St. Patrick's High School, Keady

Mathematics Department

GCSE Mathematics Practice Booklet

M3

Topic 9 – Geometry and Measures 3

Sectors, Cylinders, Cones and Spheres

Compound Measures and Units

Questions taken from CCEA Past Papers

Mark Scheme included at the end of this booklet

Keady
Maths

Q1   A lorry travels 240 km in 150 minutes.

Calculate the average speed of the lorry in km/hr.

Answer _____ km/hr [3]

Q2   A coach travels 140 miles in 2 hours 30 minutes.

Calculate the average speed.

Answer _____ mph [3]

Q3   In one section of the Circuit of Ireland rally the winning car travelled a distance of 297 miles in $4\frac{1}{2}$ hours.

Calculate the winning car's average speed for this section of the rally.
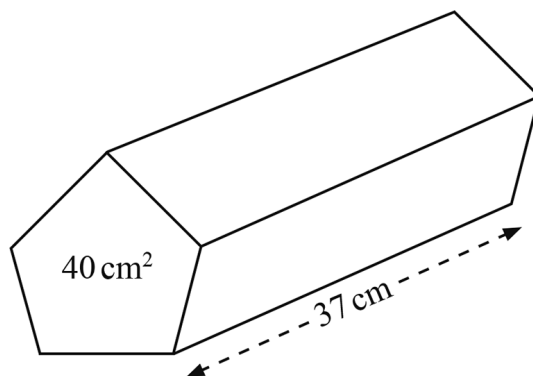
Answer _____ mph [3]

Q4   A train journey from Belfast to Dublin takes 2 hours and 15 minutes.

The distance travelled by the train is 144 kilometres.

Work out the average speed of the train in kilometres per hour.

Answer _____ km/h [2]

Q5   A solid pentagonal prism has mass 5300 g. The cross-sectional area is 40 cm^2 and the length is 37 cm.

Calculate the density of the prism in g/cm^3.

Give your answer to an appropriate degree of accuracy.

Answer _____ g/cm^3 [4]

Q6   Leah wants to check how economical her car is.

She travels 275 miles, using 22 litres of petrol.

(a) How many miles does her car travel per litre of petrol?

Answer _____ miles [1]

(b) The 275 mile journey took Leah 5 hours 30 minutes.

What was her average speed for the journey?

Answer _____ miles per hour [3]

Q7   Jane completes a 5 km race in 24 minutes.

Calculate her average speed in km/hr.

Answer _____ km/hr [2]

Q8   A cuboid has length 90 cm, width 45 cm and height 30 cm.

It has a mass of 24 300 g.

Calculate the density of the cuboid.

Include units in your answer.

Answer _____ [4]

Q9
The table shows part of a train timetable from Edinburgh to St Andrews.

The Express trains travel directly. The Standard trains stop at other stations.

	Express	Standard	Express	Standard	Express
Edinburgh	1318	1343	1424	1441	1520
Haymarket		1406		1504	
Kirkcaldy		1418		1516	
Ladybank		1423		1521	
St Andrews	1403	1439	1509	1537	1605

(a) Alex arrives at Edinburgh Airport at 1306

It takes him 26 minutes to collect his luggage.

By taxi, he arrives at Edinburgh Train Station 18 minutes later.

How long will he have to wait at the station for the next train to St Andrews?

Answer _____ minutes [3]

(b) The distance between Edinburgh and St Andrews is 54 miles.

Calculate the average speed at which the Express train travels between Edinburgh and St Andrews.
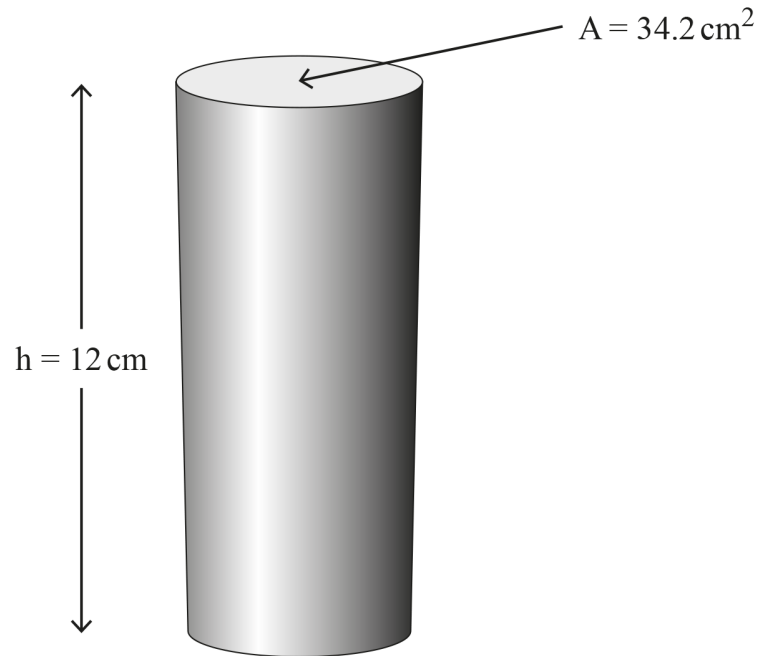
Answer _____ miles/hr [3]

Q10

(b) A horse runs 2000 metres at an average speed of 14.5 m/s.

How long does this take?

Give your answer in minutes and seconds, to the nearest second.

Answer _____ minutes _____ seconds [3]

Q11

A solid cylinder has a height of $12\,\text{cm}$ and a circular cross-sectional area of $34.2\,\text{cm}^2$

The density is $0.83\,\text{g}/\text{cm}^3$

Find the mass of the cylinder.

$A = 34.2\,\text{cm}^2$

$h = 12\,\text{cm}$

Answer _____ g [3]

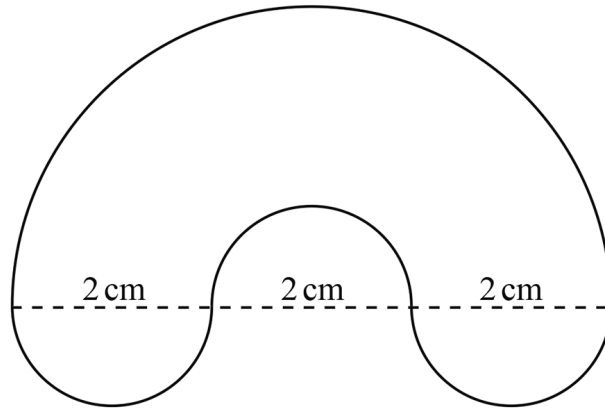**Q12**   A lorry needs to be driven 156 miles to a ferry port.

It needs to arrive at 4pm.

The lorry is driven at an average speed of 48 mph.

What is the latest time the journey should start?

Answer _____ [3]

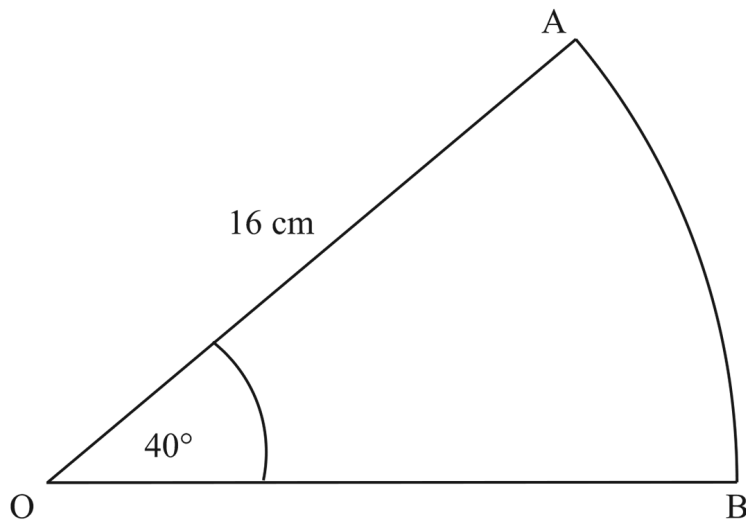**Q13**   A shape with four semicircular edges is shown.

Calculate the perimeter of the shape.

Answer _____ cm [4]

Q14   AOB is a sector of a circle, radius 16 cm.

Angle AOB = 40°

Work out the perimeter of the sector AOB.
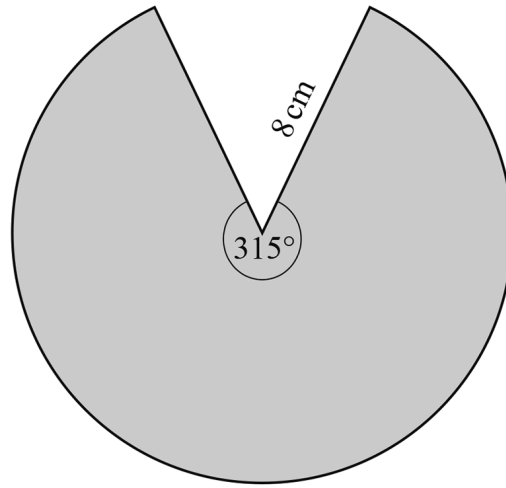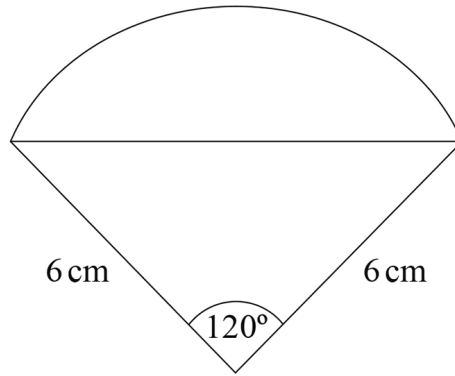
Answer _____ cm [3]

Q15

315°

8 cm

diagram not drawn accurately

Calculate the area of the shaded sector.

Answer _____ cm² [3]

Q16   The diagram shown is a sector of a circle of radius 6 cm with an angle of 120°

Calculate the area of the segment.
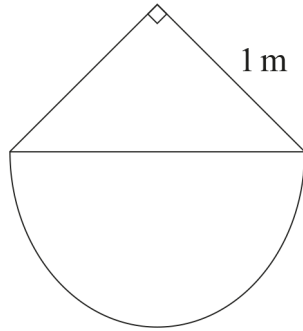
Answer _____ cm^2 [4]

Q17

1 m

diagram not
drawn accurately

The composite shape consists of a right-angled isosceles triangle and a semicircle.

(a) Show that the area of the composite shape is approximately $1.285\,\text{m}^2$

[4]

(b) Find the force applied to the area of the composite shape when the pressure is 5 N/m²

Answer _____ N [2]

Q18

Sue is training to compete in a 10 km walk.

A diagram of her local athletics track is shown below.

The track consists of a rectangle and two semicircles.
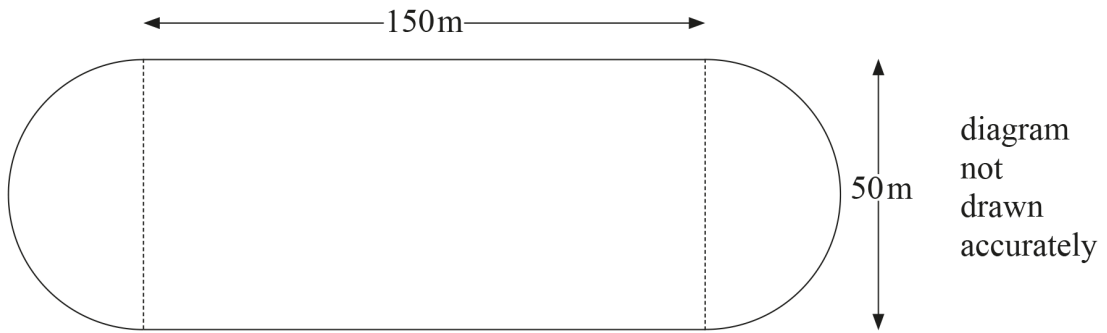
How many complete laps are needed to ensure she walks 10 km?

You must show all your working.

Answer _____ [4]
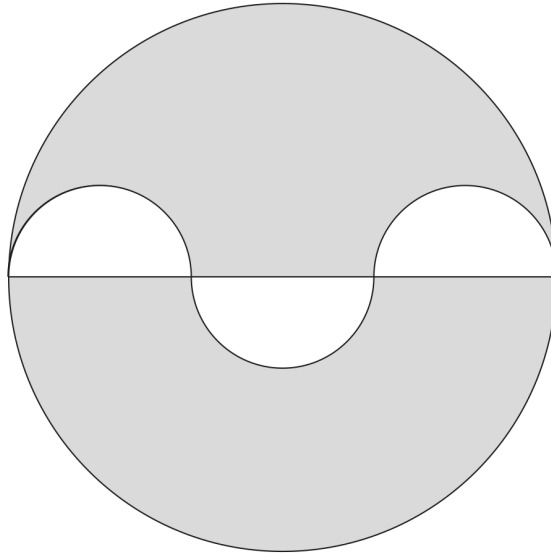
A large circle has three semicircles of equal diameters placed across its diameter as shown.

The radius of each of the small semicircles is 2 cm.

Work out the area shaded.

Answer _____ cm^2 [5]

Q20   Find the area of the shaded sector of this circle, centre O and radius 3 cm.
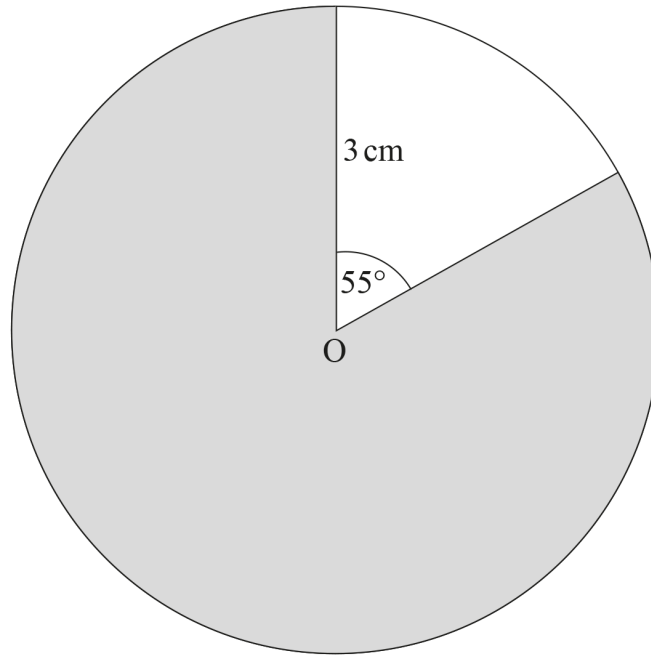
diagram
not drawn
accurately

Answer _____ cm^2 [2]

Q21

The roof on a tower is in the shape of a cone with a diameter of 7.5 m and a height of 5 m.

Calculate the volume of this cone.
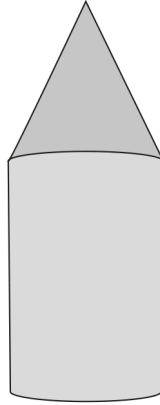
Answer _____ m³ [2]

Q22   A cylinder has a base radius of 8 cm and a height of 36 cm.

The curved surface area of this cylinder is the same as the surface area of a sphere.

What is the radius of the sphere?

Answer _____ cm [4]

Q23   The picture shows the dimensions of a label taken from a cylindrical tin of dog food.

The label covers all the curved surface of the tin with no overlap.

Calculate the volume of the tin.

Doggy Dog Food

10.5 cm

23 cm
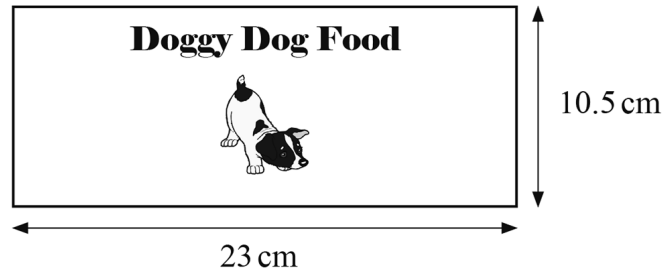
Answer _____ cm³ [4]

Q24　A metal cube made of lead is melted down to make 100 identical spherical weights with a radius of 2 cm.

Calculate the smallest **integer** side length for the cube.

Answer _____ cm [4]

Q25

A cylindrical tank has a diameter of 80 cm and a height of 150 cm as shown.
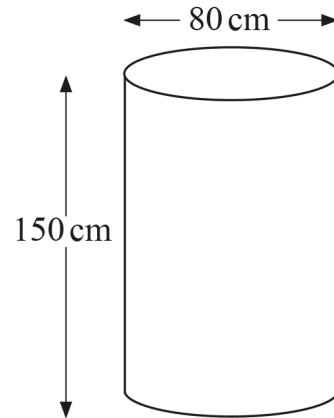
Calculate the volume of water the tank can hold when full.

Give your answer correct to the nearest litre.

Answer _____ litres [4]

Q26

The **solid** hemisphere has a diameter of 12 cm.
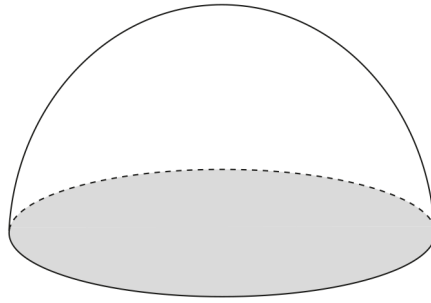
Mary says the total surface area is 226 cm^2 to the nearest cm^2

Martha says the total surface area is 339 cm^2 to the nearest cm^2

Explain with reasoning who is correct.

Answer _____ is correct [4]

Q27   Calculate the surface area of a sphere with diameter 12 cm.

Answer _____ cm^2 [2]

Q28   A cylindrical can of beans has a radius of 3.4 cm and a height of 12 cm.

The entire curved surface area is covered by a label.

The label has a 1 cm overlap to allow for sticking.
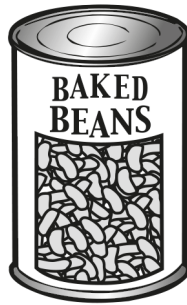
Calculate the area of the label.

Answer _____ cm^2 [3]

1. $150 \text{ (mins)} = 2\frac{1}{2}$ (hours)   A1

   $240 \div 2\frac{1}{2} = 240 \times \dfrac{2}{5}$ M1

   $= 96$ km/hr   A1

   alternatively

   240 km = 150 mins (÷5)   MA1
   48 km = 30 mins (× 2)   MA1
   96 km = 60 mins (96 km/hr)   A1

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2. $2\frac{1}{2}$ hrs   A1

   $140 \div 2\frac{1}{2} = 56$ M1 A1

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3.   297 ÷ 9 **or** 297 ÷ 4.5 **or** 297 ÷ 270   M1
   33 miles in $\frac{1}{2}$ hour **or** 594 ÷ 9 **or** 1.1 × 60   A1
   66   A1

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4.   144 ÷ 2.25 (o.e.)   M1
   64   A1

5.

$40 \times 37 = 1480$ MA1

$5300 \div 1480 = 3.58(108)$ M1 A1

3.6 or 4   MA1

6.

(a) $275 \div 22 = 12.5$ A1

(b) $275 \div 5.5$ M1 A1

    50   A1

7.

$$\text{speed} = \frac{5}{\left(\frac{24}{60}\right)} \text{ or } 5 \div 0.4 \qquad \text{MA1}$$

$$= 12.5 \, \text{km/hr} \qquad \text{A1}$$

alternative solution

$5\,\text{km} = 24 \text{ minutes} \, (\div 4)$

$1.25\,\text{km} = 6 \text{ mins} \, (\times 10)$ MA1

$12.5\,\text{km} = 60 \text{ mins} = 1 \text{ hour}$ A1

8.

$V = 90 \times 45 \times 30 = 121500$ MA1

$D = \dfrac{24300}{121500}$ MA1

$ = 0.2 \text{ g/cm}^3$ (units mark)   A1A1

9.

(a) $1306 + 26$ minutes $+ 18$ minutes   M1

$\ = 1350$ A1

Has to wait 34 minutes   A1

(b) $1424 - 1509 = 45$ mins $(\frac{3}{4}\text{ hr})$ MA1

$\text{Speed} = \dfrac{54}{\frac{3}{4}}$ **or**   54 miles in 45 minutes

 18 miles in 15 mins [or 1.2 miles in 1 min]   MA1

$\ = 72$ A1

10.

(b) $2000 \div 14.5$ MA1

137.9310.......   A1

2 minutes 18 seconds   A1

11.

$34.2 \times 12 = 410.4$ MA1

0.83×410.4 MA1

$= 340.632$ A1

12.

$156 \div 48$ MA1
3.25 A1
$12.45\,(\text{pm})$ A1

13.

Circumference of large circle $= \pi d = 18.84955592$ MA1
Outer edge of large semicircle $= (\pi \times 6)/2 = 9.424777961$ MA1
Outer edge of 1 small semicircle $= (\pi \times 2)/2 = 3.141592654$ MA1
Total $= 9.424777961 + 3 \times 3.141592654 = 18.8\,(4955592)$ MA1

14.

$2\pi r = 100.5309649$ MA1

$\frac{1}{9}$ of $(100.5309649) = 11.17$ MA1
43.17 A1

15.

$$\frac{315}{360} \times \pi \times 8^2$$

$= 175.9 \text{ cm}^2$

MA2

A1

16.

Area of sector $= \dfrac{120}{360} \times \pi \times 6^2 = 12\pi = 37.699$ MA1 A1

Area of triangle $= \frac{1}{2} \times 6 \times 6 \times \sin 120 = 15.588$ MA1

Area of segment $= 37.699 - 15.588 = 22.111$ A1

17.

(a) $d^2 = 1^2 + 1^2$ M1

$d = 1.4142 \dots$ A1

Area of half square $= 0.5$ MA1

Area of semi-circle ?

$= \frac{1}{2} \times \pi \times 0.707^2$

$= 0.785$ MA1

Total area $= 1.285$

(b) $F = 5 \times 1.285$

$= 6.42(58 \dots)$ M1 A1

18.

$\pi \times 50 = 157(.0796...)$ MA1

$157(.0796...) + 300 = 457(.0796...)$ MA1

$10000 \div 457(.0796...)$ M1

$21.8(7802...)$ so she needs to walk 22 laps   A1

19.

Area of large circle $= \pi \times 6^2 = 113.0973355$ M1 A1

Area of each semicircle $= \dfrac{1}{2} \times \pi \times 2^2 = 6.283185307$ MA1

Shaded area $= 113.0973355 - 3 \times 6.283185307$ (must use 3 semicircles)   M1
$= 94.24777961$ A1

20.

$A = \dfrac{305}{360} \times \pi \times 3^2$ MA1

$= 23.95\,(464\,398)$ A1
accept any correct rounding

21.

$V = \dfrac{1}{3}\pi \times 3.75^2 \times 5$ MA1

$= 73.6\,\text{m}^3$ A1

22.

$2\pi \times 8 \times 36$ M1

576π A1

$4\pi r^2 = 576\pi$ M1

$r^2 = 144, \therefore r = 12$ A1

23.

Radius $= 23 \div 2\pi = 3.66\,(056369\ldots)$ M1 A1

Volume $= \pi \times (3.66)^2 \times 10.5$ MA1

$\quad\quad = 442.0\,(130657\ldots)$ A1

24.

Volume of lead needed $= \dfrac{4}{3}\pi \times 2^3 \times 100$ M1

$\quad\quad\quad = 3351.032164\,\text{cm}^3$ A1

$\sqrt[3]{3351.03\,(2164)} = 14.96$ MA1

Side length $= 15\,\text{cm}$ A1

25.

$\pi \times 40^2 \times 150$ MA2

$= 753982.2369$ A1

$= 754\ \text{litres}$ MA1

26.

SA of sphere = $4 \times \pi \times 6^2 = 452$ MA1

SA hemisphere = 226   MA1

base = $\pi \times 6^2 = 113$ MA1

total = 339

Martha is correct   MA1

27.

$4 \times \pi \times 6^2$ MA1

$= 452.38(93421)$ A1

28.

$2 \times \pi \times 3.4 = 21.3628(3004)$ MA1

$21.3628 + 1 = 22.3628$ MA1

$22.3628 \times 12 = 268.35(39605)$ MA1

alternative solution

$2 \times \pi \times 3.4 \times 12 = 256.3539(605)$ MA2

$256.3539(605) + 1 \times 12 = 268.35(39605)$ MA1