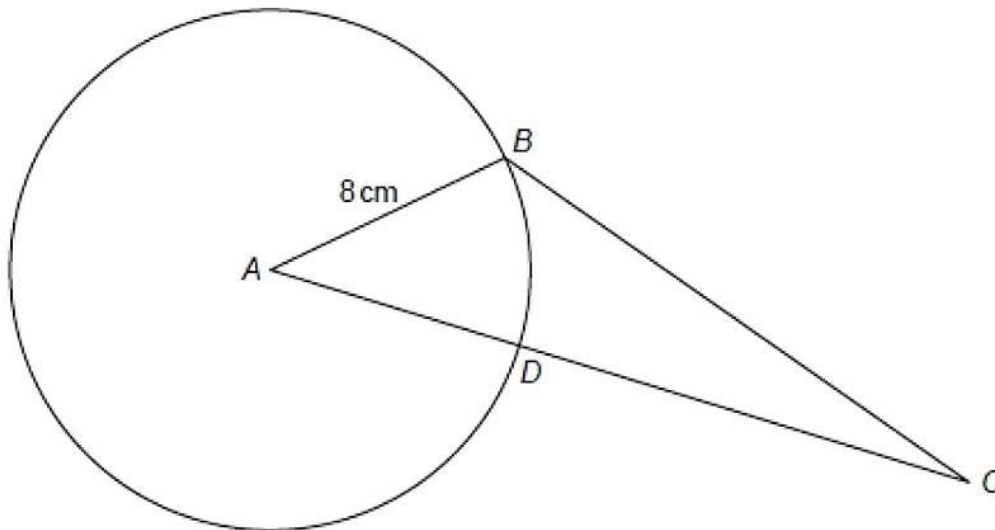The length of the line *AC* is 19 cm.
The area of triangle *ABC* is 70 cm².

Diagram not drawn to scale

Calculate the area of the sector *ABD*.   [5]
_____
Higher Maths Nov_2017 P2 Q17

ABC represents the **sector** of a circle with radius 7 cm and centre *A*, as shown below.
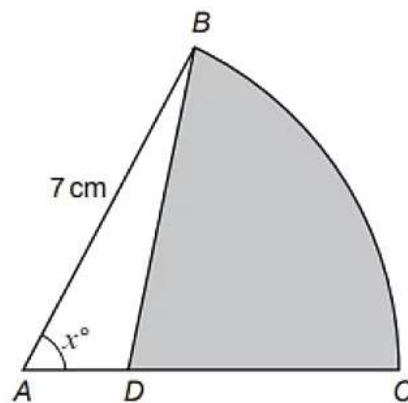$B\hat{A}C = x°$, *AD* = 3 cm and *BD* = 6 cm.

Diagram not drawn to scale

Find the area of the shaded region *BCD*.   [8]
_____

Higher Maths Summer_2018 P2 Q19

BC is the tangent to the circle at point E, as shown below.

EC = 8 cm, AC = 11 cm and D$\hat{C}$E = 31°.
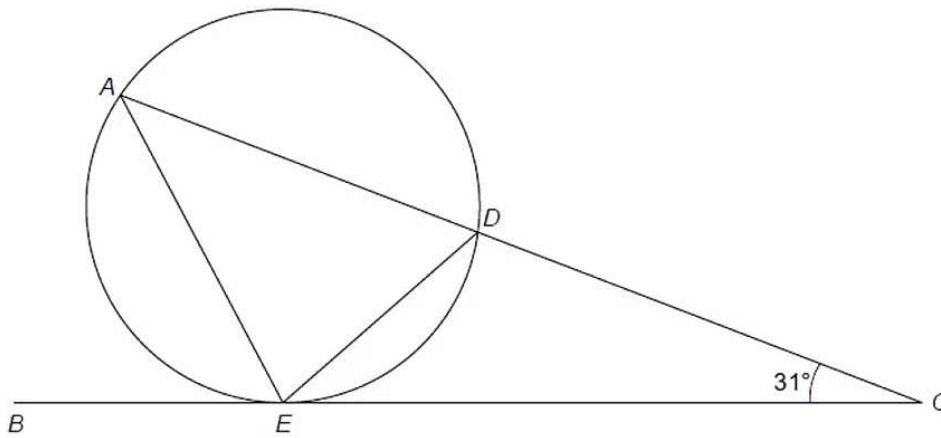

Diagram not drawn to scale

(a)   Calculate the length of AE.   [3]

(b)   Calculate the size of C$\hat{E}$D.   [4]

_____

Higher Maths Nov_2016 P2 Q18

A 9-pointed star, with centre O, is shown below.
Each side of the star is of length x cm.

The distance from the centre to every **inner** vertex of the star is 7 cm.
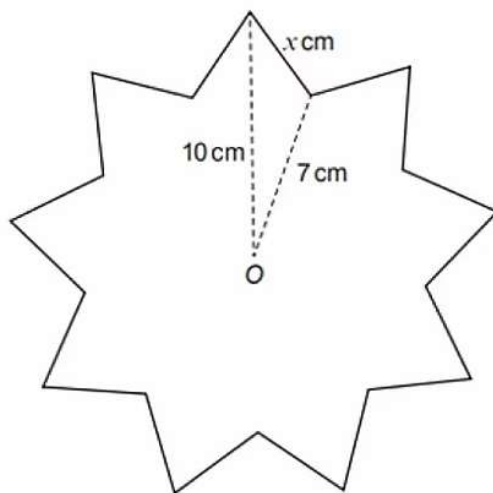The distance from the centre to every **outer** vertex of the star is 10 cm.

Diagram not drawn to scale

(a)   Calculate the perimeter of the star.   [5]

(b)   Calculate the area of the star.   [3]

Higher Numeracy Nov 2018 P1_Q13

Taryn made a birthday cake for her brother Carwyn, and placed it on a cake stand.
She made a cylindrical cake of radius 12 cm and height 10 cm.
To make the birthday cake look like the letter 'C' for Carwyn, she cut out a large slice.

The cake she has left has a uniform cross-section in the shape of a sector of a circle with sector angle 300°.
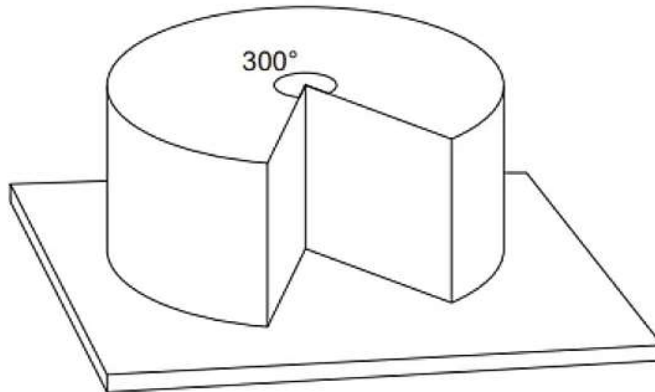

Diagram not drawn to scale

Taryn wants to put icing on all the visible surfaces of the cake.
Calculate the surface area that needs to be covered with icing.
Give your answer, **in its simplest form**, in terms of π.   [5]

Higher Maths June_2017 P1 Q19

By considering algebraic expressions, show that it will never be possible for the surface area of a sphere of radius r to be equal to the surface area of a cube with sides of length r.   [2]

Higher Numeracy Sample_1 P1 Q10

A shopkeeper pays £120 for an mp3 player.
He wishes to put a marked price on the mp3 player so that, in the forthcoming sale, when he gives a discount of 25% on the marked price, he will still make a profit of 20% on the price paid for the mp3 player.
Find the marked price.   [4]

Higher Maths Nov 2018 P2 Q18

Solve the equation $\dfrac{7x+1}{5x+2} = \dfrac{1}{x+3}$.

Give your answers correct to 2 decimal places.
You must show all your working.   [6]

Higher Maths Summer 2018 P2_Q18

Make c the subject of the following formula.   [4]

$$\sqrt{gc^2 - v} = c$$

Higher Maths Sample_1 P1 Q15

The points A, B and C lie on the circumference of a circle.

The straight line PBT is a tangent to the circle.
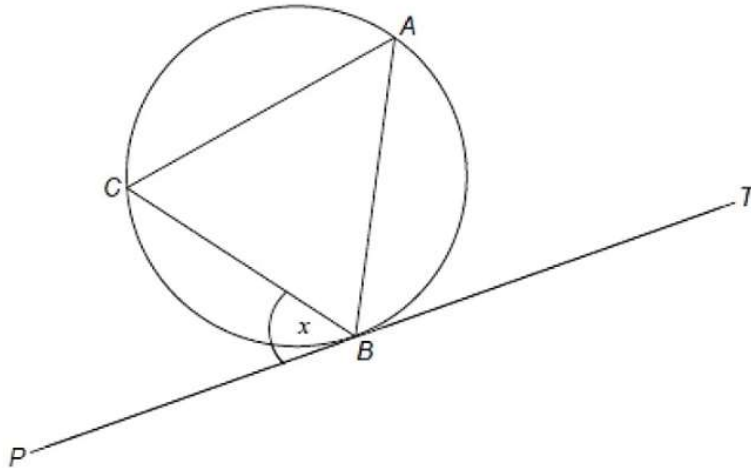AB = AC.
$C\hat{B}P = x$, where x is measured in degrees.

Diagram not drawn to scale

Show, giving reasons in your answer, that the size of $A\hat{B}C$, in degrees, is $90 - \frac{1}{2}x$.

[4]

_____

Higher Maths June_2017 P2 Q21

The cube below has an internal diagonal of length 20 cm.
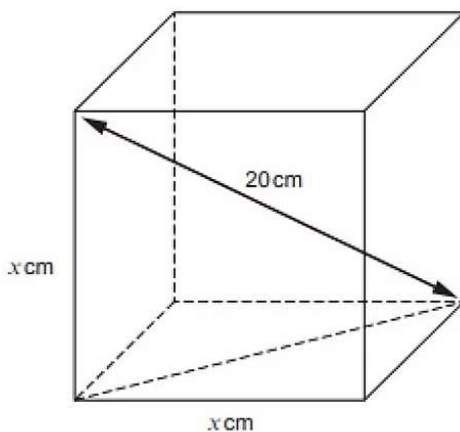Each edge of the cube is of length x cm.

20 cm

x cm

x cm
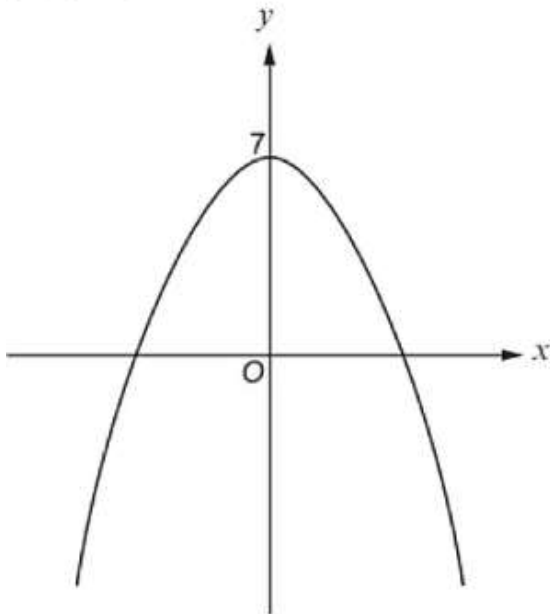
Diagram not drawn to scale

Calculate the value of x.
You must use an algebraic method and show all your working.   [4]

Higher Maths Nov_2017 P2 Q16

Each of the two graphs below is described by **one** of the equations on the right.
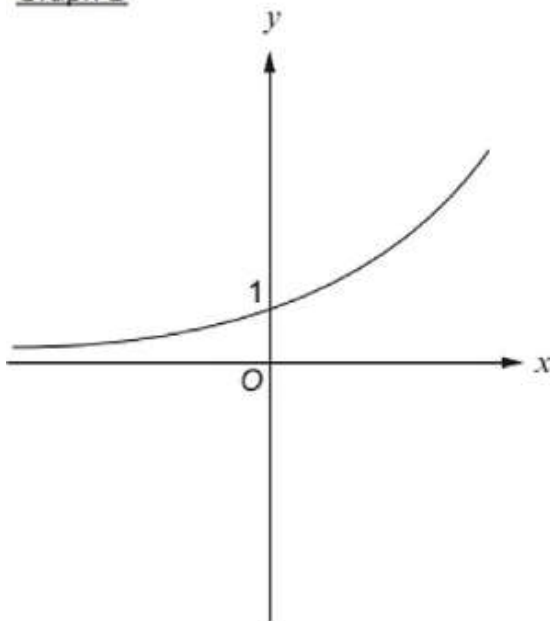Put a **tick** in the box next to the equation which correctly describes each graph.   [2]

Graph A

	Equation describing graph A
$y = 7x^2$	
$y = -(x + 7)^2$	
$y = (x - 7)^2$	
$y = 7 - x^2$	
$y = x^2 + 7$	

Graph B

	Equation describing graph B
$y = x^2 + 1$	
$y = 2^x$	
$y + 1 = x^2$	
$y = \dfrac{1}{x}$	
$y = x^0$	

.   Imran works for a company called *Derwen Insurance*.
His gross salary is £47840 per year.

Below are extracts from HM Revenue and Customs and details of Imran's
company pension scheme:

National Insurance contributions
• If you earn more than **£153** a week and up to **£805** a week, you pay 12% of the amount you earn between **£153** and **£805**
• If you earn more than **£805** a week, you also pay 2% of all your earnings over **£805**

Source: HMRC 2014

| Income tax threshold and rates	
Income tax threshold	£10,000 per year
Basic tax rate	20% on annual earnings above income tax threshold and up to £31,865
Higher tax rate	40% on annual earnings from £31,866 to £150,000
Additional tax rate	45% on annual earnings above £150,000

Source: HMRC 2014

Derwen Insurance Pension Scheme			
Gross salary	Contribution rate	Gross salary	Contribution rate
Up to £13 500	5·5%	£60 001 to £85 000	9·9%
£13 501 to £21 000	5·8%	£85 001 to £100 000	10·5%
£21 001 to £34 000	6·5%	£100 001 to £150 000	11·4%
£34 001 to £43 000	6·8%	£150 001 or more	12·5%
£43 001 to £60 000	8·5%		

Using the information on the previous page, calculate Imran's weekly net salary.
You must show all your working.   [13]

Higher Numeracy Sam_1 P2 Q9

Blodyn Garden Products makes caps for fence posts.

Solid metal fence caps	
Solid hemisphere cap	Solid pyramid cap
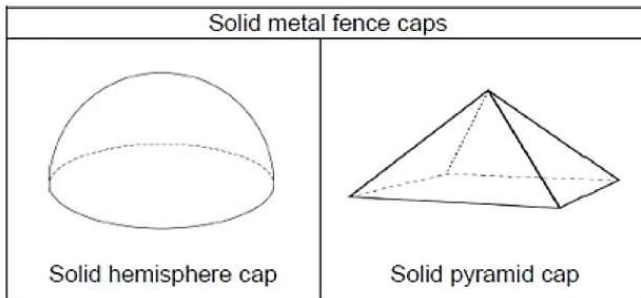
Blodyn Garden Products wants to make the price of the two different fence caps the same.
So it is important that the volume of metal used to make each cap is the same.

The lengths of the sides of the base of the pyramid are all 8 cm.
The angle between one of the sloping edges and the diagonal of the base is 32°.

(a)   Calculate the height of the square-based pyramid cap.   [5]

(b)   Calculate the volume of the square-based pyramid cap.   [2]

_____

Numeracy Higher Sample_2 P2 Q12

12. A cylinder is made of bendable plastic.
Part of a child's toy is made by bending the cylinder to form a ring.
The two circular ends of the cylinder are joined to form the ring.

Diagram not drawn to scale

The inner radius of the ring is 9 cm.
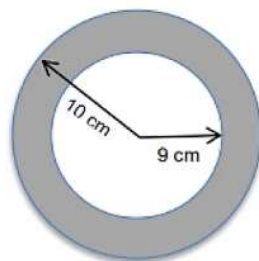The outer radius of the ring is 10 cm.

Diagram not drawn to scale

Calculate an approximate value for the volume of the ring.
State and justify what assumptions you have made in your calculations and the impact they have had on your results.

[7]

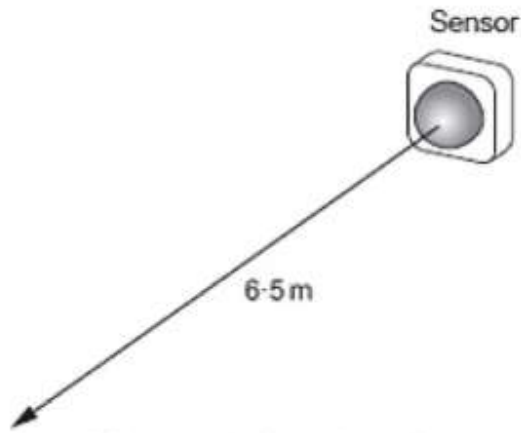1. A sensor can detect any movement up to a distance of 6·5 m.

Sensor

6·5 m

Diagram not drawn to scale

(a) A storeroom is in the shape of a cuboid, as shown below.
The sensor is placed at *A*, so that
- it is aimed directly at *B*, where *BD* = 2 m,
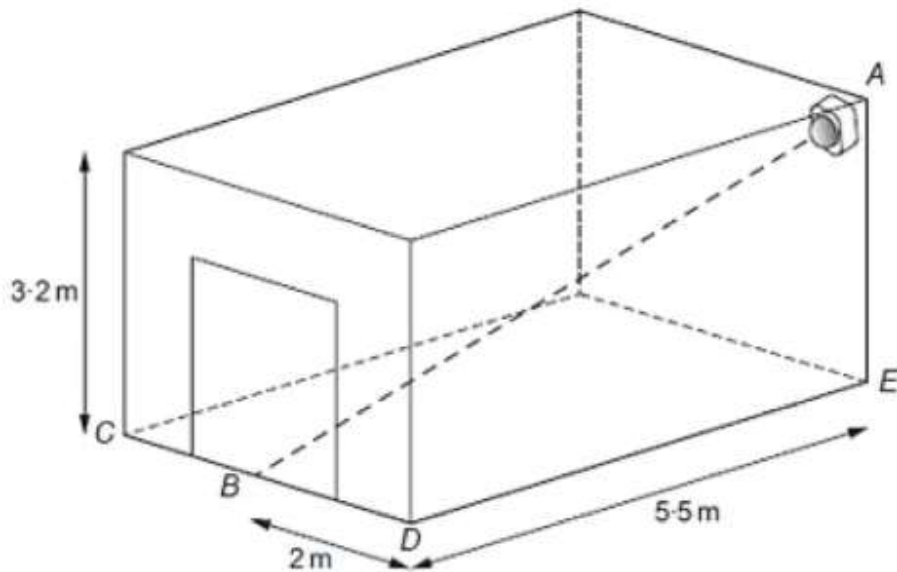- the front of the sensor is 20 cm from *A* along the line *AB*.

Diagram not drawn to scale

Will the sensor be able to detect movement at *B*?
You must show all your working.   [5]

(b) Show that $B\widehat{A}E = 61\cdot3°$, correct to 1 decimal place.   [3]

(b)

The company also makes metal door handles for kitchen cupboards.
One of the door handles it makes is shown below.
It is formed by joining two cylinders.
One of the cylinders has a diameter of 4 cm and a length of 1·2 cm.
The other cylinder has a diameter of 1·8 cm and a length of 3 cm.

4 cm

1·8 cm

1·2 cm

3 cm

Diagram not drawn to scale
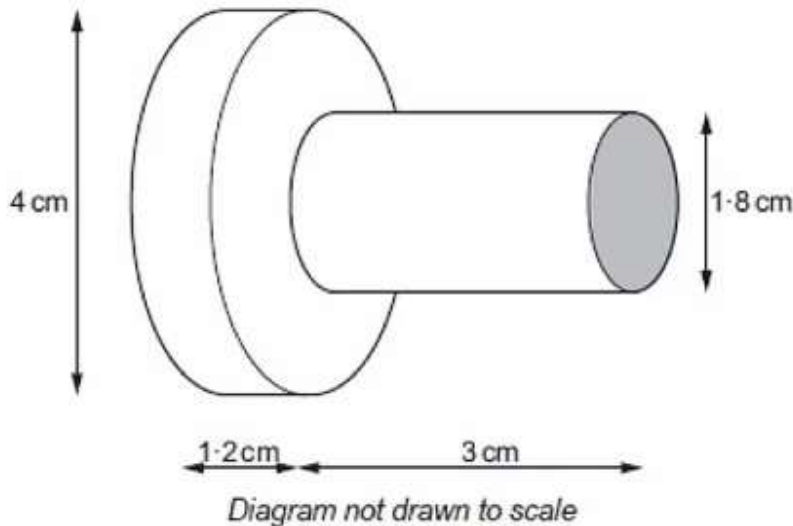
At present, the company paints all the surfaces of the handle with a protective finish **after** the two cylinders have been joined together.

The shaded circular face is pressed against a cupboard door when fitted.
In future, the company is not going to paint this shaded circular face. This is to reduce costs.

Calculate the percentage reduction in the area that is painted.   [6]

Higher Numeracy Summer_2018 P1 Q14

The diagram shows the simplified model of part of an engine.
It shows a belt which runs around three circular cogs.
The engine rotates Cog 1.
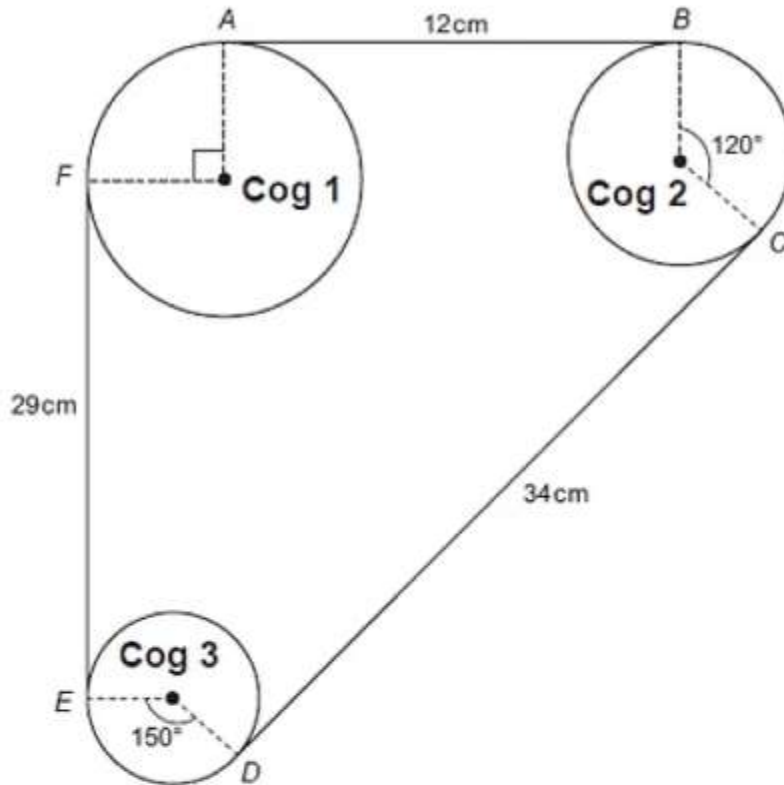Cog 1 rotates the belt, which then makes Cogs 2 and 3 rotate.

Diagram not drawn to scale

AB, CD and EF are straight sections of the belt.
AB = 12 cm, CD = 34 cm and EF = 29 cm.
The belt bends around the outer edges of the circular cogs, represented by the arcs BC, DE and AF.
The dimensions of the cogs are:
- radius of Cog 1 = 6 cm
- radius of Cog 2 = 4·5 cm
- radius of Cog 3 = 3 cm

(a) What is the length of arc AF in terms of π?
Circle your answer.   [1]

2π 3π 6π 4π $\frac{3\pi}{2}$

(b) Calculate the total length of the belt.
Give your answer in terms of π in its simplest form.   [4]

(c) Elen notices that when Cog 3 makes two revolutions, Cog 1 makes only one revolution, because the radius of Cog 3 is half the radius of Cog 1.

In one minute, Cog 3 makes 2400 revolutions.
Calculate the number of revolutions Cog 2 will make in one minute.   [3]

Higher Numeracy Nov_2016 P2 Q9

A metal round-headed nail can be thought of as a cone sitting on top of a cylinder, which sits on top of a hemisphere.

A company produces round-headed nails of different sizes, but made of the same metal.

Each nail has the following dimensions:

- height of cone = $9r$,
- height of cylinder = $15r$,
- radius of the hemisphere = $12r$,

where r is the radius of the cylinder and the base radius of the cone.
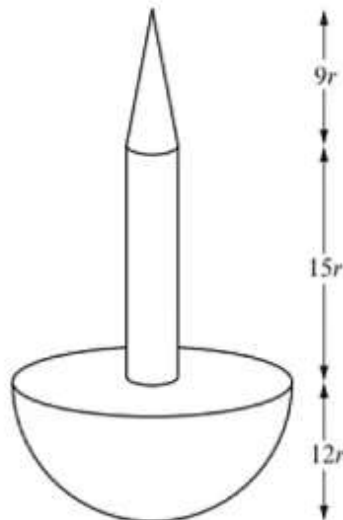

Diagram not drawn to scale

A metal cuboid of volume $18\,000\,mm^3$ is melted down, and re-cast to form round-headed nails of size A, where $r = 0.4\,mm$.

(a)   Calculate the greatest number of round-headed nails of size A that can be produced. [6]

(b)   Circle either TRUE or FALSE for each statement given below.   [2]

STATEMENT		
A nail double the height of a size A nail will have a total height of 28·8 mm.	TRUE	FALSE
A nail double the height of a size A nail will be 8 times the weight of a size A nail.	TRUE	FALSE
A nail 3 times the height of a size A nail will have a total surface area 6 times that of a size A nail.	TRUE	FALSE
When $r = 0.8\,mm$, the number of nails that could be produced from the same metal cuboid will be double the number of size A nails.	TRUE	FALSE

Higher Numeracy Nov 2017 P1_Q9

Two runners, Catrin and Delyth, start a race at the same time.
The velocity-time graph shows their velocities over the first 5 seconds of the race.
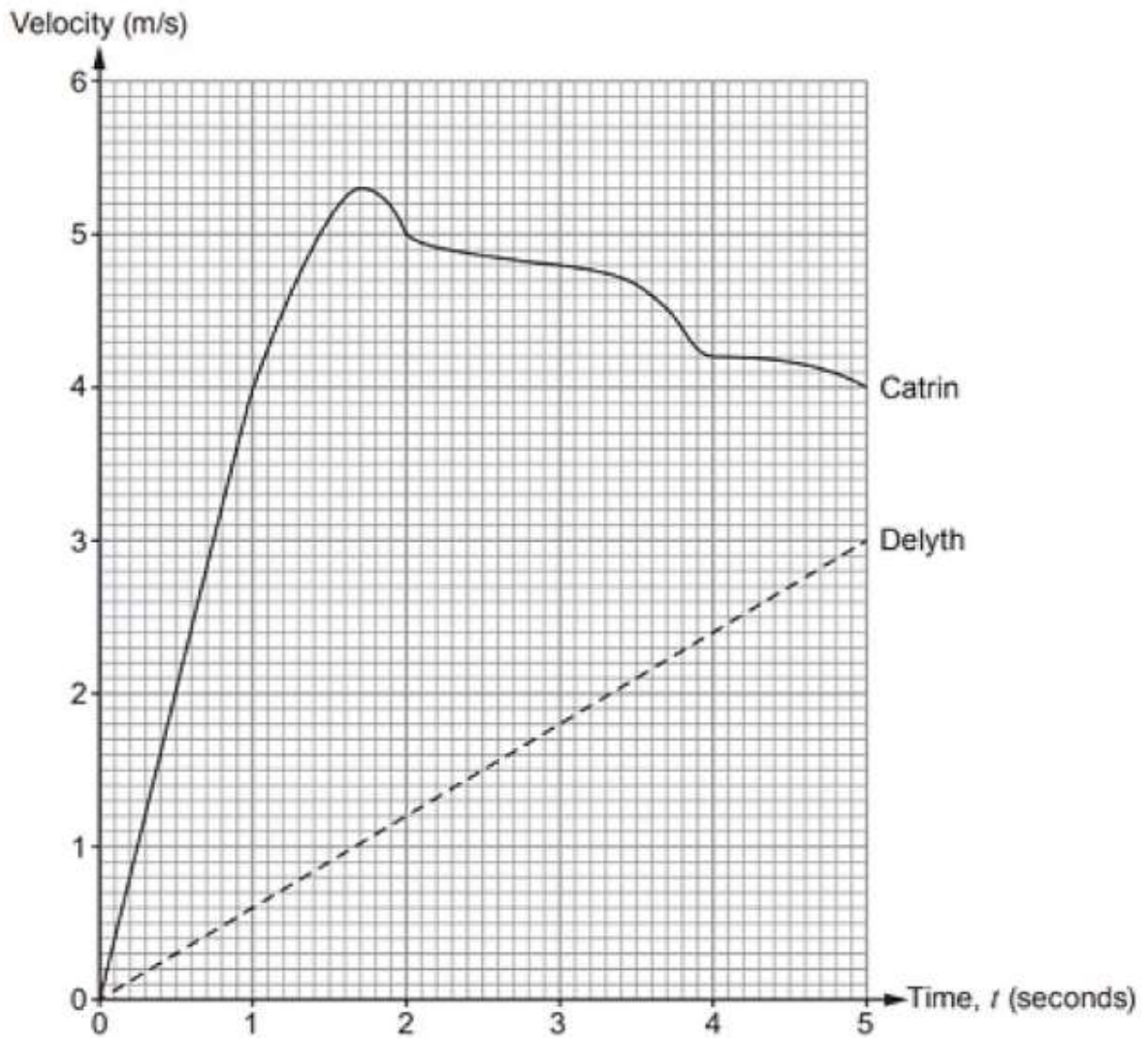
(a)   After the start of the race, what was the earliest time that Catrin's acceleration was
      0 m/s²?   [1]

(b)   Use the trapezium rule to calculate an estimate of the distance Catrin travelled in the first
      5 seconds of the race.
      Use Catrin's velocities at times $t = 0$, $t = 1$, $t = 2$, $t = 3$, $t = 4$ and $t = 5$.
      You must show all your working.   [3]

(c)   (i)   Calculate an estimate of how far Catrin was ahead of Delyth after 5 seconds.   [2]

      (ii) Explain why your answer to (c) (i) is an underestimate.   [1]