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EDEXCEL GCSE (9-1) MATHS: QUESTIONS BY TOPIC

Perimeter, Area & Volume (G4)

GCSE (9-1) Mathematics (1MA1) · Higher tier

66 questions · 273 marks · Mark schemes included

Past papers June 2017 - June 2025 · 3 sub-topics

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HOW TO USE THIS BOOKLET

Questions are grouped by sub-topic and run from the lowest to the highest mark tariff, then oldest paper first.

Click any row below to jump straight to that sub-topic or question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme; < QUESTION brings you back.

A gold bar in the left margin marks exactly where the question sits on the original page.

Diagrams, graphs, grids and tables are printed exactly as they appear in the original papers.

Each question is filed under its main topic; longer questions may also test skills from other topics.

QUESTION	SOURCE	MARKS	PAGE
G4a PERIMETER & AREA OF 2D SHAPES		12 Qs · 52 marks	3
1. Q3	GCSE Paper 3H June 2018	2	4
2. Q7	GCSE Paper 3H June 2022	3	5
3. Q8	GCSE Paper 1H June 2018	4	6
4. Q7	GCSE Paper 1H June 2019	4	7
5. Q14	GCSE Paper 3H June 2019	4	8
6. Q5	GCSE Paper 1H June 2017	5	9
7. Q6	GCSE Paper 3H November 2017	5	10
8. Q5	GCSE Paper 2H November 2018	5	11
9. Q18	GCSE Paper 1H November 2021	5	12
10. Q4	GCSE Paper 2H June 2022	5	13
11. Q24	GCSE Paper 2H June 2023	5	14
12. Q3	GCSE Paper 1H June 2024	5	16
G4b CIRCLES, ARCS & SECTORS		25 Qs · 100 marks	18
13. Q12	GCSE Paper 3H November 2023	2	19
14. Q3	GCSE Paper 2H November 2017	3	20
15. Q13	GCSE Paper 2H November 2018	3	21
16. Q13	GCSE Paper 1H June 2022	3	22
17. Q15	GCSE Paper 1H November 2022	3	23
18. Q10	GCSE Paper 1H November 2023	3	24
19. Q11	GCSE Paper 3H November 2024	3	25
20. Q21	GCSE Paper 2H June 2017	4	26
21. Q8	GCSE Paper 3H June 2017	4	27
22. Q4	GCSE Paper 1H November 2017	4	28
23. Q7	GCSE Paper 1H November 2018	4	29
24. Q12	GCSE Paper 2H June 2019	4	30
25. Q7	GCSE Paper 2H November 2020	4	31
26. Q7	GCSE Paper 3H November 2021	4	32
27. Q12	GCSE Paper 2H June 2023	4	33
28. Q14	GCSE Paper 3H June 2023	4	34
29. Q15	GCSE Paper 1H June 2024	4	35
30. Q17	GCSE Paper 2H June 2017	5	36
31. Q18	GCSE Paper 3H June 2017	5	37
32. Q20	GCSE Paper 2H November 2017	5	38
33. Q16	GCSE Paper 3H November 2018	5	39



QUESTION	SOURCE	MARKS	PAGE
34. Q22	GCSE Paper 1H November 2020	5	40
35. Q21	GCSE Paper 1H June 2022	5	41
36. Q4	GCSE Paper 2H November 2022	5	42
37. Q3	GCSE Paper 2H June 2025	5	43
G4c VOLUME & SURFACE AREA		29 Qs · 121 marks	45
38. Q19	GCSE Paper 2H November 2019	2	46
39. Q12	GCSE Paper 1H June 2019	3	47
40. Q6	GCSE Paper 1H November 2021	3	48
41. Q19	GCSE Paper 2H November 2021	3	49
42. Q9	GCSE Paper 1H June 2022	3	50
43. Q9	GCSE Paper 3H June 2024	3	51
44. Q15	GCSE Paper 1H June 2019	4	52
45. Q4	GCSE Paper 2H June 2019	4	53
46. Q18	GCSE Paper 2H November 2020	4	54
47. Q7	GCSE Paper 1H November 2021	4	55
48. Q3	GCSE Paper 1H June 2023	4	56
49. Q16	GCSE Paper 1H June 2023	4	57
50. Q7	GCSE Paper 2H November 2023	4	58
51. Q19	GCSE Paper 3H November 2023	4	59
52. Q17	GCSE Paper 2H June 2024	4	61
53. Q7	GCSE Paper 3H June 2024	4	62
54. Q19	GCSE Paper 3H November 2024	4	63
55. Q16	GCSE Paper 3H June 2025	4	64
56. Q19	GCSE Paper 2H June 2018	5	65
57. Q20	GCSE Paper 2H November 2018	5	66
58. Q8	GCSE Paper 3H November 2018	5	68
59. Q6	GCSE Paper 3H June 2019	5	69
60. Q9	GCSE Paper 2H November 2019	5	70
61. Q23	GCSE Paper 3H November 2019	5	71
62. Q9	GCSE Paper 3H November 2020	5	73
63. Q17	GCSE Paper 2H June 2022	5	74
64. Q18	GCSE Paper 3H June 2023	5	75
65. Q21	GCSE Paper 1H June 2024	5	76
66. Q24	GCSE Paper 1H November 2022	6	77



QUESTIONS

66 questions · 273 marks · 3 sub-topics

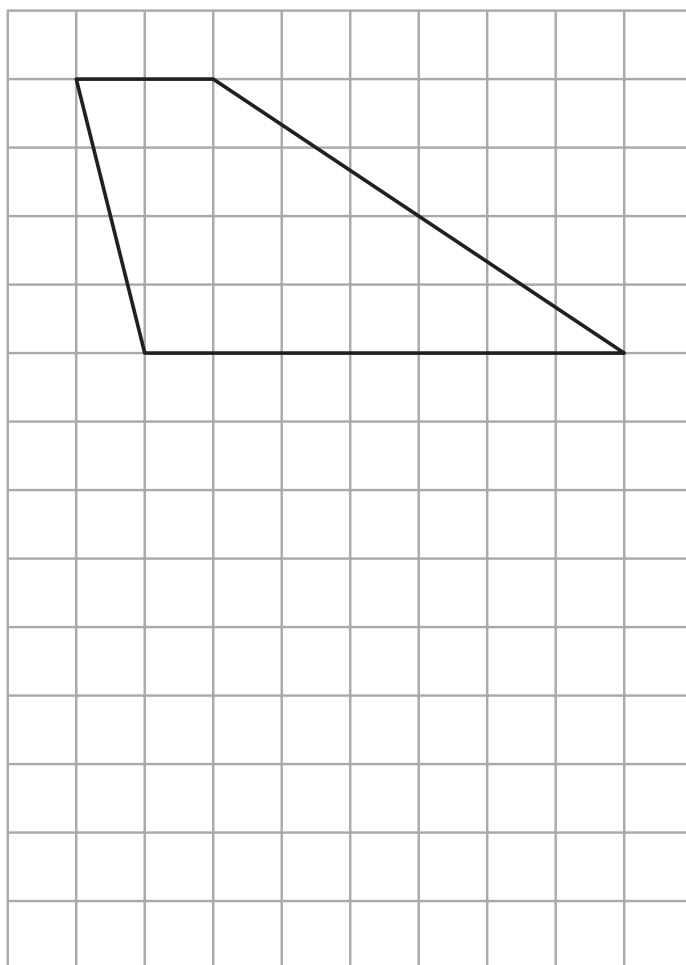
SUB-TOPIC G4a

PERIMETER & AREA OF 2D SHAPES

Sub-topic G4a · 12 questions · 52 marks · lowest tariff first



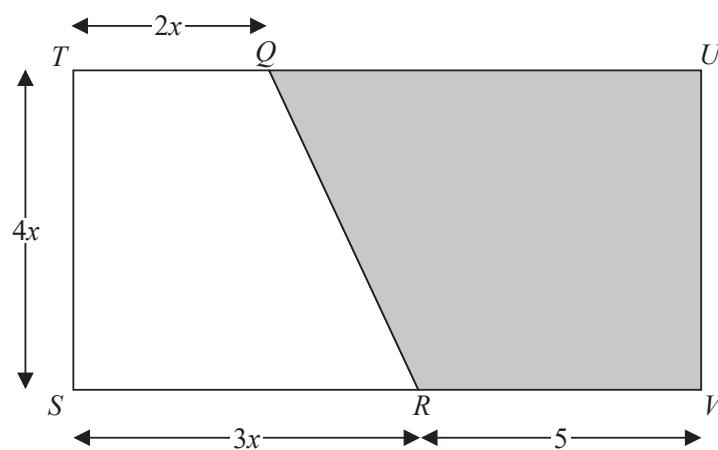
- 3 Here is a trapezium drawn on a centimetre grid.



On the grid, draw a triangle equal in area to this trapezium.

(Total for Question 3 is 2 marks)

- 7 The diagram shows rectangle $STUV$.
 TQU and SRV are straight lines.
All measurements are in cm.



The area of trapezium $QUVR$ is $A \text{ cm}^2$

Show that $A = 2x^2 + 20x$

(Total for Question 7 is 3 marks)

- 8 The perimeter of a right-angled triangle is 72 cm.
The lengths of its sides are in the ratio 3 : 4 : 5

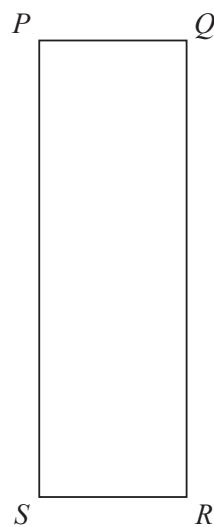
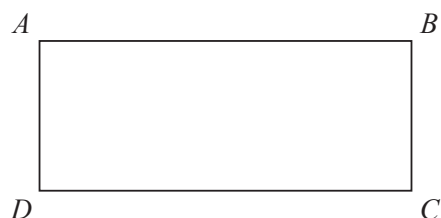
Work out the area of the triangle.

.....cm²

(Total for Question 8 is 4 marks)



7 Here are two rectangles.



$$QR = 10 \text{ cm}$$

$$BC = PQ$$

The perimeter of $ABCD$ is 26 cm

The area of $PQRS$ is 45 cm^2

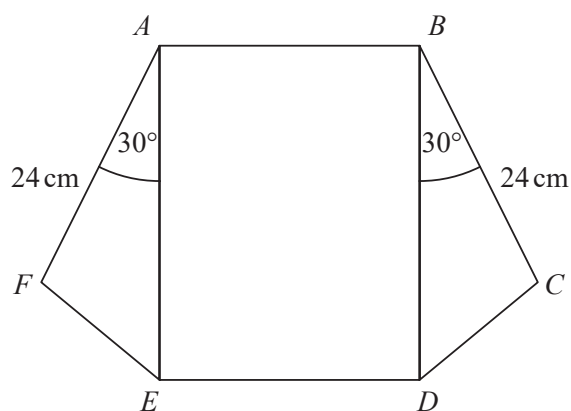
Find the length of AB .

..... cm

(Total for Question 7 is 4 marks)



- 14 The diagram shows a rectangle, $ABDE$, and two congruent triangles, AFE and BCD .



area of rectangle $ABDE$ = area of triangle AFE + area of triangle BCD

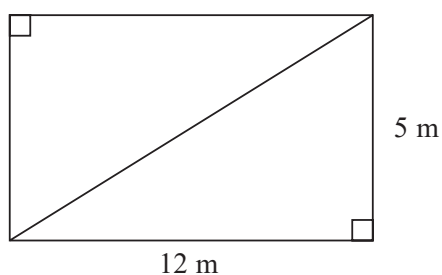
$$AB : AE = 1 : 3$$

Work out the length of AE .

..... cm

(Total for Question 14 is 4 marks)

- 5 This rectangular frame is made from 5 straight pieces of metal.



The weight of the metal is 1.5 kg per metre.

Work out the total weight of the metal in the frame.

..... kg

(Total for Question 5 is 5 marks)

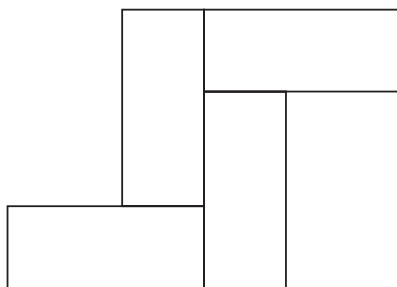


6 Here is a rectangle.



The length of the rectangle is 7 cm longer than the width of the rectangle.

4 of these rectangles are used to make this 8-sided shape.



The perimeter of the 8-sided shape is 70 cm.

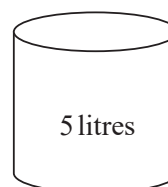
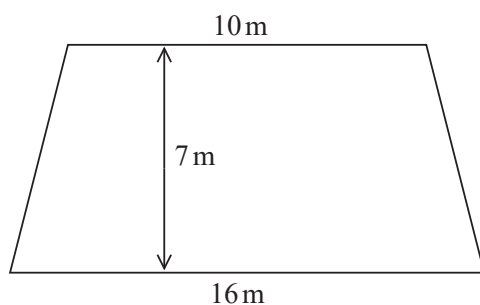
Work out the area of the 8-sided shape.

..... cm²

(Total for Question 6 is 5 marks)



- 5 The diagram shows a floor in the shape of a trapezium.



£16.99

John is going to paint the floor.

Each 5 litre tin of paint costs £16.99

1 litre of paint covers an area of 2 m^2

John has £160 to spend on paint.

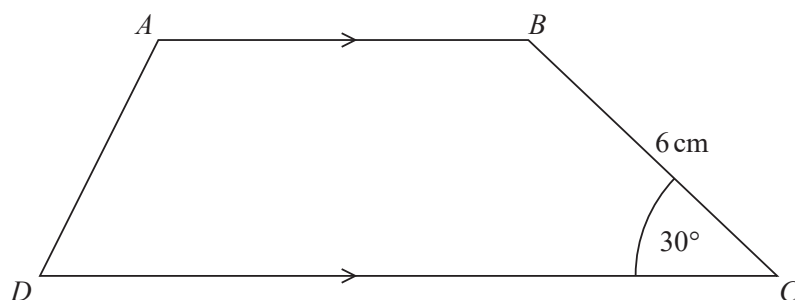
Has John got enough money to buy all the paint he needs?

You must show how you get your answer.

(Total for Question 5 is 5 marks)



18 Here is trapezium $ABCD$.



The area of the trapezium is 66 cm^2

the length of AB : the length of $CD = 2 : 3$

Find the length of AB .

..... cm

(Total for Question 18 is 5 marks)



- 4 Festival A will be in a rectangular field with an area of $80\,000\text{ m}^2$
The greatest number of people allowed to attend Festival A is 425

Festival B will be in a rectangular field 700 m by 2000 m.

The greatest number of people allowed to attend Festival B is 6750

The area per person allowed for Festival B is greater than the area per person allowed for Festival A.

- (a) How much greater?

Give your answer correct to the nearest whole number.

..... m^2
(4)

Callum says,

“ 300 cm^2 is the same as 3 m^2 because there are 100 cm in 1 m so you divide by 100”

Callum’s method is wrong.

- (b) Explain why.

.....

.....

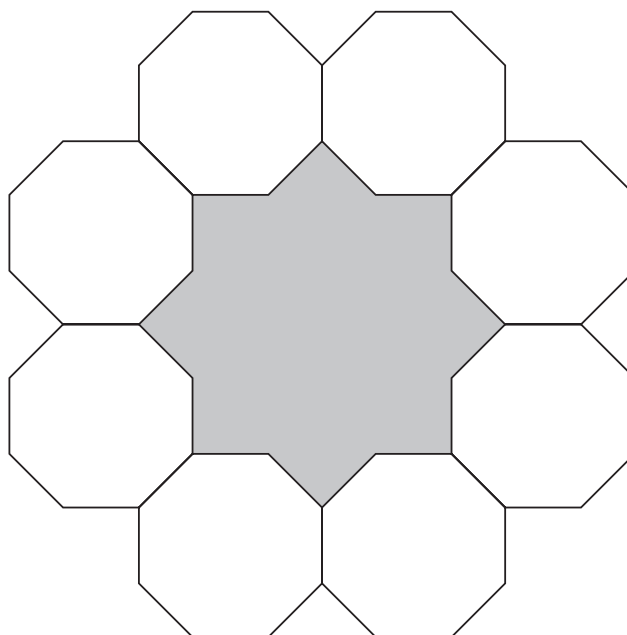
.....

(1)

(Total for Question 4 is 5 marks)



- 24 The diagram shows 8 identical regular octagons joined to enclose a shaded shape.



Each octagon has sides of length a .

Find, in terms of a , an expression for the area of the shaded shape.

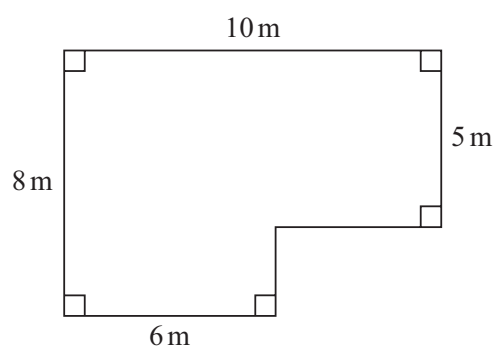
Give your answer in the form $p(2 + \sqrt{2})a^2$ where p is an integer.
You must show all your working.

(Total for Question 24 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



- 3 The diagram shows a plan of a floor.



Petra is going to cover the floor with paint.

Petra has 3 tins of paint.

There are 2.5 litres of paint in each tin.

Petra thinks 1 litre of paint will cover 10 m^2 of floor.

- (a) Assuming Petra is correct, does she have enough paint to cover the floor?
You must show all your working.

(4)



Actually, 1 litre of paint will cover 11 m^2 of floor.

- (b) Does this affect your answer to part (a)?
You must give a reason for your answer.

.....

.....

.....

(1)

(Total for Question 3 is 5 marks)



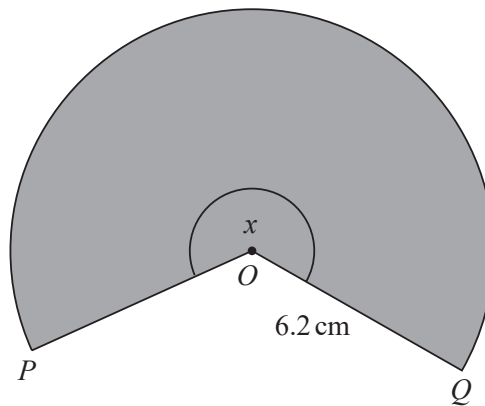
SUB-TOPIC G4b

CIRCLES, ARCS & SECTORS

Sub-topic G4b · 25 questions · 100 marks · lowest tariff first



- 12 The diagram shows a shaded sector POQ of a circle with centre O and radius 6.2 cm .



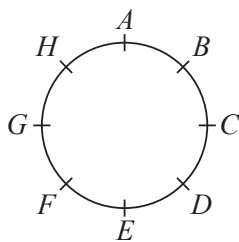
The area of the shaded sector is 82.6 cm^2

Calculate the size of angle x .

Give your answer correct to 3 significant figures.

(Total for Question 12 is 2 marks)

- 3 Hasmeet walks once round a circle with diameter 80 metres.

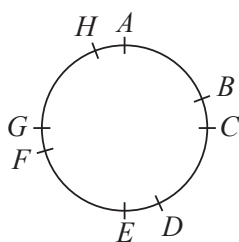


There are 8 points equally spaced on the circumference of the circle.

- (a) Find the distance Hasmeet walks between one point and the next point.

.....m
(2)

Four of the points are moved, as shown in the diagram below.



Hasmeet walks once round the circle again.

- (b) Has the mean distance that Hasmeet walks between one point and the next point changed?
You must give a reason for your answer.

.....
.....
(1)

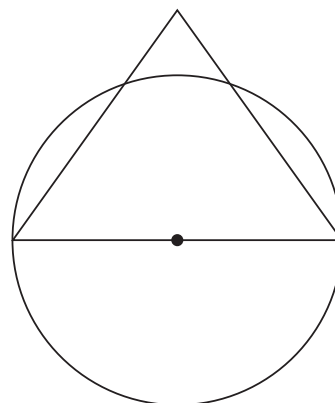
(Total for Question 3 is 3 marks)

- 13 The diagram shows a circle and an equilateral triangle.

One side of the equilateral triangle is a diameter of the circle.
The circle has a circumference of 44 cm.

Work out the area of the triangle.

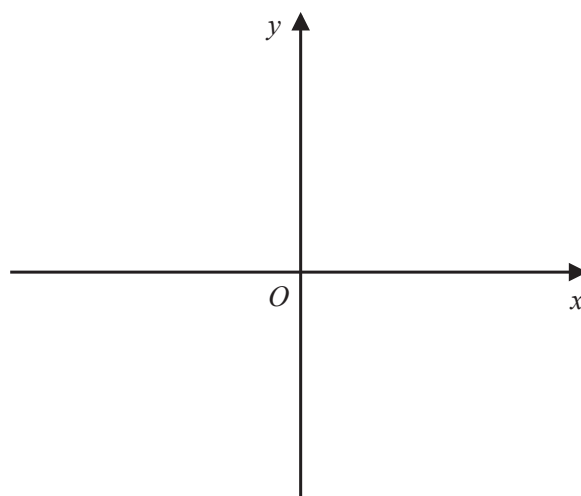
Give your answer correct to 3 significant figures.



.....cm²

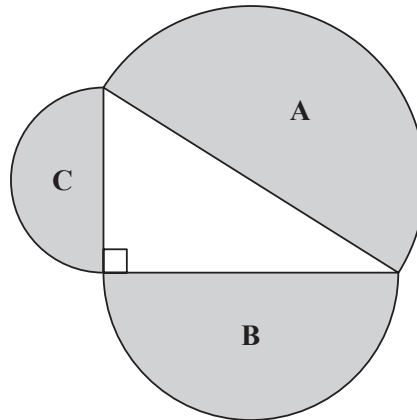
(Total for Question 13 is 3 marks)

- 14 On the grid, sketch the curve with equation $y = 2^x$
Give the coordinates of any points of intersection with the axes.



(Total for Question 14 is 2 marks)

- 13 A right-angled triangle is formed by the diameters of three semicircular regions, **A**, **B** and **C** as shown in the diagram.

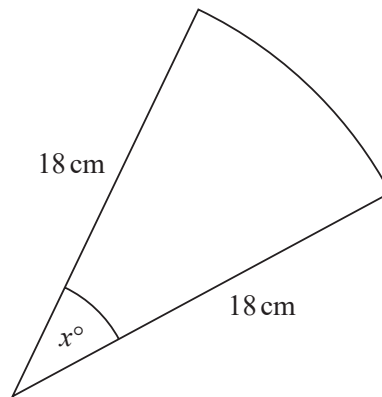


Show that

$$\text{area of region A} = \text{area of region B} + \text{area of region C}$$

(Total for Question 13 is 3 marks)

- 15 The diagram shows a sector of a circle of radius 18 cm.



The length of the arc is 4π cm.

Work out the value of x .

$x = \dots\dots\dots$

(Total for Question 15 is 3 marks)

10 The circumference of a circle is 10m.

Work out the area of the circle.

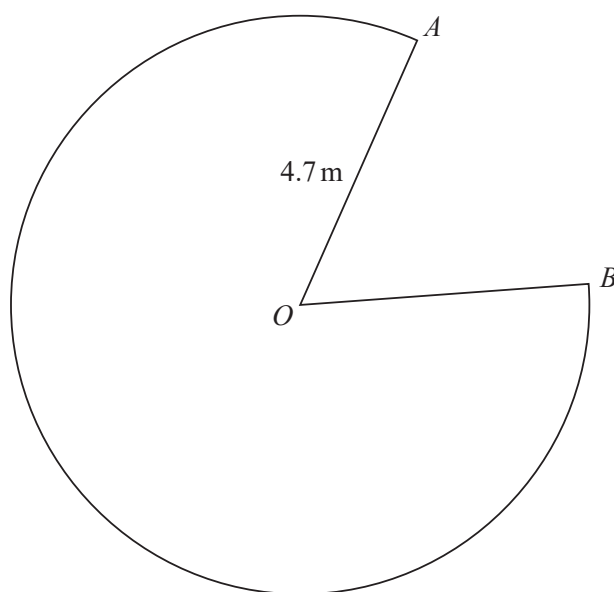
Give your answer in terms of π .

..... m²

(Total for Question 10 is 3 marks)



- 11 OAB is a sector of a circle with centre O and radius 4.7 m.



The sector has a perimeter of 34.3 m.

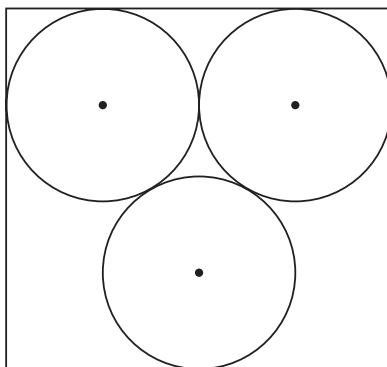
Find the size of the reflex angle AOB .

Give your answer correct to the nearest degree.

(Total for Question 11 is 3 marks)



- 21 The diagram shows 3 identical circles inside a rectangle. Each circle touches the other two circles and the sides of the rectangle, as shown in the diagram.



The radius of each circle is 24 mm.

Work out the area of the rectangle.

Give your answer correct to 3 significant figures.

..... mm²

(Total for Question 21 is 4 marks)

- 8 A square, with sides of length x cm, is inside a circle.
Each vertex of the square is on the circumference of the circle.

The area of the circle is 49 cm^2 .

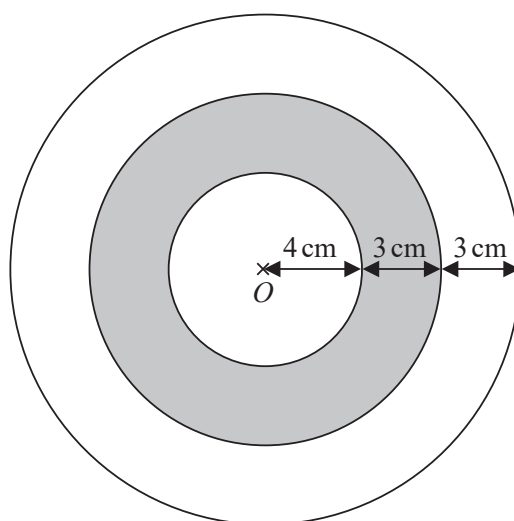
Work out the value of x .

Give your answer correct to 3 significant figures.

(Total for Question 8 is 4 marks)



- 4 The diagram shows a logo made from three circles.



Each circle has centre O .

Daisy says that exactly $\frac{1}{3}$ of the logo is shaded.

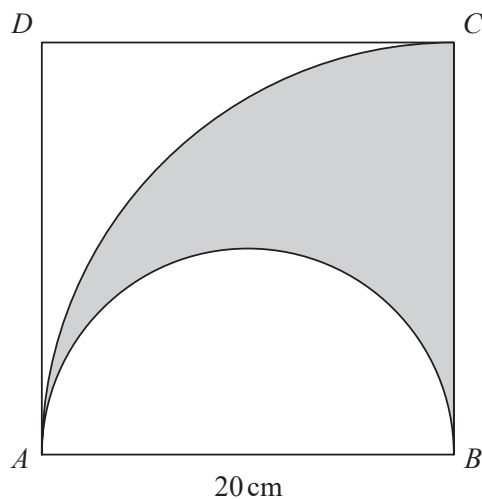
Is Daisy correct?

You must show all your working.

(Total for Question 4 is 4 marks)



- 7 The diagram shows a square $ABCD$ with sides of length 20 cm. It also shows a semicircle and an arc of a circle.



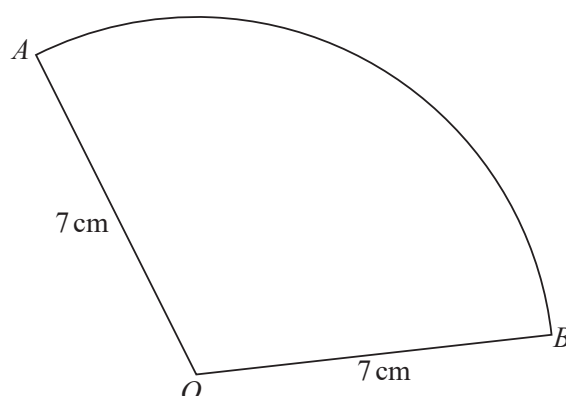
AB is the diameter of the semicircle.

AC is an arc of a circle with centre B .

Show that $\frac{\text{area of shaded region}}{\text{area of square}} = \frac{\pi}{8}$

(Total for Question 7 is 4 marks)

12 OAB is a sector of a circle with centre O and radius 7 cm .



The area of the sector is 40 cm^2

Calculate the perimeter of the sector.

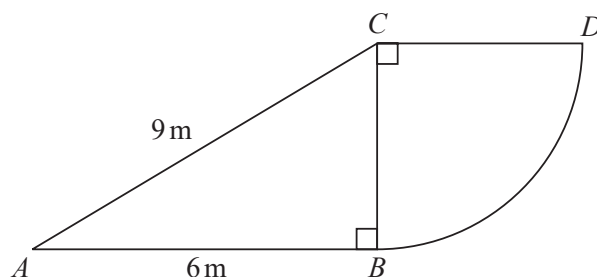
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 12 is 4 marks)



- 7 The diagram shows a right-angled triangle and a quarter circle.



The right-angled triangle ABC has angle $ABC = 90^\circ$
The quarter circle has centre C and radius CB .

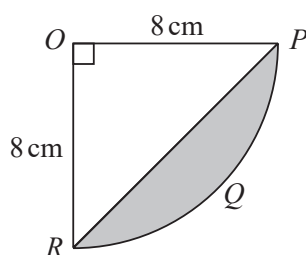
Work out the area of the quarter circle.
Give your answer correct to 3 significant figures.
You must show all your working.

..... m^2

(Total for Question 7 is 4 marks)



- 7 The diagram shows a sector $OPQR$ of a circle, centre O and radius 8 cm.



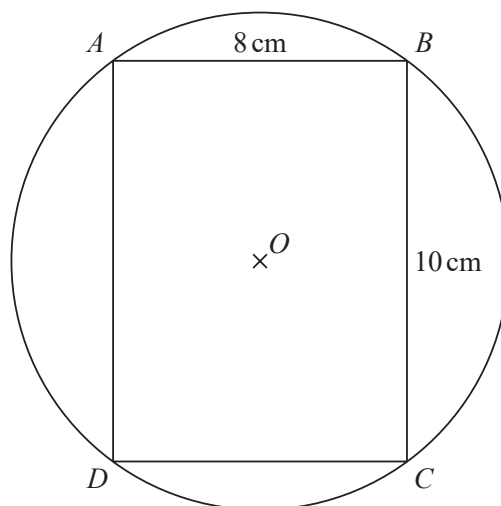
OPR is a triangle.

Work out the area of the shaded segment PQR .
Give your answer correct to 3 significant figures.

..... cm²

(Total for Question 7 is 4 marks)

- 12 The points A , B , C and D lie on a circle, centre O .
 $ABCD$ is a rectangle.



$$AB = 8 \text{ cm} \quad BC = 10 \text{ cm}$$

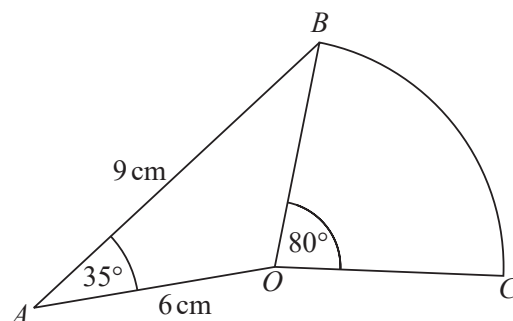
Work out the circumference of the circle.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 12 is 4 marks)



- 14 OAB is a triangle.
 OBC is a sector of a circle, centre O .



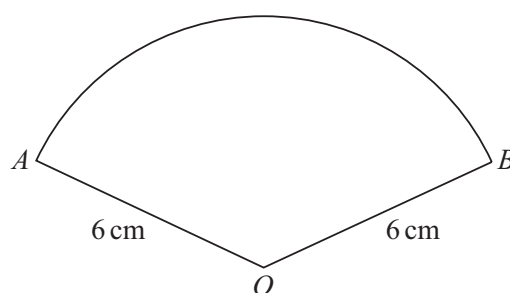
Calculate the area of OBC .
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 14 is 4 marks)



15 OAB is a sector of a circle with centre O and radius 6 cm.



The length of the arc AB is 5π cm.

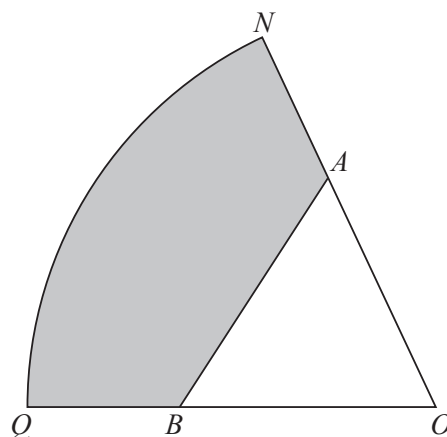
Work out, in terms of π , the area of the sector.
Give your answer in its simplest form.

..... cm^2

(Total for Question 15 is 4 marks)



17



ONQ is a sector of a circle with centre O and radius 11 cm.

A is the point on ON and B is the point on OQ such that AOB is an equilateral triangle of side 7 cm.

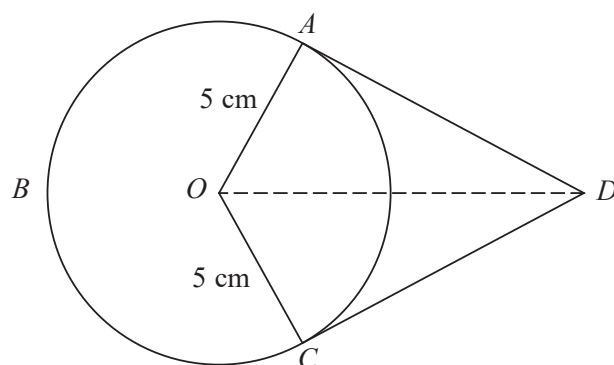
Calculate the area of the shaded region as a percentage of the area of the sector ONQ .
Give your answer correct to 1 decimal place.

.....%

(Total for Question 17 is 5 marks)



18



A , B and C are points on a circle of radius 5 cm, centre O .

DA and DC are tangents to the circle.

$DO = 9$ cm

Work out the length of arc ABC .

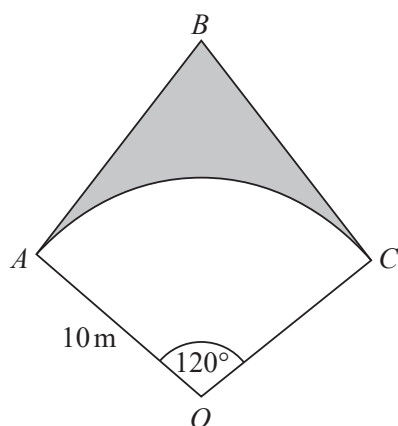
Give your answer correct to 3 significant figures.

..... cm

(Total for Question 18 is 5 marks)



20



OAC is a sector of a circle, centre O , radius 10 m .

BA is the tangent to the circle at point A .

BC is the tangent to the circle at point C .

Angle $AOC = 120^\circ$

Calculate the area of the shaded region.

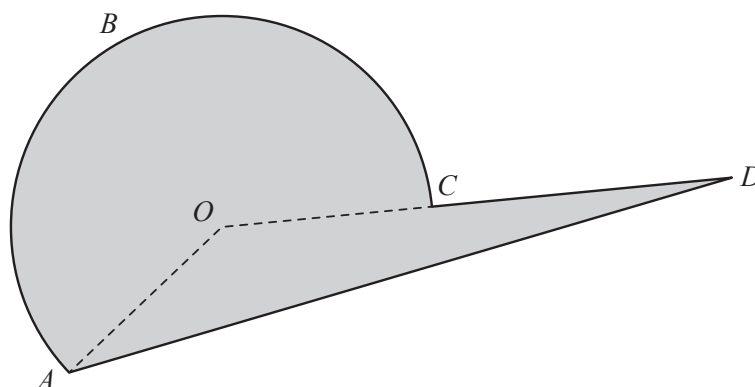
Give your answer correct to 3 significant figures.

..... m^2

(Total for Question 20 is 5 marks)



16 Here is a shaded shape $ABCD$.



The shape is made from a triangle and a sector of a circle, centre O and radius 6 cm.
 OCD is a straight line.

$$AD = 14 \text{ cm}$$

$$\text{Angle } AOD = 140^\circ$$

$$\text{Angle } OAD = 24^\circ$$

Calculate the perimeter of the shape.

Give your answer correct to 3 significant figures.

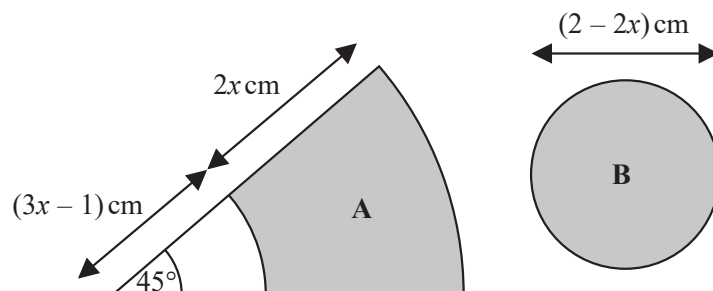
.....cm

(Total for Question 16 is 5 marks)

22 The diagram shows two shaded shapes, **A** and **B**.

Shape **A** is formed by removing a sector of a circle with radius $(3x - 1)$ cm from a sector of the circle with radius $(5x - 1)$ cm.

Shape **B** is a circle of diameter $(2 - 2x)$ cm.



The area of shape **A** is equal to the area of shape **B**.

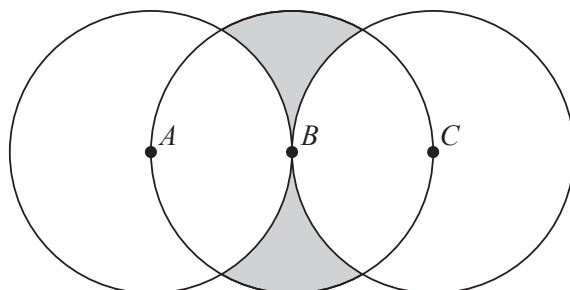
Find the value of x .

You must show all your working.

(Total for Question 22 is 5 marks)

21 The diagram shows three circles, each of radius 4 cm.

The centres of the circles are A , B and C such that ABC is a straight line and $AB = BC = 4$ cm.



Work out the total area of the two shaded regions.
Give your answer in terms of π

..... cm²

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

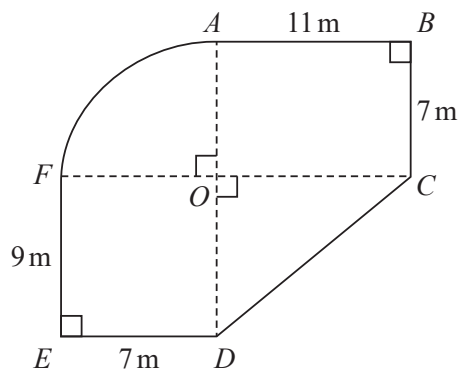


- 4 The diagram shows a plan of Jason's garden.

$ABCO$ and $DEFO$ are rectangles.

CDO is a right-angled triangle.

AFO is a sector of a circle with centre O and angle $AOF = 90^\circ$



Jason is going to cover his garden with grass seed.

Each bag of grass seed covers 14 m^2 of garden.

Each bag of grass seed costs £10.95

Work out how much it will cost Jason to buy all the bags of grass seed he needs.

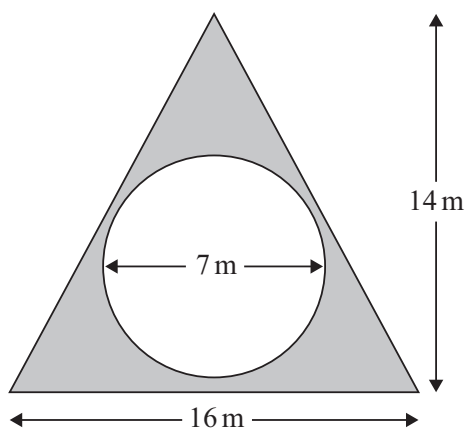
£.....

(Total for Question 4 is 5 marks)



- 3 Here is a plan of part of Macsen's garden.

There is a circle inside a triangle.
The circle has a diameter of 7 m.



Macsen will cover the shaded area with gravel.

Gravel is sold in bags.

Each bag of gravel covers an area of 12.5 m^2

- (a) Work out the number of bags of gravel Macsen will need.

..... bags
(4)

Macsen finds that each bag of gravel only covers an area of 11 m^2

(b) How does this affect your answer to part (a)?

.....

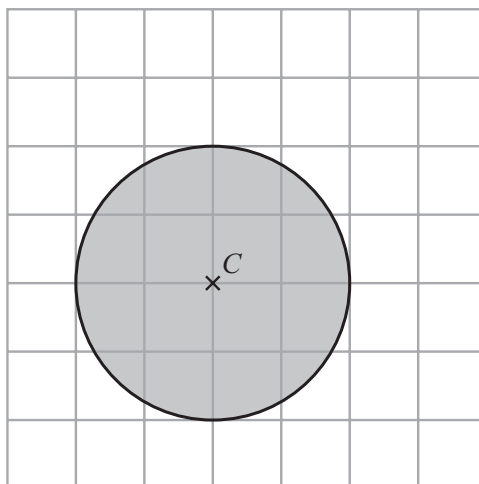
.....

.....

(1)

(Total for Question 3 is 5 marks)

4 The point C is shown on a centimetre grid.



A point P is at least 2 cm from the point C .

Nadia is asked to shade the region where point P could be.

Her answer is shown on the grid.

Explain the mistake Nadia has made.

.....

.....

.....

(Total for Question 4 is 1 mark)

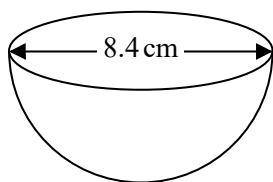
SUB-TOPIC G4c

VOLUME & SURFACE AREA

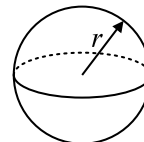
Sub-topic G4c · 29 questions · 121 marks · lowest tariff first



- 19 The diagram shows a hemisphere with diameter 8.4 cm.



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



Work out the volume of the hemisphere.
Give your answer correct to 3 significant figures.

..... cm³

(Total for Question 19 is 2 marks)

20 $d = \frac{1}{8} c^3$

$c = 10.9$ correct to 3 significant figures.

By considering bounds, work out the value of d to a suitable degree of accuracy.
Give a reason for your answer.

(Total for Question 20 is 4 marks)

Richard says that the people on coach A vary more in age than the people on coach B.

(c) Is Richard correct?

You must give a reason for your answer.

.....

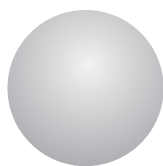
.....

.....

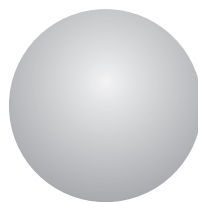
(1)

(Total for Question 11 is 4 marks)

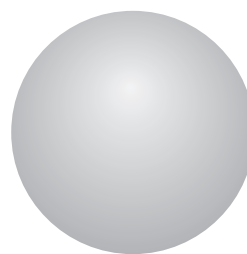
12 Here are three spheres.



P



Q



R

The volume of sphere **Q** is 50% more than the volume of sphere **P**.

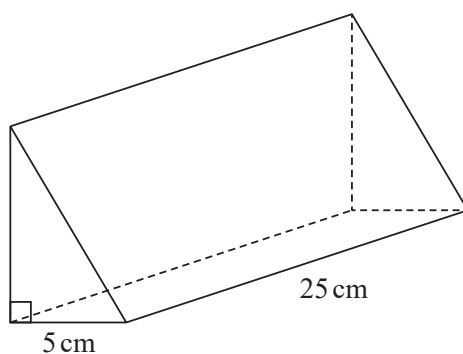
The volume of sphere **R** is 50% more than the volume of sphere **Q**.

Find the volume of sphere **P** as a fraction of the volume of sphere **R**.

(Total for Question 12 is 3 marks)



- 6 The diagram shows a prism.



The cross section of the prism is a right-angled triangle.
The base of the triangle has length 5 cm

The prism has length 25 cm
The prism has volume 750 cm^3

Work out the height of the prism.

..... cm

(Total for Question 6 is 3 marks)



19 **A**, **B** and **C** are three spheres.

The volume of sphere **A** is 125 cm^3

The volume of sphere **B** is 27 cm^3

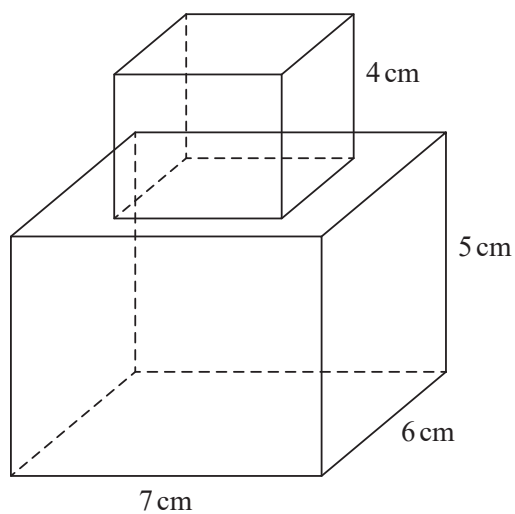
The ratio of the radius of sphere **B** to the radius of sphere **C** is $1:2$

Work out the ratio of the surface area of sphere **A** to the surface area of sphere **C**.

(Total for Question 19 is 3 marks)



- 9 A cube is placed on top of a cuboid, as shown in the diagram, to form a solid.



The cube has edges of length 4 cm.
The cuboid has dimensions 7 cm by 6 cm by 5 cm.

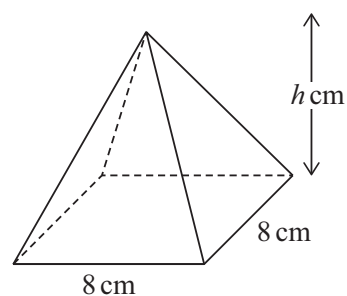
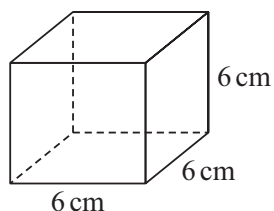
Work out the total surface area of the solid.

..... cm²

(Total for Question 9 is 3 marks)



- 9 The diagram shows a cube and a square-based pyramid.



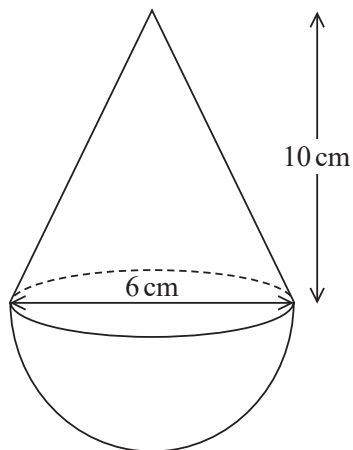
The volume of the cube is equal to the volume of the pyramid.

Work out the perpendicular height, h cm, of the pyramid.

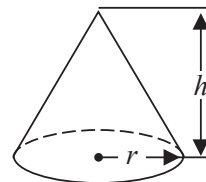
..... cm

(Total for Question 9 is 3 marks)

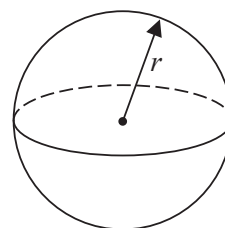
- 15 The diagram shows a solid shape.
The shape is a cone on top of a hemisphere.



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



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



The height of the cone is 10 cm.
The base of the cone has a diameter of 6 cm.
The hemisphere has a diameter of 6 cm.

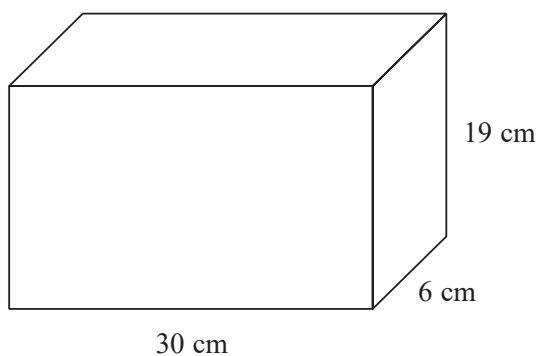
The total volume of the shape is $k\pi \text{ cm}^3$, where k is an integer.

Work out the value of k .

$k = \dots\dots\dots$

(Total for Question 15 is 4 marks)

- 4 A container is in the shape of a cuboid.



The container is $\frac{2}{3}$ full of water.

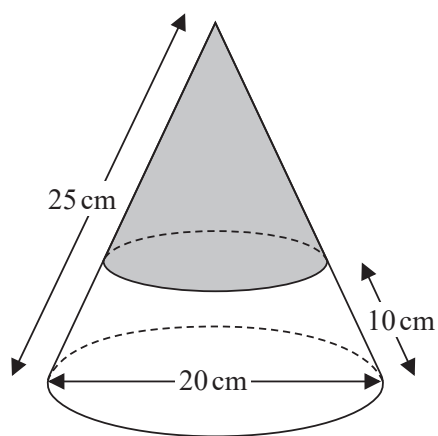
A cup holds 275 ml of water.

What is the greatest number of cups that can be completely filled with water from the container?

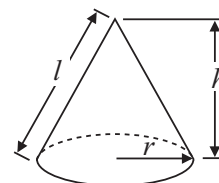
(Total for Question 4 is 4 marks)



18 The diagram represents a solid cone.



Curved surface
area of cone = $\pi r l$



The cone has a base diameter of 20 cm and a slant height of 25 cm.

A circle is drawn around the surface of the cone at a slant height of 10 cm above the base.
The curved surface of the cone above the circle is painted grey.

Work out the area of the curved surface of the cone that is **not** painted grey.

Give your answer as a multiple of π

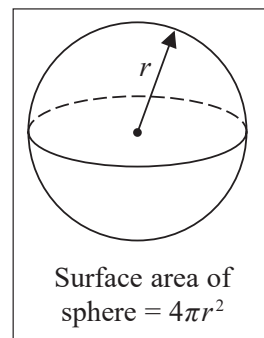
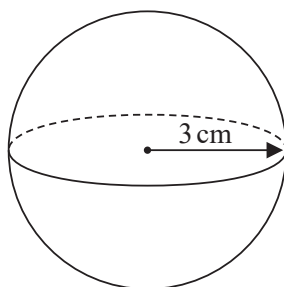
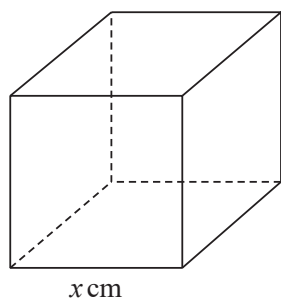
You must show all your working.

..... cm²

(Total for Question 18 is 4 marks)



- 7 The diagram shows a cube with edges of length x cm and a sphere of radius 3 cm.



The surface area of the cube is equal to the surface area of the sphere.

Show that $x = \sqrt{k\pi}$ where k is an integer.

(Total for Question 7 is 4 marks)

3 A cube has a total surface area of 150 cm^2

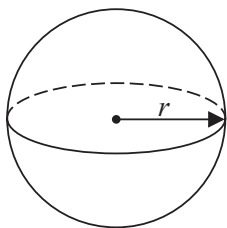
Work out the volume of the cube.

..... cm^3

(Total for Question 3 is 4 marks)



16 Here is a sphere.



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

$\frac{3}{8}$ of the surface area of this sphere is $75\pi \text{ cm}^2$

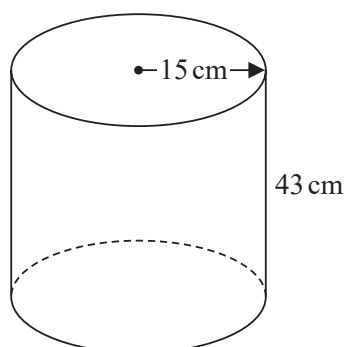
Find the diameter of the sphere.

Give your answer in the form $a\sqrt{b}$ where a is an integer and b is a prime number.

..... cm

(Total for Question 16 is 4 marks)

- 7 The diagram shows an empty tank in the shape of a cylinder.



The cylinder has radius 15 cm and height 43 cm.

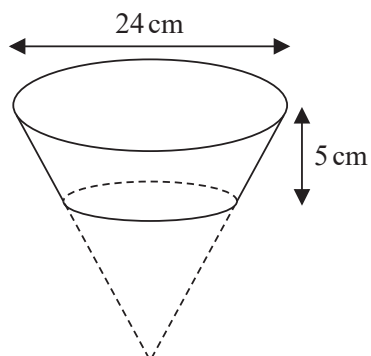
Water flows into the tank at a rate of 0.47 litres per minute.

Calculate the number of minutes it will take to completely fill the tank.
Give your answer correct to the nearest minute.

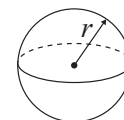
..... minutes

(Total for Question 7 is 4 marks)

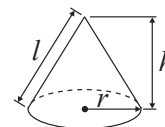
19



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



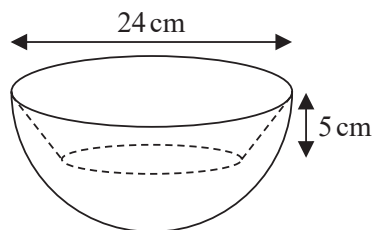
$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$



The diagram above shows a frustum **F** of a cone.

The frustum is made by removing a cone with height 10 cm from a solid cone with height 15 cm and base diameter 24 cm.

The solid **S** is made by removing **F** from a solid hemisphere as shown in the diagram below.



The hemisphere has diameter 24 cm.

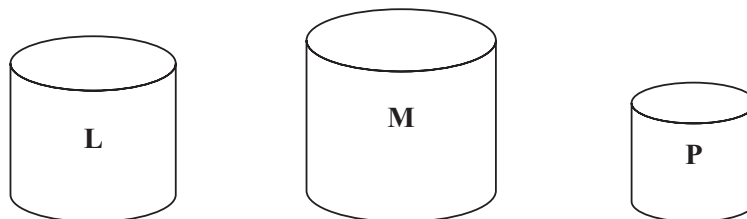
Calculate the volume of solid **S**.

Give your answer correct to 3 significant figures.

(Total for Question 19 is 4 marks)



17 **L**, **M** and **P** are three similar solid cylinders made from the same material.



L has a mass of 64 g

M has a mass of 125 g

M has a total surface area of 144 cm^2

P has a total surface area of 16 cm^2

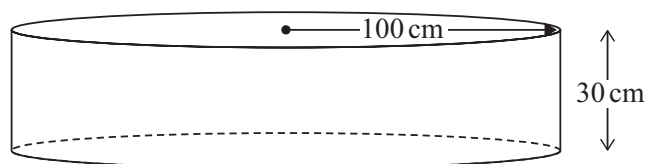
Work out

height of cylinder **L** : height of cylinder **M** : height of cylinder **P**

(Total for Question 17 is 4 marks)



- 7 A paddling pool is in the shape of a cylinder.



The pool has radius 100 cm.

The pool has depth 30 cm.

The pool is empty.

It is then filled with water at a rate of 250 cm^3 per second.

Work out the number of minutes it takes to fill the pool completely.

Give your answer correct to the nearest minute.

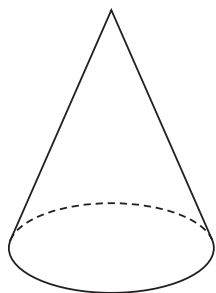
You must show all your working.

..... minutes

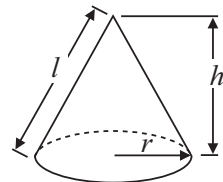
(Total for Question 7 is 4 marks)



19 The diagram shows a cone.



Curved surface
area of cone $= \pi r l$



The radius of the base of the cone is $\frac{3}{4}$ of the height of the cone.

The total surface area of the cone is $54\pi \text{ cm}^2$

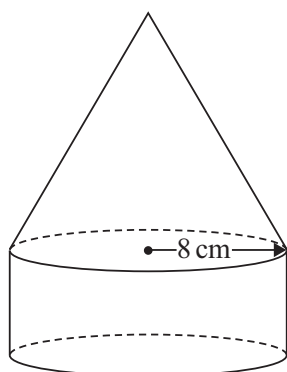
Work out the height of the cone.

..... cm

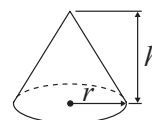
(Total for Question 19 is 4 marks)



16 The diagram shows a solid shape made from a cylinder and a cone.



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



The cone has a base radius of 8 cm.

The cylinder has a radius of 8 cm.

The vertical height of the cone is three times the height of the cylinder.

The volume of the solid shape is $640\pi \text{ cm}^3$

Work out the vertical height of the cone.

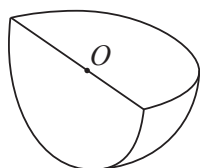
You must show all your working.

..... cm

(Total for Question 16 is 4 marks)



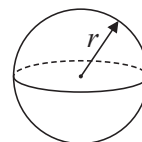
19 Shape S is one quarter of a solid sphere, centre O .



Shape S

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

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



The volume of S is $576\pi \text{ cm}^3$

Find the surface area of S.

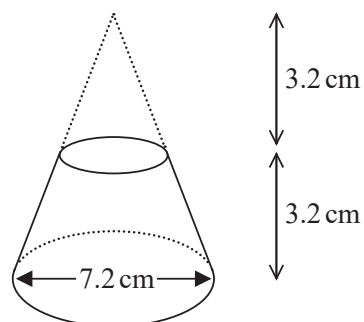
Give your answer correct to 3 significant figures.

You must show your working.

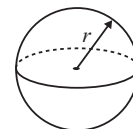
..... cm^2

(Total for Question 19 is 5 marks)

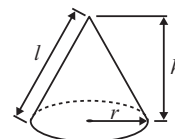
20 Here is a frustum of a cone.



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

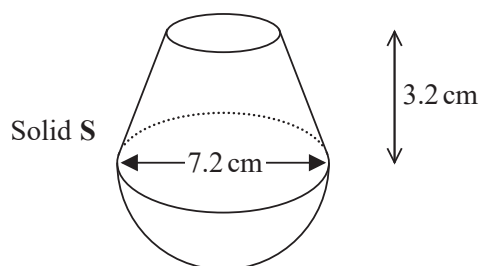


$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$



The diagram shows that the frustum is made by removing a cone with height 3.2 cm from a solid cone with height 6.4 cm and base diameter 7.2 cm.

The frustum is joined to a solid hemisphere of diameter 7.2 cm to form the solid S shown below.



The density of the frustum is 2.4 g/cm^3

The density of the hemisphere is 4.8 g/cm^3

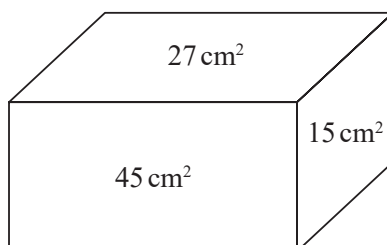
Calculate the average density of solid S.

(Total for Question 20 is 5 marks)

- 8 The diagram shows a solid metal cuboid.

The areas of three of the faces are marked on the diagram.

The lengths, in cm, of the edges of the cuboid are whole numbers.



The metal cuboid is melted and made into cubes.

Each of the cubes has sides of length 2.5 cm.

Work out the greatest number of these cubes that can be made.

(Total for Question 8 is 5 marks)

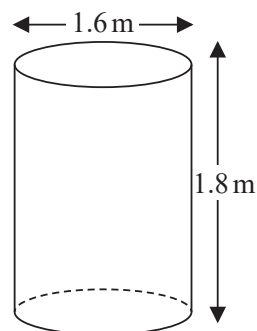


6 Jeremy has to cover 3 tanks completely with paint.

Each tank is in the shape of a cylinder with a top and a bottom.
The tank has a diameter of 1.6 m and a height of 1.8 m.

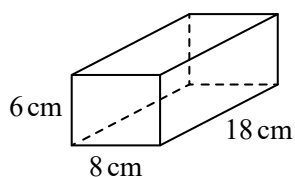
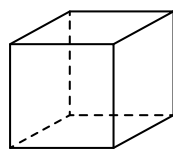
Jeremy has 7 tins of paint.
Each tin of paint covers 5 m^2

Has Jeremy got enough paint to cover completely the 3 tanks?
You must show how you get your answer.



(Total for Question 6 is 5 marks)

- 9 The diagram shows a cube and a cuboid.



The total surface area of the cube is equal to the total surface area of the cuboid.

Janet says,

“The volume of the cube is equal to the volume of the cuboid.”

Is Janet correct?

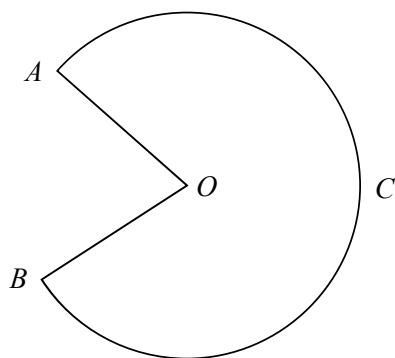
You must show how you get your answer.

(Total for Question 9 is 5 marks)



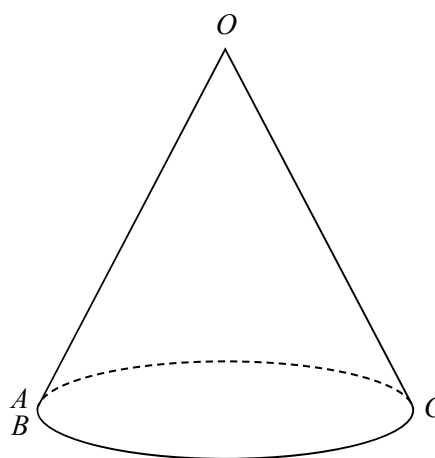
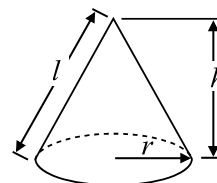
- 23 The diagram shows a sector $OACB$ of a circle with centre O .
The point C is the midpoint of the arc AB .

The diagram also shows a hollow cone with vertex O .
The cone is formed by joining OA and OB .



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

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

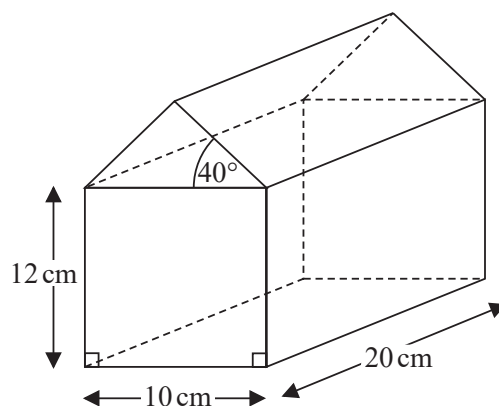


The cone has volume 56.8 cm^3 and height 3.6 cm .

Calculate the size of angle AOB of sector $OACB$.
Give your answer correct to 3 significant figures.
You must show all your working.

C

- 9 The diagram shows a prism.



The cross section of the prism has exactly one line of symmetry.

Work out the volume of the prism.

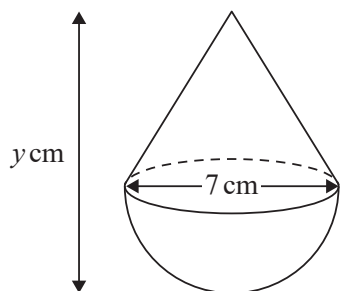
Give your answer correct to 3 significant figures.

..... cm³

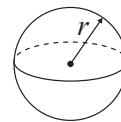
(Total for Question 9 is 5 marks)



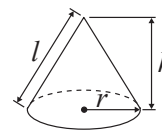
17 A solid cone is joined to a solid hemisphere to make the solid **T** shown below.



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



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



The diameter of the base of the cone is 7 cm.

The diameter of the hemisphere is 7 cm.

The total volume of **T** is $120\pi \text{ cm}^3$

The total height of **T** is $y \text{ cm}$.

(a) Calculate the value of y .

Give your answer correct to 3 significant figures.

$$y = \dots\dots\dots (4)$$

The diameter of the base of the cone and the diameter of the hemisphere are both increased by the same amount.

Assuming the total volume of **T** does not change,

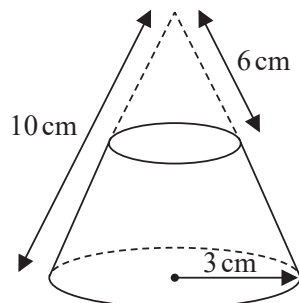
(b) explain the effect this would have on your answer to part (a).

.....

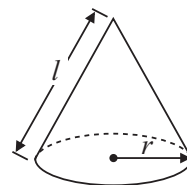
 (1)

(Total for Question 17 is 5 marks)

- 18 A solid frustum is made by removing a small cone from a large cone as shown in the diagram.



Curved surface area of cone = $\pi r l$



The slant height of the small cone is 6 cm.
 The slant height of the large cone is 10 cm.
 The radius of the base of the large cone is 3 cm.

Calculate the total surface area of the frustum.
 Give your answer correct to 3 significant figures.

..... cm²

(Total for Question 18 is 5 marks)

- 21** A solid cuboid has a volume of 300 cm^3
The cuboid has a total surface area of 370 cm^2

The length of the cuboid is 20 cm.

The width of the cuboid is greater than the height of the cuboid.

Work out the height of the cuboid.

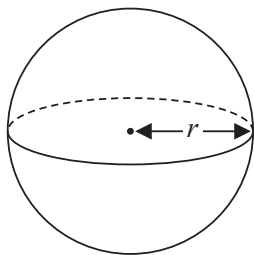
You must show all your working.

..... cm

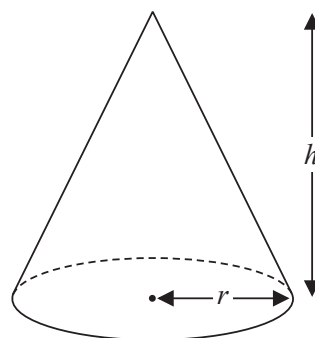
(Total for Question 21 is 5 marks)



24 Here is a solid sphere and a solid cone.



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



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

All measurements are in cm.

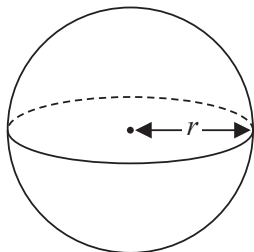
The volume of the sphere is equal to the volume of the cone.

(a) Find $r:h$

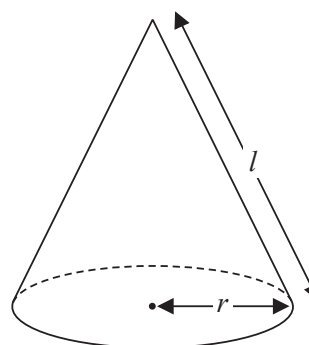
Give your answer in its simplest form.

.....
(2)

Here is a different solid sphere and a different solid cone.



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



Curved area of cone = $\pi r l$

All measurements are in cm.

The surface area of the sphere is equal to the **total** surface area of the cone.

(b) Find $r:h$

Give your answer in the form $1:\sqrt{n}$ where n is an integer.

(4)

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS

MARK SCHEMES

official mark schemes, in the same order as the questions



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	negative	B1	cao	Ignore any description of a relationship and any reference to strength of correlation
(b)	Explanation	C1	for a correct explanation, eg "not in line with the trend of the other points" "does not fit in with the correlation" "is far away from the other points or line of best fit"	
(c)	Comment	C1	for an explanation eg "point would be outside of the range of the scatter diagram"	
2	$9p + 13$	M1 A1	for method to expand one bracket, eg $5 \times p + 5 \times 3 (= 5p + 15)$ or $2 \times 1 - 2 \times 2p (= 2 - 4p)$ or $-2 \times 1 - 2 \times -2p (= -2 + 4p)$ cao	If an attempt is made to multiply by -2 in the second brackets then it must be done consistently.
3	Triangle of area 18	M1 A1	for a complete method to find area of trapezium eg $\frac{1}{2}(2 + 7) \times 4 (= 18)$ OR for a triangle drawn of area 36 OR for a triangle that would give an area ft their area of trapezium for a triangle drawn of area 18 eg base = 6, height = 6 or base = 9, height = 4	The value for the area of the trapezium must be clear for the ft to be checked. Accept use of dimensions that are not whole numbers as long as the intention is clear



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	Complete chain of reasoning	M1	for (area of trapezium $TQRS = 0.5 \times 4x \times (2x + 3x)$ or for (area of rectangle $TUVS = 4x \times (3x + 5) (= 12x^2 + 20x)$	Evidence for the award of marks may be seen on the diagram
		M1	for (area of trapezium $QUV R = 4x(3x + 5) - 0.5 \times 4x \times (2x + 3x)$	
		C1	for correct algebraic processing and simplification to the given form	Alternative methods may be seen.
		M1	Alternative 1 for ($QU = 3x + 5 - 2x (= x + 5)$	
		M1	for (area of trapezium $QUV R = 0.5 \times 4x \times ((x + 5) + 5)$ or $0.5 \times 4x \times (x + 10)$	
		C1	for correct algebraic processing and simplification to the given form	
		M1	Alternative 2 for (area of triangle $= 0.5 \times (3x - 2x) \times 4x$ or for (area of rectangle $= 4x \times 5$	Accept x for $(3x - 2x)$
		M1	for (area of trapezium $QUV R = "0.5 \times (3x - 2x) \times 4x" + "4x \times 5"$	
		C1	for correct algebraic processing and simplification to the given form	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
8	216	P1	for process to work with ratio eg $72 \div (3 + 4 + 5) (= 6)$ or $72 \div 12 (= 6)$	
		P1	for process to find length of base or height of triangle eg $3 \times "6" (= 18)$ or $4 \times "6" (= 24)$ OR process to find area scale factor eg $"6" \times "6" (= 36)$	
		P1	complete process to find the area of the triangle eg $\frac{1}{2} \times "18" \times "24"$ or $\frac{1}{2} \times 3 \times 4 \times "6"{}^2$	
		A1	cao	
9 (a)	6	B1	cao	Accept ± 6
(b)	1	B1	cao	
(c)	$\frac{1}{9}$	M1	for evidence of working with a cube root eg $\sqrt[3]{27}$ or $\sqrt[3]{729}$ OR evidence of working with a reciprocal eg $\frac{1}{27^{2/3}}$ or $\left(\frac{1}{27}\right)^{\frac{2}{3}}$	
		A1	cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	96	P1	for process to find the ratio of the number of pens of each colour sold, eg $2 \times 7 : 5 \times 3 : 6 \times 4$ (= 14 : 15 : 24)	Does not have to be seen as a ratio but all three needed P3 can be implied by the values 56, 60 and 96
		P1	for process to find the proportion of green pens sold, eg $\frac{212}{"14"+"15"+"24"}$ or $\frac{"24"}{"14"+"15"+"24"}$	
		P1	for a complete process to find the number of green pens sold, eg $\frac{212}{"14"+"15"+"24"} \times "24"$ or $\frac{"24"}{"14"+"15"+"24"} \times 212$	
		A1	cao	
7	8.5	P1	for process to use the area of $PQRS$ to find the length of PQ , eg $10y = 45$ or $45 \div 10$ (= 4.5)	Sets up equation for area Uses perimeter of $ABCD$ Accept $\frac{17}{2}$
		P1	for process to use the perimeter of $ABCD$, eg $2x + 2 \times "4.5" = 26$ or $26 - 2 \times "4.5"$ (= 17) or $26 \div 2$ (= 13)	
		P1	for process to use length of BC to find length of AB , eg solves $2x + 2 \times "4.5" = 26$ or $(26 - 2 \times "4.5") \div 2$ or $"13" - "4.5"$	
		A1	for 8.5 or $8\frac{1}{2}$	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	1.01	P1	for $1.09 \times 60 (= 65.4 \text{ or } \frac{327}{5})$ or $0.97 \times 128 (= 124.16 \text{ or } \frac{3104}{25})$	Note that the volumes may be converted to ml, eg $1.09 \times 60000 (= 65400)$ Candidates working in ml must use 188,000 If an answer within the range is seen in working but then rounded incorrectly award full marks. Accept 1 for 1.00 Note that the correct value is 1.008.....
		P1	for $1.09 \times 60 (= 65.4 \text{ or } \frac{327}{5})$ and $0.97 \times 128 (= 124.16 \text{ or } \frac{3104}{25})$ or “65.4” + “124.16” ($= 189.56 \text{ or } \frac{4739}{25}$)	
		P1	for a complete process to find the density of antifreeze eg “65.4” + “124.16” $\div 188$ or $189.56 \div 188$ or $\frac{4739}{25} \div 188$	
		A1	for answer in the range 1.00 to 1.01	
14	36	P1	for process to find an expression for the area of triangle eg $\frac{1}{2} \times 24 \times AE \times \sin 30 (= 6AE)$	Accept any correct expression, eg $\frac{1}{2} \times 24 \times y \times \sin 30$ May be shown on the diagram by labelling AE and AB with, for example, $3x$, x or x , $\frac{1}{3}x$ or $\frac{3}{4}x$, $\frac{1}{4}x$ Do not accept 3, 1 or $1, \frac{1}{3}$ or $\frac{3}{4}, \frac{1}{4}$ for this mark.
		P1	(dep P1) for process to link the area of rectangle with the area of the triangle eg $2 \times \frac{1}{2} \times 24 \times AE \times \sin 30 (= 12AE)$ or for $AB = 12$	
		P1	(indep) for use of given ratio eg $AE = 3AB$ or, eg area of rectangle $= AE \times AB = 3x \times x$	
		A1	cao	



Paper: 1MA1/1H				
Question	Working	Answer	Mark	Notes
5		70.5	P1 P1 P1 P1 A1	starts process of Pythagoras e.g. $5^2 + 12^2$ complete process for Pythagoras e.g. $\sqrt{5^2 + 12^2}$ or $\sqrt{25 + 144}$ or $\sqrt{169}$ (=13) (dep P1 for Pythagoras) process of adding all the lengths e.g. $5 + 5 + 12 + 12 + "13"$ (=47) (indep) process of multiplying at least 2 lengths by 1.5 cao SC: any evidence of working with Pythagoras award the P1 or P2
6		comparison	M1 A1	starts to manipulate expression e.g. $3y = 9x - 6$ or $3y = 9x - 5$ gives equation(s) which can be used to show that the gradients of the two lines are the same e.g. $y = 3x - 5/3$
7		72	P1 P1 A1	for showing the process of 30×60 (=1800) or 20×54 (=1080) (dep P1) for showing the complete process e.g. (" 1800 " – " 1080 ") $\div 10$ concluding the answer is 72 (and not 66)
8 (a) (b)		0.00000797 6.3×10^7	B1 M1 A1	cao for partial calculation involving powers of 10 e.g. $0.63 \times 10^{5-3}$ or 6.3×10^n where $n \neq 7$ or for $n \times 10^8$ or for 63000000 cao
9		500	M1 A1	recognition of 1.2 or 120% oe eg $600 \div 1.2$ oe $x \times 1.2 = 600$ oe or $120\% = 600$ cao
10		$x^3 + 6x^2 + 11x + 6$	M1 M1 A1	for method to find the product of any two linear expressions (3 correct terms) e.g. $x^2 + x + 2x + 2$ or $x^2 + 2x + 3x + 6$ or $x^2 + x + 3x + 3$ for method of multiplying out remaining products, half of which are correct (ft their first product) e.g. $x^3 + x^2 + 2x^2 + 3x^2 + 2x + 3x + 6x + 6$ cao



Paper: 1MA1/3H				
Question	Working	Answer	Mark	Notes
4		15	P1	strategy to start the problem, eg 8:20 and 20:5
			P1	process to solve the problem, eg $\frac{5}{33} \times 100$ or 24:60:15
			A1	cao
5 (a) (b)		0.625 $9.75 \leq x < 9.85$	B1	cao
			B2	for $9.75 \leq x < 9.85$
			[B1	for 9.75 or 9.85 (or 9.849)]
6		147	P1	starts process, eg uses x and $x + 7$
			P1	starts to work with at least 6 correct sides, may be on the diagram or in an expression
			P1	(dep on previous P1) gives a correct expression for the perimeter, eg $x + x + 7 + x + 7 + x + 7 + x + x + 7 + x + 7 + x + 7$ or adds at least 6 correct sides and equates to 70
			A1	for width = 3.5 oe and length = 10.5 oe
			B1	ft (dep P2) for correct area for their x
7		0.0007452	M1	digits 7452 seen
			A1	cao



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
4 (b)	conclusion	C1	conclusion (ft) eg no change, shares now 182.5... Acceptable examples no since shares/Ben now 182.5 Still Ben since $182.5 > \text{Ali}$ No; he only gets 8.57 more No; he gets 68.56 instead of 59.98 (3rd yr) No; Ben already gets more interest, he would just get even more Not acceptable examples no shares now 182.5 Still Ben since less than Ali $182.5 > 153.78$ no; he needs 20.17 more	Conclusion needs to be supported. ft is from part (a); calculations carried out as part of (b) need to be correct for the comparison to be valid.
5	No (supported)	P1 P1 P1 P1 C1	calculates area of trapezium eg $\frac{1}{2} \times 7 \times (10+16) (=91)$ for division by coverage eg $\div 2$ or [area of trapezium] $\div 2 (=45.5)$ or process to find coverage per tin eg $5 \times 2 (=10)$ for division to find the number of tins eg $\div 5$ or "45.5" $\div 5 (=9.1)$ or [area of trapezium] $\div "10" (=9.1)$ (dep on at least P2) for a process to multiply a whole number of tins (rounded up) by 16.99 for 'No' supported by correct figures eg 169.9 or 90 and 91 for process to find number of tins bought eg $160 \div 16.99 = 9$ tins for using whole no. of tins to find total litres eg $9 \times 5 (=45)$ (dep on at least P2) for a process to find the total coverage eg "45" $\times 2 (=90)$	[area of trapezium] needs to be clearly stated if the process of finding the area is not clear There must be a conclusion ("No" or equivalent wording) including the figure 169.9 and working showing processes followed.



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	Region shaded	M1 M1 A1	for two of the lines $2y + 4 = x$, $x = 3$, $y = 6 - 3x$ correctly drawn for all three correct lines correctly drawn for a fully correct region indicated with all lines correct	Accept full or broken lines for all marks Award for clear intention, shading not needed Diagram at end of mark scheme
18	17.6	P1 P1 P1 P1 A1	for correct trig statement, eg $\sin 30 = \frac{h}{6}$ for complete process to find h , eg $6 \times \frac{1}{2} (= 3)$ for correct substitution into the area of a trapezium formula, eg $\frac{1}{2}(a + b) \times "3" = 66$ or $a + b = 44$ or $\frac{1}{2}(2x + 3x) \times h = 66$ for complete correct process to find the length of AB , eg $\left[\frac{66 \times 2}{3} \div (2 + "3") \right] \times 2$ cao	 An answer of $\frac{88}{5}$ gets P4 A0



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
4 (a)	19	P1	for process to find area available at festival B, eg $700 \times 2000 (=1\,400\,000)$	
		P1	for process to find the area available per person at one festival, eg $80\,000 \div 425 (= 188.23\dots)$ or $[\text{area}] \div 6750 (= 207.40\dots)$	Accept either number rounded eg 207 or 188
		P1	for process to find the area available per person at both festivals, eg $80\,000 \div 425 (= 188.23\dots)$ and $[\text{area}] \div 6750 (= 207.40\dots)$	Accept either number rounded eg 207 or 188
		A1	for an answer in the range 18.7 to 19.5	
	(b) explanation	C1	for a valid statement relating to scale factor for area, Acceptable examples There are 10000 (cm ²) in 1 (m ²) Because 1 m ² is the same as $100 \times 100 = 10000$ cm ² There are 2 side lengths that change from 1 m to 100 cm $300 \div 3$ is 100 should use 100 ² $300 \div 100 \div 100 = 0.03$ $3 \times 100 \times 100 = 30000$ Because it's area not length. Because it's in m ² not just metres He hasn't taken the squared sign into account Not acceptable examples There are 1000 cm in 1 m Callum is correct because $300 \div 3$ is 100 $3^2 = 9$ $300 \times 300 = 90000$ You have to square the number	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
24	$4(2+\sqrt{2})a^2$	P1	for process to find area required and identifying 135° or 45° or 90° angle(s), eg splitting shape into square and 4 triangles and an angle relevant to the triangle clearly identified.	90° must be in a triangle to gain credit. May be seen on diagram.
		P1	for process to find the area of a relevant triangle using 45° , eg $\frac{1}{2} \times a \times \left(2 \times \frac{a}{\sqrt{2}}\right) \times \frac{1}{\sqrt{2}} \left(= \frac{a^2}{2}\right)$ or using 90° , eg $\frac{1}{2} \times a \times a \left(= \frac{a^2}{2}\right)$ or process to find the area of a square made from 2 small triangles, eg $a \times a \left(= a^2\right)$	Accept $0.49 \dots a^2$ May be seen as the area of 2 squares (from 4 small triangles)
		P1	for process to find the length of the square, eg $a + a + \sqrt{a^2 + a^2} \left(= 2a + a\sqrt{2}\right)$	Accept $3.41a$
		P1	for process to find the total area, eg $\left(2a + a\sqrt{2}\right)^2 + 4 \times \frac{a^2}{2}$	Accept $(11.655 + 4 \times 0.49) a^2$
		A1	(dep on P3) for $4(2+\sqrt{2})a^2$	Answer only award no marks. If working in decimals accept $\frac{13.656}{2+\sqrt{2}}$ leading to 4 Accept $p = 4$ if supported by correct working



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
3 (a)	Yes (supported)	P1	for a process to find the area of one shape, eg $10 \times 8 (= 80)$ or $10 \times 5 (= 50)$ or $8 \times 6 (= 48)$ or $(10 - 6) \times 5 (= 20)$ or $(10 - 6) \times (8 - 5) (= 12)$ or $6 \times (8 - 5) (= 18)$ or $5 \times 6 (= 30)$	Do not award this mark if they go on to multiply by a third length
		P1	for a complete process to find the total area, eg “80” – “12” (= 68) or “50” + “18” (= 68) or “48” + “20” (= 68)	
		P1	for a complete process to find the area covered by 3 tins eg $3 \times 2.5 \times 10 (= 75)$ or for a complete process to find the number of litres needed eg “68” $\div 10 (= 6.8)$ or [area] $\div 10$ or for a complete process to find the number of tins needed eg “68” $\div 10 \div 2.5 (= 2.72)$ or [area] $\div 10 \div 2.5$	
		A1	for ‘Yes’ supported by correct figures eg $68 \text{ (m}^2\text{)}$ and $75 \text{ (m}^2\text{)}$ or 6.8 (litres) and 7.5 (litres) or $68 \text{ (m}^2\text{)}$ and $2.72 \text{ (tins needed)}$	
(b)	No effect (supported)	C1	ft from (a) for “has no effect” with reason Acceptable examples No effect, she will need less paint It won’t change, she will still have enough No, she will have more paint left over No, as this will cover 82.5m^2 Not acceptable examples Petra will need less paint She will have more paint left over She won’t have enough paint She will need more paint	Ignore incorrect amount of paint left over if correct figures seen Must have a decision in (a) Must include a decision eg yes / no / no effect If figures included in the statement they must be correct for their [area] in (a)

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	12	P1	for process of working with area scale factor, eg area SF = 50^2 (= 2500) or 0.5×0.5 (= 0.25) or $48 \times 50 \times 50$ (= 120 000)	
			or	
			for process which uses $1 \text{ (m}^2\text{)} = 10\,000 \text{ (cm}^2\text{)}$, eg $\frac{48}{10\,000}$	
		P1	for complete process, eg $\frac{120\,000}{100 \times 100}$ or “0.25” $\times$ 48	
		A1	cao	
12	246	P1	for start of process to find angle inside sector eg $\frac{x}{360} \times \pi \times 6.2^2 = 82.6$ or $\frac{82.6}{\pi \times 6.2^2} \times 360$	The size of the angle in the unshaded sector is 114 If an answer is shown in the range in working and then incorrectly rounded award full marks.
		A1	for an answer in the range 113 to 114 for answer in range 246 to 247	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
3 (a)		31.4	P1	for working with circumference formula, eg $\pi \times 80$ (=251. ...) oe
			A1	for answer in the range 31.4 to 31.5 accept 10π
			C1	Mean distance stays the same with reason, eg total distance remains unchanged or same number of points
4		$\frac{1}{11}$	P1	for starting the process, eg by writing down a correct ratio or using a given number of cubes for one relationship, eg 2B 1Y or B:Y = 2:1 or 4G 1B or G:B = 4:1 or 8G, 1Y or G:Y = 8:1 oe or yellow = 2, blue = 4, or states 2:1:8 oe in any order (can be algebraic)
			P1	for complete process to find possible number of each colour or equivalent ratio, eg 8G 2B 1Y or G:B:Y = 8:2:1 oe or yellow = 2, blue = 4, green = 16 oe (can be algebraic)
			A1	$\frac{1}{11}$ oe
5 (a)		(-2, 1) (-4, 1) (-2, 2) (-5, 2)	B1	Shape labelled A
			B1	Shape labelled B
(b)		(1, -4) (3, -4) (1, -5) (4, -5)		



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	84.9	P1 P1 A1	shows a process to find the radius or diameter eg $44 = 2 \times \pi \times r$ or $r = \frac{22}{\pi}$ or $d = \frac{44}{\pi}$ or $r = 7.0028$ or $d = 14.0056$. (dep on P1) complete method to find the area eg $\frac{1}{2} \times "d" \times \sin 60$ oe, $\frac{1}{2} \times 14 \times \tan 60$ oe, $\frac{1}{2} \times 14 \times \sqrt{14^2 - 7^2}$ oe for answer in the range 84.8 to 85	Allow r in the range 7 to 7.1 and d in the range 14 to 14.1 Could be shown on the diagram. If the correct answer in the range is given in working and then rounded incorrectly award full marks.
14	curve (0,1) labelled	C1 C1	sketch of graph which starts above x-axis for negative x , and makes an increasing exponential rise into positive x for showing a label of (0,1) on the y axis	Condone graph "touching" the x axis. Do not award from a graph for positive x only. Do not award if a point is given for crossing the x -axis. Accept the coordinates shown as a label of "1" written on the y axis at the intersection.
15	6.5	B1	oe	Accept (eg) $6\frac{1}{2}$ and $\sqrt{42.25}$



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	Relationship shown	M1	for use of Pythagoras' theorem, eg $d_A^2 = d_B^2 + d_C^2$ or $a^2 = b^2 + c^2$ or $(2x)^2 = (2y)^2 + (2z)^2$ or $a = \sqrt{b^2 + c^2}$ or uses a 3, 4, 5 triangle	May be seen at any stage Where d_A , a , $2x$, etc are their diameters Could be any Pythagorean triple
		M1	for forming correct expressions for the areas of at least 2 of the 3 semicircles, eg at least two of $\frac{1}{2}\pi\left(\frac{a}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{b}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{c}{2}\right)^2$ or at least two of $\frac{1}{2}\pi x^2$, $\frac{1}{2}\pi y^2$, $\frac{1}{2}\pi z^2$ or at least two of $\frac{1}{2}\pi\left(\frac{5}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{3}{2}\right)^2$, $\frac{1}{2}\pi\left(\frac{4}{2}\right)^2$	Where a , b , c are their diameters Where $2x$, $2y$, $2z$ are their diameters Where 3, 4, 5 are their diameters
		C1	for a fully correct and convincing chain of reasoning, eg showing that eg $\frac{1}{2}\pi\left(\frac{a}{2}\right)^2 = \frac{1}{2}\pi\left(\frac{b}{2}\right)^2 + \frac{1}{2}\pi\left(\frac{c}{2}\right)^2$ can be reduced to $a^2 = b^2 + c^2$ or that $(2x)^2 = (2y)^2 + (2z)^2$ is the same as $\frac{1}{2}\pi x^2 = \frac{1}{2}\pi y^2 + \frac{1}{2}\pi z^2$	
14 (a)	0.9	M1	for drawing a tangent at $t = 2$	
		M1	for a complete method to find the gradient eg tangent at $t = 2$ and “2.7” ÷ “3”	Use of change in y over change in x Working may be seen on the diagram
		A1	for answer in the range 0.7 to 1.1	Accept answers in the form $\frac{a}{b}$ where a and b are integers
(b)	Statement	C1	eg distance (travelled)	If units are given they must be correct

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
13	$t = 20$ $p = 4, 50$	M1	for method to find a missing value of p , eg $\frac{100}{25}$ oe ($= 4$) or $\frac{100}{2}$ oe ($= 50$) or for $p = \frac{100}{t}$	Marks for 4 or 50 can only be awarded if in correct cell of table or unambiguous in working
		M1	for method to find the missing value of t , eg $100 \div \frac{5}{1}$ ($= 20$) or for finding both missing values of p	Mark for 20 can only be awarded if in correct cell of table or unambiguous in working
		A1	cao	
14	Histogram drawn	B3	for fully correct histogram, eg relative heights 1, 5, 6, 1.5	Frequency densities are 1, 5, 6, 1.5
		(B2)	for 3 correct bars or for frequency $\div$ class interval for at least 3 frequencies and 2 correct bars of different widths)	
		(B1)	for 2 correct bars of different widths or for frequency $\div$ class interval for at least 3 frequencies)	
15	40	P1	for a start to the process, eg $\frac{x}{360} \times 2 \times \pi \times 18$ ($= 4\pi$) oe or $\frac{4\pi}{2 \times \pi \times 18}$ ($= \frac{x}{360}$) oe	Any arrangement equivalent to this equation acceptable
		P1	for a complete process to find x , eg $\frac{4\pi}{36\pi} \times 360$ oe	
		A1	cao	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
9 (a)	Graph drawn	B2	for a correct line drawn	Accept answers in the form $\frac{a}{b}$ where a and b are integers If figures are given as part of the answer they must be correct, but can allow ft
		(B1)	for stating or plotting at least 2 points on the line eg (0, 0) and (4, 5) or (4, 5) and (8, 10) or giving the equation of the line eg $y = \frac{5}{4}x$	
(b)(i)	1.25	B1	oe or ft their line in part (a)	
(ii)	Explanation	C1	for explanation Acceptable examples the number of cups of water per cup of rice every cup of rice has 1.25 cups of water for every 4 cups of rice there are 5 cups of water Not acceptable examples cups of water $\div$ cups of rice the gradient represents the steepness of the line the number of cups of rice for each cup of water	
10	$\frac{25}{\pi}$	P1	for showing $\pi d = 10$ or $2\pi r = 10$ or $r = \frac{10}{2\pi}$ or $d = \frac{10}{\pi}$	Need not be simplified but needs to show a single value of π
		P1	(dep P1) for using $r = \frac{5}{\pi}$ or $r = \frac{10}{2\pi}$ or $d = \frac{10}{\pi}$ in πr^2 eg $\pi \times \left(\frac{10}{2\pi}\right)^2$	
		A1	oe	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
10	55	M1	for a complete method eg $46.75 \div 0.85$ oe or for a correct equation eg $0.85x = 46.75$ oe or 55 seen, then used as part of an extended method eg 8.75 or 101.75	
		A1	accept trailing zeros eg 55.00	
11	304	P1	for start of process to find the arc length eg $34.3 - 2 \times 4.7 (= 24.9)$ or for forming a suitable equation eg $\frac{\angle AOB}{360} \times \pi \times 2 \times 4.7 + 2 \times 4.7 = 34.3$	Condone omission of the addition of 2 radii in the equation for this mark only eg $\frac{\angle AOB}{360} \times \pi \times 2 \times 4.7 = 34.3$
		P1	for process to isolate the arc length in an equation eg $\frac{\angle AOB}{360} \times \pi \times 2 \times 4.7 = "24.9"$ or for complete process to find AOB eg $\angle AOB = \frac{"24.9" \times 360}{\pi \times 2 \times 4.7}$	
		A1	answer in the range 303 to 304	If an answer is given in the range in working and then rounded incorrectly award full marks



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
20 (a)		-0.4 to -0.2 and 3.2 to 3.4	M1 A1	for $(y =) x + 4$ for answers in the range -0.4 to -0.2 and 3.2 to 3.4
(b)		1.6 to 2.5	M1 M1 A1	for drawing a tangent to the curve at $x = 2$ for method to find gradient of their tangent for answer in the range 1.6 to 2.5
21		8600	P1 P1 P1 A1	for process to find the length of the rectangle, e.g. $24 \times 4 (= 96)$ for process to find the perpendicular height of an equilateral triangle of side (24×2) cm, e.g. $48\sin 60 (= 41.5(69..))$ or $\sqrt{48^2 - 24^2} (= 24\sqrt{3}$ oe) for complete process to find the width of rectangle, e.g. " $41.5(69..)$ " + $24 + 24 (= 89.5(69..))$ for answer in the range 8592 to 8602
22		$2n^2 + n + 1$	M1 M1 A1	for a correct start to a method to find n th term, eg. equal 2nd differences imply a term in n^2 or sight of $an^2 + bn + c$ for a method leading to $2n^2$ and either n or 1 for $2n^2 + n + 1$ oe
23		$y = \frac{-3}{\sqrt{7}}x + \frac{8}{\sqrt{7}}$	M1 M1 A1	for method to find gradient of OP, eg. $\frac{\sqrt{7}}{2} \div \frac{3}{2} (= \frac{\sqrt{7}}{3}$ or 0.88 ...) oe (dep) for method to find gradient of tangent, m , eg. $\frac{\frac{\sqrt{7}}{2}}{\frac{3}{2}} \times m = -1$ ($m = \frac{-3}{\sqrt{7}}$ or -1.13..)) for $y - \frac{\sqrt{7}}{2} = \frac{-3}{\sqrt{7}}(x - \frac{3}{2})$ or $y = \frac{-3\sqrt{7}}{7}x + \frac{8\sqrt{7}}{7}$ oe or $y - 1.32.. = -1.13..(x - 1.5)$



Paper 1MA1: 3H				
Question	Working	Answer	Mark	Notes
6		1.01	P1 P1 P1 A1	fruit syrup $15 \times 1.4 (= 21)$ or water $280 \times 0.99 (= 277.2)$ or apple juice $25 \times 1.05 (= 26.25)$ (dep P1) for complete process to find the total mass e.g. “277.2” + “26.25” + “21” (= 324.45) or a weighted density eg $15 \times 1.4 \div 320 (= 0.065625)$ or $280 \times 0.99 \div 320 (= 0.86625)$ or $25 \times 1.05 \div 320 (= 0.08203125)$ (dep P2) for complete process to find the density eg “324.45” $\div 320 (= 1.01..)$ or “0.065625” + “0.86625” + “0.08203125” (= 1.0139..) 1.01 to 1.014
7		5.86	M1 A1	for $\sin 23 = \frac{AB}{15}$ NB Allow any alternative equivalent method to form an equation in AB 5.8 to 5.9
8		5.59	M1 M1 M1 A1	For use of $\pi r^2 = 49$, where r is the radius or $r = 3.9(49...)$ or diameter = 7.8(9865...) For use of Pythagoras to set up an equation in x^2 e.g. $x^2 + x^2 = (d)^2$ or $x^2 = r^2 + r^2$ For use of trigonometry to set up an equation in x eg $\sin 45 = x \div d$ (dep on M2) Rearrange to $(x^2 =) 2 \times “3.949..”^2$ Rearrange to $(x =) “7.898..” \times \sin 45$ oe 5.5 to 5.6
9	(a) (b) 60,180,300,350,650 (c) Medians 250 and 300	180 Statement	M1 A1 B2 (B1) C1	for evidence of using the LQ (150) and UQ (330) eg $330 - 150$ cao for fully correct box plot for showing a box and at least 3 correctly plotted values for a correct comparative statement relevant to the question e.g. Yes because the female students have a greater median than the male students

Paper: 1MA1/1H						
Question	Working	Answer	Mark	Notes		
4		Daisy is wrong (supported)	P1 P1 A1 C1	for process to find area of any relevant circle ie $\pi \times 4^2 (=16\pi)$, $\pi \times 7^2 (=49\pi)$, $\pi \times 10^2 (=100\pi)$ or 7^2 and 4^2 for completed method to find shaded area eg “ $\pi \times 7^2$ ” – “ $\pi \times 4^2$ ” ($=33\pi$) or use of radii eg $7^2 - 4^2 (=33)$ for 2 comparable figures, eg 33π and 100π or 33 and 100 or 103 to 103.7 and 314 to 314.2 or 103 to 103.7 and 104.6 to 104.8 statement eg No because it should be $\frac{33}{100}$ and their accurate figures Allow use of $\pi = 3$ or better		
5	(a)	365	M1	$\hat{f}x$ with x consistent within intervals eg 200×1 , 300×11 , 400×5 , 500×0 , 600×3 , if 200, 3300, 2000, 0, 1800 are seen without working then condone 1 error (dep) $\Sigma \hat{f}x \div \Sigma f$ eg “7300” $\div 20$		
	(b)	Comment	M1 A1 C1	cao for comment about outliers affecting mean		
6		Shows reasoning to reach $y=3$	M1 M1 M1 A1	forms equation eg $2x + 6 = 5x - 9$ isolates x and number terms $3x = 15$ substitutes “5” into side length eg $2 \times 5 + 6 (=16)$ $48 \div 16 = 3$ or $16 \div 3 = 48$	$48 \div 3 (=16)$ forms equation $2x + 6 = “16”$ or $5x - 9 = “16”$ isolates x and number terms $2x = “10”$ or $5x = “25”$ shows $x=5$ for both solutions	$3(2x + 6) = 48$ or $3(5x - 9) = 48$, condone missing bracket Isolates x and number terms $6x = “30”$ or $15x = “75”$ forms the second equation $x=5$ from 2 different equations.



Paper: IMA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	$x = 4.5, y = -1.5$	M1 M1 A1	correct process to eliminate one variable (condone one arithmetic error) (dep) for substituting found value in one of the equations OR correct process after starting again (condone one arithmetic error) for $x = 4.5, y = -1.5$ oe	Fractions do not need to be in simplest form
7	shown	C1 C1 C1 C1	for method to find area of semicircle, eg $\pi \times 10^2 \div 2 (= 50\pi)$ for method to find area of quarter circle, for $\pi \times 20^2 \div 4 (= 100\pi)$ for a complete method to find area shaded and area of square, eg $\pi \times 20^2 \div 4 - \pi \times 10^2 \div 2$ and 20×20 fully correct working leading to $\frac{\pi}{8}$	Can award first 3 marks if a value for π is used Working out to find the area of the shaded region must be shown
8 (a) (b)	1 8	B1 M1 A1	cao starts process, eg $\cos(60) = \frac{4}{x}$ or $0.5 = \frac{4}{x}$ oe or $\sin 30 = \frac{4}{x}$ or $\frac{\sin 30}{4} = \frac{\sin 90}{x}$ oe cao	All three elements of cos, 4, x must be present in an equation. eg $\cos = 4/x$ is acceptable but $\cos(4/x)$ is insufficient



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	25.4	P2	for finding the size of the angle eg $\frac{40 \times 360}{\pi \times 7^2}$ (=93.5(4..)) or for working with proportion, eg $\frac{40}{49\pi}$ (=0.259(8...) or 0.26) or $\frac{49\pi}{40}$ (=3.84(8...) or 3.85)	
		(P1	for finding the area of the circle eg $\pi \times 7^2$ (=153(.938..) or 154))	May be embedded
		P1	(dep on P2) for a process to find the arc length, eg $\frac{"93.5(4...)" }{360} \times \pi \times 2 \times 7$ (=11.4(28...)) or $\frac{40}{49\pi} \times \pi \times 2 \times 7$ (=11.4(28...)) or $\pi \times 2 \times 7 \div \frac{49\pi}{40}$ (=11.4(28...))	
		A1	for answer in the range 25 to 25.44	If an answer is shown in the range in working and then incorrectly rounded award full marks. Accept $\frac{178}{7}$



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
5	99.5	M1	for $\sin(34) = \frac{x}{178}$ oe or alternative method to find x	If an answer in the range 99.5 to 99.7 is given in the working space then incorrectly rounded, award full marks
		A1	for answer in range 99.5 to 99.7	
6	$\begin{pmatrix} -9 \\ 14 \end{pmatrix}$	M1	for $2\begin{pmatrix} 3 \\ 4 \end{pmatrix} - 3\begin{pmatrix} 5 \\ -2 \end{pmatrix}$ or $\begin{pmatrix} 6 \\ 8 \end{pmatrix}$ and $\begin{pmatrix} 15 \\ -6 \end{pmatrix}$ or $\begin{pmatrix} -9 \\ y \end{pmatrix}$ or $\begin{pmatrix} x \\ 14 \end{pmatrix}$	May be seen in two separate calculations eg $2 \times 3 + -3 \times 5$ and $2 \times 4 + -3 \times -2$ Condone incorrect notation if method is clear for this mark only
		A1	cao	
7	35.3	P1	for starting the process to find length of third side of triangle, eg $9^2 - 6^2 (= 45)$ or $6^2 + x^2 = 9^2$	[radius] is any value If an answer in the range 35.2 to 35.4 is given in the working space then incorrectly rounded, award full marks No working, answer only, no marks
		P1	for $\sqrt{9^2 - 6^2}$ or $\sqrt{81 - 36}$ or $\sqrt{45}$ or $3\sqrt{5}$ ($= 6.7..$) or $r^2 = 45$	
		P1	for stating or using $\pi \times [\text{radius}]^2 \div 4$	
		A1	for answer in range 35.2 to 35.4	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
5	12	P1	for a process to find the fifth term, eg $3a + 5a (= 8a)$	[8a] allow use of what is clearly indicated as the missing term $\frac{228}{19}$ or $\frac{228}{1+2+3+5+8}$ scores P1 P1 $\frac{228}{1+2+3+5+8}$ scores P0P1
		P1	for setting up the equation eg $a + 2a + 3a + 5a + [8a] = 228$	
		A1	cao	
6	(a)	P1	for $1 - 0.05 - 0.15 (= 0.8)$	Award this mark for any two probabilities that sum to 0.8
		A1	oe	
	(b)	M1	$18 \div 0.15$ oe or $6 + 18 + a + b$ where $a + b = 96$	
		A1	cao	
7	18.3	P1	for finding the area of the triangle eg $0.5 \times 8 \times 8 (= 32)$	Accept rounded or truncated figures If the answer is given within the range but then rounded incorrectly award full marks.
		P1	for finding the area of the circle $\pi \times 8 \times 8 (= 201.06..)$	
		P1	for finding the area of the sector eg $\frac{1}{4} \times \pi \times 8^2$ or "201.06.." $\div 4 (= 50.26...)$	
		A1	for an answer in the range 18.2 to 18.3	
8	(a)	C1	Sketch	Accept freehand provided intention is clear
	(b)	C1	Sketch	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	$x = -2, y = 1.5$	M1 A1 M1 A1	for a correct process to eliminate one variable (condone one arithmetic error) for either $x = -2$ or $y = 1.5$ oe (dep M1) for substituting found value in one of the equations or correct process after starting again (condone one arithmetic error) for $x = -2, y = 1.5$ oe SCB2 for both correct answers if no more than 1 mark awarded SCB1 for one correct answer if no marks awarded	Fractions do not need to be in simplest form Fractions do not need to be in simplest form
12	40.2	P1 P1 P1 A1	for start of process to find the diameter or the radius of the circle, eg $8^2 + 10^2 (= d^2)$ oe or $4^2 + 5^2 (= r^2)$ oe for complete process to find diameter, eg $\sqrt{8^2 + 10^2}$ (= 12.8...) or complete process to find radius, eg $\sqrt{4^2 + 5^2}$ (= 6.40...) or for process to find circumference, eg $\pi \times "12.8..."$ or $2 \times \pi \times "6.40..."$ answer in the range 40.2 to 40.24	Accept $\sqrt{164}$ or $2\sqrt{41}$ or $\sqrt{41}$ If an answer is given in the range in working and then rounded incorrectly award full marks.

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	Shown	M1	for a method to find the product of two linear expressions (3 out of 4 terms correct or 4 correct terms ignoring signs) eg $x^2 + 3x - x - 3$ or $x^2 + 3x - 5x - 15$ or $x^2 - 5x - x + 5$	Note that (eg) $2x - 3$ in expansion of $(x - 1)(x + 3)$ is to be regarded as 3 correct terms. First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $x^3 - 5x^2 - 10x + 2x^2 - 3x + 15$	
		A1	for $x^3 - 3x^2 - 13x + 15$ shown, accept $x^3 + -3x^2 + -13x + 15$	
13	Proof	M1	for giving a general term for a consecutive triangular number eg $\frac{(n+1)(n+2)}{2}$ or $\frac{(n-1)n}{2}$	
		M1	for $\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$ or $\frac{(n-1)n}{2} + \frac{n(n+1)}{2}$ oe	
		C1	for completing the proof to show a square number, eg $(n + 1)^2$ or n^2	
14	19.9	P1	for substituting into the cosine rule to find OB , eg $(OB^2) = 9^2 + 6^2 - 2 \times 9 \times 6 \times \cos 35$	May be implied by $OB = 5.34...$ Values may be rounded or truncated. If a correct answer within the range is shown in working but incorrectly rounded award full marks.
		P1	for using correct order of operations eg $81 + 36 - 88.46...$ (= 28.5...)	
		P1	for process to find the area of the sector, eg $\frac{80}{360} \times \pi \times "5.34..."^2$	
		A1	for answer in the range 19.8 to 20	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	15π	P2 P1 P1 A1	for process to find size of the angle eg $\frac{5\pi \times 360}{2 \times \pi \times 6}$ oe (= 150) or for working with proportion eg $\frac{5\pi}{12\pi} (= \frac{5}{12})$ or $\frac{12\pi}{5\pi} (= \frac{12}{5})$ (P1 for a first step eg $\frac{x}{360} \times 2 \times \pi \times 6 = 5\pi$) (dep on P2) for process to find the area eg $\frac{150}{360} \times \pi \times 6^2$ or $\frac{5\pi}{12\pi} \times \pi \times 6^2$ cao	
16	Shown	M1 A1	for $\frac{n}{n+1}$ or $\frac{n-1}{n}$ (dep) for $\frac{n}{n+1} \times \frac{n-1}{n}$ oe = $\frac{n-1}{n+1}$	Do not award A1 if errors seen
17	(a) $\frac{\sqrt{7}}{7}$ (b) $3\sqrt{5}$	B1 M1 A1	for $\frac{\sqrt{7}}{7}$ or $\frac{k\sqrt{7}}{7k}$ or $\frac{\sqrt{7k^2}}{7k}$ where k is an integer not equal to 0 for writing $\sqrt{80}$ as $\sqrt{16 \times 5}$ or $\sqrt{16} \times \sqrt{5}$ or $4\sqrt{5}$ for $3\sqrt{5}$ or $\sqrt{45}$	



Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
17		66.5	B1 P1 P1 P1 A1	for recognising an angle of 60 at AOB for a process to find the area of the sector, e.g. $\frac{60}{360} \times \pi \times 11^2$ (= 63.3.. or $\frac{121\pi}{6}$) for a process to find the area of the triangle, e.g. $\frac{1}{2} \times 7^2 \times \sin 60$ (=21.2.. or $\frac{49\sqrt{3}}{4}$) for a process to find the required percentage, e.g. $\frac{63.3.. - 21.2..}{63.3..} \times 100$ for answer in the range 66.5 to 66.6
18		1.45	P1 P1 A1 P1 A2	for converting to a common base with at least one correct conversion, eg. $(16 \Rightarrow) 2^4$ or $(8 \Rightarrow) 2^3$ (dep) for correct use of index laws to derive an equation, eg. $4 \times \frac{1}{5} + x = 3 \times \frac{3}{4}$ oe for 1.45 oe (accept $2^{1.45}$) OR for a process to find the value of 2^x , eg. $8^{\frac{3}{4}} \div 16^{\frac{1}{5}} = 2.73...$ for 1.45 oe (accept $2^{1.45}$)
19		$a = 4, b = -42$	M1 M1 M1 A1	for at least two terms from $2(x-3)(x+3)$, $(x+2)(x+3)$, $(x-6)(x-3)$ (dep) for the correct expansion of at least two expressions, irrespective of signs, eg. $2x^2 - 18$, $x^2 + 2x + 3x + 6$, $x^2 - 6x - 3x + 18$ oe for $2x^2 - 18 - x^2 - 5x - 6 - x^2 + 9x - 18$ for $a = 4, b = -42$ (accept $4x - 42$)

Paper 1MA1: 3H				
Question	Working	Answer	Mark	Notes
18	Note $DOC=DOA$, $ADO=CDO$	21.6	P1 P1 P1 P1 A1	Recognises that OAD or OCD is 90° or right angle for using trigonometry to set up an equation in DOA or ADO eg $\cos DOA = \frac{5}{9}$ for using inverse trigonometry to find DOA or ADO eg $DOA = \cos^{-1} \frac{5}{9}$ ($= 56.25\dots$) for a complete process to find arc length ABC or AC eg $\frac{360-2 \times 56.25}{360} \times 2 \times \pi \times 5$ ($= 21.598\dots$) or $\frac{2 \times 56.25}{360} \times 2 \times \pi \times 5$ ($= 9.8174\dots$) for answer in the range 21.5 to 21.65
19		$x < -2, x > \frac{1}{2}$	M1 A1 A1	for a first step to solve the quadratic e.g. factorisation: $(2x + 4)(x - \frac{1}{2})$ or $(2x - 1)(x + 2)$ or using the formula $\frac{-3 \pm \sqrt{3^2 - 4 \times 2 \times (-2)}}{2 \times 2}$ for -2 and $\frac{1}{2}$
20 (a) (b)		(0,1) Circle radius 4 Centre (3,0) and (-1,0) and (7,0) labelled	B1 M1 M1 A1	(0,1) For centre (3,0) implied by drawing or label or a circle of radius 4 or intersections on the x-axis at -1 or 7 implied by drawing or labels for 2 of centre (3,0) implied by drawing or label intersections on the x-axis at -1 and 7 implied by drawing or label circle drawn with radius 4 for a fully correct answer

Paper: 1MA1/2H				
Question	Working	Answer	Mark	Notes
20		68.5	B1	for angle $OAB = 90^\circ$ or angle $OCB = 90^\circ$, may be seen on diagram
			P1	for a process to find the length of AB or the length of CB ($= 10\sqrt{3}$ oe) eg $10 \times \tan 60^\circ$ ($= 17.3\dots$) or the length of OB ($= 20$), eg $10 \div \cos 60^\circ$
			P1	for a process (dep previous P1) to find the area of the triangle OAB ($= 50\sqrt{3}$ oe) or area of triangle OCB ($= 50\sqrt{3}$ oe) or area of kite $OABC$ ($= 100\sqrt{3}$ oe)
			P1	for a process to find the area of the sector OAC e.g. $\frac{1}{3} \times \pi \times 10^2$ ($= 104.7\dots$), accept rounded or truncated to 3 significant figures or more
			A1	for $68.4 - 68.6$



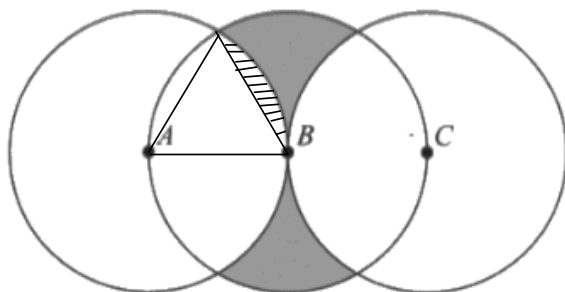
Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	proof	C1	for writing an expression for an odd number, eg $2n + 1$ or $2n - 1$ (assuming n is any integer) or states n is even and eg $(n + 1)$ or $(n + 3)$ as odd numbers	Expansion of $(2n - 1)^2 - (2n + 1)^2$ oe is acceptable
		C1	for a correct expression of the form $(2n + 1)^2 - (2n - 1)^2$ expanded eg $4n^2 + 12n + 9 - (4n^2 + 4n + 1)$ or $4n^2 + 4n + 1 - (4n^2 - 4n + 1)$ or $(2n + 1 + 2n - 1)(2n + 1 - (2n - 1))$ or when n is even and eg $(n^2 + 6n + 9) - (n^2 + 2n + 1) (=4n + 8)$	
		C1	for a correct simplified expression as a multiple of 8 eg $8n + 8$ or $8n$ or when n is even and eg $4n + 8$ and full explanation as to why $4(n+2)$ is always a multiple of 8	
16	39.9	P1	for finding the length of the minor or major arc eg $\frac{220}{360}\pi \times 12$ ($= 23(.03834..)$)	Allow appropriate rounding if calculation seen in parts
		P1	for substituting into the sine or cosine rule to find OD eg $14 \div \sin 140 = OD \div \sin 24$ or $(OD^2 =) 6^2 + 14^2 - 2 \times 6 \times 14 \times \cos 24$ ($=78.5...$)	Must involve OD in the relationship but may be implied
		P1	for a complete process to find the length OD eg $14 \div \sin 140 \times \sin 24$ ($=8.8(58778..)$)	
		P1	for a complete process to find the perimeter eg $"23(.03834..)" + 14 + "8.8(58778..)" - 6$	May be seen in multiple calculations
		A1	for an answer in the range 39.8 to 40	If an answer in the range is seen in working and then incorrectly rounded award full marks.



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
21	Proof	M1 M1 B1 C1	for $\overrightarrow{DQ} = \frac{1}{2}(\mathbf{b} - \mathbf{a})$ oe or $\overrightarrow{EQ} = \frac{1}{2}(\mathbf{a} - \mathbf{b})$ oe for $\overrightarrow{PQ} = \frac{1}{2}\mathbf{a} + \overrightarrow{DQ}$ or $\frac{1}{2}\mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a})$ oe or $\overrightarrow{PQ} = -\frac{1}{2}\mathbf{a} + \mathbf{b} + \overrightarrow{EQ}$ or $-\frac{1}{2}\mathbf{a} + \mathbf{b} + \frac{1}{2}(\mathbf{a} - \mathbf{b})$ oe for $\overrightarrow{PQ} = \frac{1}{2}\mathbf{b}$ for complete proof with statement, eg $FE = 2PQ$ or FE is a multiple of PQ or $\mathbf{b} = 2(\frac{1}{2}\mathbf{b})$	Vectors could be written on the diagram
22	0.5	P1 P1 P1 P1 A1	derive an algebraic expression for the area of A eg $\frac{1}{8}\pi[(5x-1)^2 - (3x-1)^2]$ expand and simplify for either area A or area B eg $\frac{1}{8}\pi(16x^2 - 4x)$ or $\pi(x^2 - 2x + 1)$ (dep P2) equate and rearrange into a quadratic eqn of the form $ax^2 + bx + c = 0$ eg $2x^2 + 3x - 2 = 0$ (dep P3) factorise eg $(2x-1)(x+2) = 0$ or use of formula eg $\frac{-3 \pm \sqrt{3^2 - 4 \times 2 \times -2}}{2 \times 2}$ oe	Accept only the single value of 0.5 oe but award 0 marks for a correct answer with no supportive working

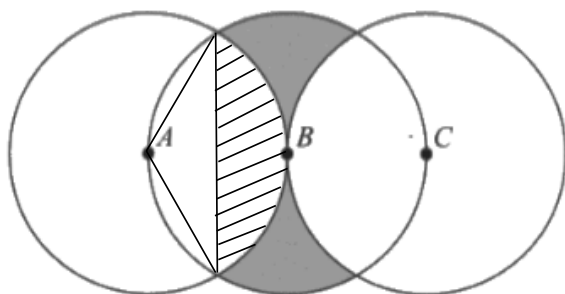
Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
21	$16\sqrt{3} - \frac{16\pi}{3}$	P1	for identifying an angle of 60 or 120	
		P1	for process to find the area of a sector of angle 60 or 120 eg $\pi 4^2 \times \frac{60}{360} (= \frac{8\pi}{3})$ or $\pi 4^2 \times \frac{120}{360} (= \frac{16\pi}{3})$	
		P1	for process to find the area of an equilateral triangle eg $\frac{1}{2} \times 4 \times 4 \times \sin 60 (= 4\sqrt{3})$ or $\frac{4 \times \sqrt{4^2 - 2^2}}{2} (= 2\sqrt{12} \text{ or } 4\sqrt{3})$ or the area of an isosceles triangle or area of a right-angled triangle eg $\frac{1}{2} \times 4 \times 4 \times \sin 120 (= 4\sqrt{3})$ or $\frac{2 \times \sqrt{4^2 - 2^2}}{2} (= \sqrt{12} \text{ or } 2\sqrt{3})$	
		P1	for using area of sector – area of triangle to find area of a segment eg $\pi 4^2 \times \frac{60}{360} - \frac{1}{2} \times 4 \times 4 \times \sin 60 (= \frac{8\pi}{3} - 4\sqrt{3})$ or $\pi 4^2 \times \frac{120}{360} - \frac{1}{2} \times 4 \times 4 \times \sin 120 (= \frac{16\pi}{3} - 4\sqrt{3})$	
		A1	for $16\pi - 4(\frac{16\pi}{6} - 4\sqrt{3} + \frac{16\pi}{6})$ or $16\sqrt{3} - \frac{16\pi}{3}$ oe	Does not need to be in simplest form





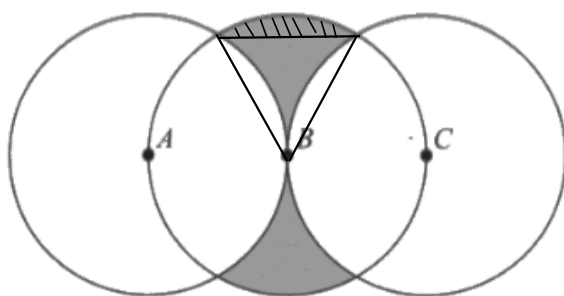
area of segment = area of sector centre A – area of equilateral triangle

Total shaded area = area of circle – 4 × area of sector – 4 × area of segment
or area of circle – 4 × area of triangle – 8 × area of segment



area of segment = area of sector centre A – area of isosceles triangle

Total shaded area = area of circle – 4 × area of segment



area of segment = area of sector centre B – area of equilateral triangle

Total shaded area = 2 × (area of sector – 2 × area of segment)
or 2 × (area of triangle – area of segment)

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
4	186.15	P1	for correctly finding the area of at least three sections, eg 3 of $11 \times 7 (= 77)$, or $9 \times 7 (= 63)$, or $\frac{1}{2} \times 11 \times 9 (= 49.5)$, or $\frac{1}{4} \times \pi \times 7^2 (= 38.4845\dots)$	Note a trapezium for the rectangle and triangle should be classed as two areas. Accept figures rounded or truncated to 1 dp or better throughout.
		P1	for a method to find the number of bags required for one area or a combination of areas eg $"77" \div 14 (= 5.5)$ or $"227.9845\dots" \div 14 (= 16.2846\dots)$	
		P1	for method to work out the total area for all four sections eg $"77" + "63" + "49.5" + "38.4845\dots" (= 227.9845\dots)$ or adding the exact number of bags per section for all four sections eg $"5.5" + "4.5" + "3.53\dots" + "2.74\dots" (= 16.28\dots)$	This mark is dependent upon correct processes seen for all four sections.
		P1	for method to find the cost, eg integer number of bags $\times 10.95$	integer number of bags must come from area $\div 14$ rounded up
		A1	cao	
5	8.73	M1	for a correct trig statement, eg $14.5 \times \cos 53$ or $\cos 53 = x \div 14.5$	Can use a combination of skills but must have only one unknown in x to score this mark
		A1	answer in the range 8.726 to 8.73	If an answer is given in the range in working and then rounded incorrectly award full marks.
6	7318.15	M1	for a correct first step eg working out increase for one year $7000 \times (100 + 3) \div 100 (= 7210)$ oe or $7000 \times 3 \div 100 (= 210)$ oe or find the multiplier for both years eg $(100 + 3) \div 100 \times (100 + 1.5) \div 100 (= 1.04545)$	7315 or 315 implies M1
		M1	for a compound method, eg $7000 \times (100 + 3) \div 100 \times (100 + 1.5) \div 100$ oe or $"7210" \times 1.5 \div 100$ or $(= 108.15)$ oe	318.15 implies M1M1A0
		A1	cao	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
3 (a)	6	P1	for a process to find a relevant area, eg $16 \times 14 \div 2 (= 112)$ or $\pi \times \left(\frac{7}{2}\right)^2 (= 38.4\dots)$	May be implied by $\frac{49}{4}\pi$
		P1	for a process to find the shaded area, eg “112” – “38.4...” (= 73.51...) or “8.96” – “3.07...” (= 5.88...)	
		P1	for a complete process to find the number of bags required for a full or partial area, eg “73.51...” $\div$ 12.5 (= 5.88...) or “112” $\div$ 12.5 (= 8.96) or “38.4...” $\div$ 12.5 (= 3.07...) or [area] $\div$ 12.5 or uses 12.5 in a build up method to exceed [area], eg $12.5 \times 6 (= 75)$ oe	[area] can be any area but cannot be a length.
(b)	Statement	A1	cao	
		C1	for a valid statement relating to effect on number of bags needed, eg Acceptable examples Will need more bags It will increase Will need an extra bag or will now need 7 bags He won't have enough There is no change (fit their [area] but must be supported by calculation) Not acceptable examples Will cover less area Needs to change the number of bags needed There is no change (unsupported or incorrect fit their [area]) He may need more bags A calculation using 11 with no supporting statement	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	155	M1	for a complete method to find the volume of the hemisphere, eg $\frac{1}{2} \times \frac{4}{3} \times \pi \times 4.2^3$ oe	If an answer in the range is seen in working and then incorrectly rounded award full marks
		A1	answer in range 155 to 155.2	
20	160 (supported)	B1	stating bound of 10.85 or 10.95	Accept 10.949 or 10.9499... for 10.95
		M1	using both UB and LB to work out value of d eg [UB of c] ³ ÷ 8 and [LB of c] ³ ÷ 8 or gives a bound of 159.66... from correct working or gives a bound of 164.11... from correct working	10.9 < UB ≤ 10.98 10.85 ≤ LB < 10.9
		A1	for 159.66... and 164.11... from correct working	Accept bounds rounded or truncated to at least 4 sig fig
		C1	for 160 from 159.66... and 164.11... with a supporting reason eg "since both UB and LB round to 160"	



Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	12	P1 P1 A1	for a process to find the area of cross section, eg $750 \div 25 (= 30)$ oe or $\frac{1}{2} \times 5 \times h$ oe for a correct equation in h , eg $750 \div 25 = \frac{1}{2} \times 5 \times h$ oe or $\frac{1}{2} \times 5 \times h \times 25 = 750$ oe or for a complete process to find h , eg $\frac{750}{25} \times \frac{2}{5}$ oe or “30” $\times 2 \div 5$ cao SC B1 for answer of 6 if P0 scored	May use any letter for h or may use ?
7	Shown	M1 M1 M1 A1	for a correct expression for the area of one face of the cube, eg x^2 or a correct expression for the surface area of the cube, eg $6 \times x^2$ for a correct expression for the surface area of the sphere, eg $4 \times \pi \times 3^2 (= 36\pi)$ for forming a suitable equation, eg $6 \times x^2 = 4 \times \pi \times 3^2$ or $6x^2 = “36\pi”$ for completing the method to $x = \sqrt{6\pi}$ or $k = 6$	No marks for $x = \sqrt{6\pi}$ without any working. $6 \times x^2 = 4 \times \pi \times 3^2$ $x^2 = 36\pi \div 6$ $x = \sqrt{6\pi}$



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	25 : 36	P1 P1 A1	for $\sqrt[3]{125}$ (= 5) and $\sqrt[3]{27}$ (= 3) oe OR for correct process to find the radius of A and radius of B (3.10... and 1.86...) for method to find values in ratio of length between A and C eg 5 and 2×3 (= 6) oe or "3.10..." and "1.86..." $\times 2$ (= 3.72...) OR 25 and 36 OR for correct process to find SA of A and SA of C (120.(8...)) and (174.(0...)) for 25 : 36 oe eg 1 : 1.44	Accept scale factors expressed as fractions or decimals eg 1.66, 1.67, 0.6 or better Ignore units throughout For both P marks the lengths need not be written as a ratio
20	0.748	P1 P1 P1 A1	for a process to find a correct probability product for 2 consecutive days, eg. 0.7×0.8 (rain M + T) or 0.7×0.2 (rain M + no rain T) or 0.3×0.6 (no rain M + rain on T) or 0.3×0.4 (no rain M + T) for process to find a correct triple probability product for it raining on Wednesday, eg. $0.7 \times 0.8 \times 0.8$ (rain M + T + W) (= 0.448 or $\frac{56}{125}$ oe) or $0.7 \times 0.2 \times 0.6$ (rain M + no rain T + rain W) (= 0.084 or $\frac{21}{250}$ oe) or $0.3 \times 0.6 \times 0.8$ (no rain M + rain T + rain W) (= 0.144 or $\frac{18}{125}$ oe) or $0.3 \times 0.4 \times 0.6$ (no rain M + no rain T + rain W) (= 0.072 or $\frac{9}{125}$ oe) for complete process, eg. "0.448" + "0.084" + "0.144" + "0.072" oe eg. $\frac{187}{250}$	Throughout accept probabilities given as fractions or percentages Could be for Tuesday and Wednesday also NB: correct answer without supportive working gets 0 marks

Paper: 1MA1/1H																
Question	Answer	Mark	Mark scheme	Additional guidance												
8	19	M1	for a method to find 5 products within intervals (including end points)	<table><tr><td>Min fx</td><td>Max fx</td></tr><tr><td>0</td><td>80</td></tr><tr><td>100</td><td>200</td></tr><tr><td>140</td><td>210</td></tr><tr><td>60</td><td>80</td></tr><tr><td>120</td><td>150</td></tr></table>	Min fx	Max fx	0	80	100	200	140	210	60	80	120	150
		Min fx	Max fx													
		0	80													
100	200															
140	210															
60	80															
120	150															
M1	for $\Sigma "fx" \div (8 + 10 + 7 + 2 + 3)$ or $(5 \times 8 + 15 \times 10 + 25 \times 7 + 35 \times 2 + 45 \times 3) \div (8 + 10 + 7 + 2 + 3)$ or $("40" + "150" + "175" + "70" + "135") \div "30"$ or $"570" \div "30"$	$\Sigma "fx"$ must come from 5 products fx within intervals (including end points)														
A1	cao															
9	278	P1	for working out at least 3 areas from $5 \times 7 (= 35)$ $5 \times 6 (= 30)$ $7 \times 6 (= 42)$ $4 \times 4 (= 16)$													
		P1	for a complete process, eg $"35" \times 2 + "30" \times 2 + "42" + ("42" - "16") + "16" \times 5$ oe or $"35" \times 2 + "30" \times 2 + "42" \times 2 + "16" \times 4$ OR for a process to find the total surface area of at least 5 faces for each solid, eg $"35" \times 2 + "30" \times 2 + "42"$ and $"16" \times 6$ or $"35" \times 2 + "30" \times 2 + "42" \times 2$ and $"16" \times 5$	Total surface area of cuboid = 214 Total surface area of cube = 96												
		A1	cao													

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9	10.125	P1	for process to find volume of at least one of the cube or the pyramid, eg $6 \times 6 \times 6 (= 216)$ oe or $k \times 8 \times 8 \times h (= \frac{64}{3}h)$ oe	Check diagram for working Throughout $0 < k \leq 1$
		P1	for process to form an equation, eg $6 \times 6 \times 6 = k \times 8 \times 8 \times h$ or “216” = $\frac{64}{3}h$ or for process to find h eg “216” $\div 8^2 \div k$	
		A1	for 10.125 oe mixed number	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
14	$\frac{1}{2}$	M1 A1	for $\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{2}$ or $\frac{\sqrt{3}}{3} \times \frac{\sqrt{3}}{2}$ or $(\frac{1}{2} \div \frac{\sqrt{3}}{2}) \times \frac{\sqrt{3}}{2}$ OR $\tan 30 = \frac{1}{\sqrt{3}}$ oe or $\sin 60 = \frac{\sqrt{3}}{2}$ for $\frac{1}{2}$ or 0.5	
15	48	M1 M1 M1 A1	for method to use a volume formula with correct substitution for the cone, sphere or hemisphere eg $\frac{1}{3} \times \pi \times 3^2 \times 10$ or $\frac{4}{3} \times \pi \times 3^3$ or $\frac{2}{3} \times \pi \times 3^3$ oe for complete method to find total volume eg $\frac{1}{3} \times \pi \times 3^2 \times 10 + \frac{2}{3} \times \pi \times 3^3$ (dep first M1) for correct partial simplification, eg 30π or 18π cao SC B2 for answer of 264 or 264π	May work without π or with an approximation of π ; must use the correct radius of 3 (and 10) in substitution Must be cone or hemisphere Accept 48π

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
3 (i)	65	M1	for working with proportion eg $10 \div 30 \times 195 (=65)$	Condone use of 200 for 195
		A1	cao	
(ii)	statement	C1	for statement Acceptable examples sample is representative (otherwise answer wrong) random sample (otherwise answer will be different) the 30 students are from the 195 (otherwise not accurate) 10 out of every 30 want to go to the Theme Park (otherwise answer will be different/wrong) there is no bias Not acceptable examples There would be more than 10 people who want to go to the Theme Park I rounded my answer	
4	8	P1	for working with volume of the cuboid, eg $30 \times 6 \times 19 (= 3420)$ OR for using $\frac{2}{3}$ with one dimension, eg. $30 \times 2 \div 3 (= 20)$	For P marks, ignore attempts at unit conversion
		P1	for “3420” $\times 2 \div 3 (= 2280)$ or “3420” $\div 3 (= 1140)$ OR “20” $\times 6 \times 19 (= 2280)$ OR “3420” $\div 275 (= 12.4\dots = 12 \text{ cups})$	
		P1	(dep on P2) for “2280” $\div 275 (= 8(.29\dots))$ or “1140” $\div 275 (= 4(.14\dots))$ OR “12” $\times 2 \div 3$ OR for $275 \times 8 (= 2200)$ or $275 \times 9 (= 2475)$	
		A1	cao	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	$3n^2 + 2n + 5$	M1	for a correct start to a method to find the n th term, eg equal 2nd differences imply a term in n^2	Need to see constant second difference found and n^2
		M1	for working with $3n^2$, eg $3n^2$ and sequence 7, 9, 11, ...	$3n^2 + 2n$ implies M2
		A1	for $3n^2 + 2n + 5$	
17	$-12, -7$	B1	cao	
18	160π	P1	for process to find curved surface area of cone, eg $\pi \times 10 \times 25 (= 250\pi) (= 785\dots)$	
		P1	for process to find the radius or diameter of the smaller cone eg $10 \times \frac{15}{25} (= 6)$ or $20 \times \frac{15}{25} (= 12)$ oe OR uses area scale factor, eg " 250π " $\times \left(\frac{15}{25}\right)^2 (= 90\pi)$	15 comes from $25 - 10$ $\frac{15}{25}$ may be seen as 0.6
		P1	for a complete process, eg " 250π " $- \pi \times "6" \times 15 (= 785\dots - 282\dots)$ or answer in range 502 to 503	
		A1	for 160π	Award 0 marks for an answer of 160π or an answer in range 502 to 503 with no supportive working. If 160π seen but answer in range 502 to 503 given on answer line isw and award full marks



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	65	P1	for a full process to find the volume of the container, eg $\pi \times 15^2 \times 43$ (= 30 394.9...)	These steps may be completed in a different order Accept 9675π
		P1	for a process to convert between cm^3 and litres, eg "30 394.9..." $\div 1000$ (= 30.39...) or [volume] $\div 1000$ or 0.47×1000 (= 470)	Accept 9.675π or $\frac{387}{40}\pi$
		P1	for a process to find the time taken, eg [volume] $\div 0.47$ or [volume] $\div$ "470"	[volume] can be any value they believe to be the volume that might have been incorrectly converted (or not at all)
		A1	answer in the range 64.6 to 65	If an answer is given in the range in working and then rounded incorrectly award full marks.
8	$1.85 \leq x < 1.95$	B1	for 1.85 in correct position	Accept 1.949 or 1.9499(...)
		B1	for 1.95 in correct position	
9	$x^3 + 8x^2 + x - 42$	M1	for a method to find the product of two linear expression (3 out of 4 terms correct or 4 correct terms ignoring signs), eg $x^2 - 2x + 7x - 14$ or $x^2 + 3x - 2x - 6$ or $x^2 + 3x + 7x + 21$	Note that (eg) $5x - 14$ in expansion of $(x + 7)(x - 2)$ is to be regarded as 3 correct terms.
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product), eg $x^3 + 3x^2 - 2x^2 + 7x^2 - 6x + 21x - 14x - 42$	First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		A1	cao	

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	12 : 15 : 5	P1	for process to find ratio of heights of L and M eg $\sqrt[3]{64} : \sqrt[3]{125}$ (= 4 : 5) oe or $\sqrt[3]{\frac{64}{64}} : \sqrt[3]{\frac{125}{64}}$ (= 1 : 1.25) oe or $\sqrt[3]{\frac{64}{125}} : \sqrt[3]{\frac{125}{125}}$ (= 0.8 : 1) oe	Condone not written as a ratio as long as clear $\frac{125}{64} = 1.953...$ $\frac{64}{125} = 0.512$
		P1	for process to find ratio of heights of M and P eg $\sqrt[3]{144} : \sqrt[3]{16}$ (= 12 : 4 = 3 : 1) oe or $\sqrt[3]{\frac{144}{16}} : \sqrt[3]{\frac{16}{16}}$ (= 3 : 1) oe or $\sqrt[3]{\frac{144}{144}} : \sqrt[3]{\frac{16}{144}}$ (= 1 : 0.3) oe	Condone not written as a ratio as long as clear $\frac{144}{16} = 9$ $\frac{16}{144} = 0.1$
		P1	(dep on P2) for process to find ratio of heights of all 3, eg “(4 : 5)” × 3 and “(3 : 1)” × 5 or (1 : 1.25) × 12 and (3 : 1) × 5 or (0.8 : 1) and (1 : 0.3)	
		A1	for 12 : 15 : 5 oe	Can ISW incorrect simplification of a correct ratio



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
6 (a)	0.4	B1	for 0.4 in correct position	Accept equivalent fractions or percentages for probabilities An answer of $\frac{0.33}{1}$ scores M1A0
	0.45, 0.55, 0.45	B1	for the correct probabilities for coin B in the correct place on the branches	
	0.33	M1	for a correct method, eg 0.6×0.55 only	
		A1	for 0.33 oe	
7	63	P1	for process to find volume, eg $\pi \times 100^2 \times 30$ ($= 300\,000\pi$ or $942\,477(.796\dots)$)	(volume $\Rightarrow$) 942 478 implies P1
		P1	for process to find time in seconds, eg " $942\,477(.796\dots)$ " $\div$ 250 ($= 1200\pi$ or $3769(.911\dots)$) or [volume] $\div$ 250 or for converting rate to minutes, eg 250×60 ($= 15\,000$)	(time $\Rightarrow$) 3770 implies P2 [volume] $\neq$ 30, 60, 100, 250
		P1	for complete process eg " $3769(.911\dots)$ " $\div$ 60 ($= 20\pi$) or " $942\,477(.796\dots)$ " $\div$ " $15\,000$ " ($= 20\pi$)	A correct answer with no supportive working gets 0 marks If an answer is shown in the range in working and then incorrectly rounded award full marks
		A1	for answer in the range 62 to 63	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	6	P1	for starting process, by defining height, radius and using Pythagoras to form an equation for the slant height l eg height = h , radius = $\frac{3}{4}h$ and $l^2 = h^2 + \left(\frac{3h}{4}\right)^2 \left(= \frac{25}{16}h^2\right)$ or $(l =) \sqrt{h^2 + \left(\frac{3h}{4}\right)^2} \left(= \frac{5}{4}h\right)$ oe eg $r = 3x$ and $h = 4x$ and $l^2 = (3x)^2 + (4x)^2$	Can use any other letter than h provided it is defined eg height = x
		P1	(dep P1) for process to form a correct expression for the curved surface area in terms of a single variable, eg $\pi \times \frac{3}{4}h \times \frac{5}{4}h \left(= \frac{15}{16}\pi h^2\right)$ or $\pi \times 3x \times 5x$ where $h = 4x$	May include area of circle eg $\pi \times \left(\frac{3}{4}h\right)^2 + \pi \times \frac{3}{4}h \times \frac{5}{4}h \left(= \frac{24}{16}\pi h^2\right)$
		P1	for forming and simplifying a correct equation to find height, eg $\frac{24\pi}{16}h^2 = 54\pi$	
		A1	cao	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
16	15	P1	for process to find volume of cylinder or volume of cone, eg $\pi \times 8^2 \times \frac{h}{3}$ oe or $\frac{1}{3} \times \pi \times 8^2 \times h$ oe or $\pi \times 8^2 \times H$ oe or $\frac{1}{3} \times \pi \times 8^2 \times 3H$ oe or $\pi \times 8^2 \times \frac{x}{4}$ oe or $\frac{1}{3} \times \pi \times 8^2 \times \frac{3x}{4}$ oe	h = height of the cone H = height of the cylinder x = total height of the shape Allow any letter for h, H and x, does not have to be defined for the award of the marks The award of all marks requires the substitution of $r = 8$, allow this to be done at a later stage in the question
		P1	(dep P1) for setting up an equation in terms of one variable, eg "$\pi \times 8^2 \times \frac{h}{3} + \frac{1}{3} \times \pi \times 8^2 \times h$" = 640π oe or "$\pi \times 8^2 \times H + \frac{1}{3} \times \pi \times 8^2 \times 3H$" = 640π oe or "$\pi \times 8^2 \times \frac{x}{4} + \frac{1}{3} \times \pi \times 8^2 \times \frac{3x}{4}$" = 640π oe or "$\pi \times 8^2 \times \frac{h}{3}$" = 320π oe or "$\frac{1}{3} \times \pi \times 8^2 \times h$" = 320π oe or "$\pi \times 8^2 \times H$" = 320π oe or "$\frac{1}{3} \times \pi \times 8^2 \times 3H$" = 320π oe or "$\pi \times 8^2 \times \frac{x}{4}$" = 320π oe or "$\frac{1}{3} \times \pi \times 8^2 \times \frac{3x}{4}$" = 320π oe	A correct equation implies the first P1 Allow inconsistent use of π within their equation provided the correct volumes are seen previously



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
		P1	(dep P2) for process to solve for h or H or x eg $(h =) \frac{640\pi}{\frac{1}{3} \times \pi \times 8^2 + \frac{1}{3} \times \pi \times 8^2}$ oe eg $(h =) \frac{3 \times 640\pi}{\text{"64}\pi" + \text{"64}\pi"}$ or $(H =) \frac{640\pi}{\pi \times 8^2 + \frac{1}{3} \times \pi \times 8^2 \times 3} (=5)$ oe eg $(h =) \frac{640\pi}{\text{"64}\pi" + \text{"64}\pi"} (=5)$ or $(x =) \frac{640\pi}{\pi \times 8^2 \times \frac{1}{4} + \frac{1}{3} \times \pi \times 8^2 \times \frac{3}{4}} (=20)$ oe eg $(x =) \frac{640\pi}{\text{"32}\pi"} (=20)$	Can be an equation in the form $ah = p$ or $bH = q$ or $cx = r$ where a or b or c is an integer
		A1	cao	Award 0 marks for a correct answer with no (or incorrect) supportive working
17	$-\frac{1}{7}$	M1	for using a common denominator eg $\frac{5x(3x+1) - 2x(3x-1)}{(3x-1)(3x+1)} (=1)$ or for removing the fraction eg $5x(3x+1) - 2x(3x-1) = (3x-1)(3x+1)$	Allow one error in total in all the expansions (may be a sign error)
		M1	for correct methods to remove all fraction(s) and expand the brackets, eg $15x^2 + 5x - 6x^2 + 2x = 9x^2 + 3x - 3x - 1$	
		A1	for $-\frac{1}{7}$ oe	Allow $-0.14(2\dots)$ for $-\frac{1}{7}$



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	905	P1	for correct use of formula for the volume of a sphere eg $\frac{1}{4} \times \frac{4}{3} \times \pi \times r^3$ ($= 576\pi$ or $1809\dots$) OR $576\pi \times 4$ or 2304π or $7238\dots(\frac{4}{3} \times \pi \times r^3)$	We do not need to see what is in the brackets to award this mark. The contents of the bracket alone would score P0
		P1	for a complete correct process to find r , eg $r = \sqrt[3]{\frac{576 \times 4 \times 3}{4}}$ or $r = 12$	Could be shown in several stages $\sqrt[3]{\frac{576 \times 4 \times 3}{4}} = \sqrt[3]{1728}$
		P1	for a process to find the curved surface area eg $\frac{4 \times \pi \times [\text{radius}]^2}{4}$ ($= 144\pi$ or $452\dots$) OR the surface area of both flat surfaces eg $(2 \times \frac{\pi \times [\text{radius}]^2}{2})$ OR complete expression for the total surface area eg $\frac{4\pi r^2}{4} + \frac{\pi r^2}{2} \times 2$ oe	Radius used must be clearly identified as their radius of the solid
		P1	for process to find the complete surface area eg $\frac{4 \times \pi \times [\text{radius}]^2}{4} + (2 \times \frac{\pi \times [\text{radius}]^2}{2})$	
		A1	answer in the range $904.7 - 905$ or 288π (SCB2 for an answer in the range $358.1 - 359.2$)	If an answer is given in the range but then incorrectly rounded, award full marks.
20	(a) explanation	C1	for a correct explanation, eg $\sqrt{3} \times -\sqrt{3} = -3$, not 3	
	(b) explanation	C1	for correct explanation, eg $\sqrt{12} = 2\sqrt{3}$, not $3\sqrt{2}$	



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
20	3.75	P1	works to find vol of frustum eg $\frac{1}{3}\pi(3.6)^2 \times 6.4 - \frac{1}{3}\pi(1.8)^2 \times 3.2$ or $86.858... - 10.857... (=24.192\pi \text{ or } 76.00...)$	781.7... by use of diameter does not get the mark [vol] is their volume which could be ft using the radius, using the diameter, or could be another value as long as it is stated as being the volume, or clearly intended from working. All figures must come from correct method shown.
		P1	works to find vol of hemisphere eg $\frac{1}{2} \times \frac{4}{3} \pi \times 3.6^3 (=31.104\pi \text{ or } 97.7...)$	
		P1	mass of frustum as [vol]×density eg “76.00” × 2.4 (=182.4..) or mass of hemisphere as [vol]×density eg “97.7...”×4.8 (=469.037...)	
		P1	mean density as total mass ÷ total volume eg (“182.4..” + “469.037”) ÷ (“76...” + “97.7..”) or “651.4..” ÷ “173.7...”	
		A1	answer in the range 3.7 to 3.8	
21	proof	C1	uses cyclic quad eg if $CAB = x$ then $CRO = 180 - x$ (<u>Opposite angles</u> of a <u>cyclic quadrilateral</u> add up to 180° .)	Underlined words need to be shown; reasons need to be linked to their method; any reasons not linked do not credit. Correct method can be implied from angles on the diagram if no ambiguity or contradiction. Full reasons given without any redundant reasons and correct reasoning throughout.
		C1	establishes relationship outside a circle eg $ORB = x$ (<u>Angles</u> on a straight <u>line</u> add up to 180)	
		C1	uses properties of a circle eg $RO = OB$ (both radii) so $ABC = x$ (Base angles of an <u>isosceles triangle</u> are equal.)	
		C1	Complete proof and conclusion	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	Diagram drawn	B2 (B1)	for correct frequency polygon for points plotted at correct midpoints of intervals or joining points at correct heights consistently within intervals including plotting at end values or correct frequency polygon with one point incorrect or correct frequency polygon with first and last points joined directly)	Plotting at (5,14), (15,18), (25,26), (35,12) Must use line segments for B2 Joining must be with line segments NB ignore any histogram drawn and any part of frequency polygon outside range of first and last points plotted
8	8	P1 P1 P1 P1 A1	process to start the problem eg $xy = 45$ and $xz = 15$ and $yz = 27$ or $5 \times 9 (=45)$ and $3 \times 9 (=27)$ and $3 \times 5 (=15)$ or 3, 5 and 9 stated for $3 \times 5 \times 9 (=135)$ or 2 of “9” $\div 2.5 (=3.6)$ or “5” $\div 2.5 (=2)$ or “3” $\div 2.5 (=1.2)$ for $2.5^3 (=15.625)$ or all of “9” $\div 2.5 (=3.6)$ and “5” $\div 2.5 (=2)$ and “3” $\div 2.5 (=1.2)$ for a complete process to find the number of cubes possible eg [volume] $\div$ “15.625” (=8.64) or “3.6” $\times$ “2” $\times$ “1.2” (=8.64) cao	Maybe seen on diagram [Volume] must come from multiplying together what they clearly indicate as the 3 dimensions of the cuboid. The three dimensions cannot be 45, 27 and 15



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	No Supported	P1	for finding the area of a circle eg $\pi \times 0.8^2 (= 2.01\dots)$	Must be area of circle and not part of a volume, eg $\pi r^2 h$ May be seen as $2\pi r^2$
		P1	for finding the curved surface area eg $2\pi \times 0.8 \times 1.8 (= 9.047\dots)$	May be seen from $2\pi rh$ or from πdh
		P1	for use of the coverage information with an area eg “2.01...” $\div 5 (= 0.402\dots)$ or “4.02...” $\div 5 (= 0.804\dots)$ or “9.047...” $\div 5 (= 1.8095\dots)$ or “11.058” $\div 5 (= 2.2116\dots)$ or “13.069...” $\div 5 (= 2.6138\dots)$ OR for process to find total coverage for comparison eg $5 \times 7 (= 35)$	Accept numbers without working written to no less than 2dp Do not award if a volume has been used as part of the calculation. An independent mark for 5×7
		P1	(dep P1) for finding total surface area for 3 tanks eg [total surface area] $\times 3 (= 39.2\dots)$ OR for complete process to find the number of tins needed for total area of 3 tanks eg “13.069”... $\times 3 \div 5 (= 7.84\dots)$ OR for complete process to find coverage needed from each tin eg “13.069”... $\times 3 \div 7 (= 5.6\dots)$	[total surface area] must come from the addition of two attempts at area, but not from volume.
		C1	for conclusion “No” supported by accurate figures eg 8 tins or 7.84 (> 7) or 39.2 > 35 or 5.6 (> 5)	Clear statement that there is not enough paint supported by correct figures for comparison. NB: $2.6 \times 3 = 9$ tins needed is inaccurate 8 or 7.84 tins is sufficient without restating the 7, 5.6 m ² is sufficient without restating the 5 but 39.2 and 35 are needed for comparison. A statement of “No, 8 tins” alone gets 0 marks without supporting working.

Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
7	4.56×10^{-2}	M1 A1	for $0.000000342 \div 0.0000075$ OR for 0.0456 oe eg 0.456×10^{-1} or 45.6×10^{-3} or $\frac{57}{1250}$ OR for an answer of 4.56×10^0 cao	
8	6	M1 M1 A1	for $720 \div 40 (= 18)$ or $720 \div 30 (= 24)$ for a complete process eg $(720 \div 30) - (720 \div 40)$ or $"18" \times 4/3 - "18"$ or $"24" - "24" \times 3/4$ cao	
9	No (supported)	P1 P1 P1 P1 A1	for finding the area of 3 or more faces of the cuboid and adding eg $(6 \times 8) + (8 \times 18) + (6 \times 18) \dots$ or $"48" + "144" + "108" \dots (= 300)$ complete process to find surface area of cuboid, eg $6 \times 8 \times 2 + 6 \times 18 \times 2 + 8 \times 18 \times 2 (= 600)$ for process to find side length of cube, eg [surface area] $\div 6$ and square rooting ($= 10$) (dep on previous P1) for processes to find volume of cube and volume of cuboid, eg [side length] ³ ($= 1000$) and $6 \times 8 \times 18 (= 864)$ for a process to find the volume of the cuboid $6 \times 8 \times 18 (= 864)$ and cube rooting ($= 9.52\dots$) to find a side length (dep on previous P1) for process to find surface area of cube, eg. $("9.52\dots")^2 \times 6 (= 544.28\dots)$ No with 1000 and 864 OR No with 600 and 544(.28...)	Could be an addition of <i>any</i> three faces eg $48 + 48 + 144$ etc. [surface area] must come from the addition of at least three attempts at area, but not from volume.



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
22	7x	M1	multiplication by reciprocal, eg $\frac{7(x-2)}{(x-2)(x+6)} \times \frac{x(x+6)(x-6)}{x-6}$	Independent mark, may be awarded at any point
		M1	for factorising the numerator or denominator of the 1 st fraction, eg $\frac{7(x-2)}{(x-2)(x+6)}$ or $\frac{7(x-2)}{x^2+4x-12}$ or $\frac{7x-14}{(x-2)(x+6)}$	
		M1	for factorising the denominator of the second fraction, eg $\frac{x-6}{x(x+6)(x-6)}$ ($= \frac{1}{x(x+6)}$)	
		A1	completing the algebra to reach 7x	
23	264	P1	correct substitution into the volume formula, eg $56.8 = \frac{1}{3} \times \pi \times r^2 \times 3.6$	AOB does not need to be the subject of the equation
		P1	completes process to find base radius or the value of r^2 , eg $r = \sqrt{\frac{56.8 \times 3}{\pi \times 3.6}}$ ($= 3.88158\dots$) or $r^2 = \frac{56.8}{1.2\pi}$ ($= 15.066$)	
		P1	Uses Pythagoras to find the sloping length, eg $\sqrt{3.88^2 + 3.6^2}$ ($= 5.29\dots$)	
		P1	process to find an equation in AOB, eg $\pi \times 3.88 \times 5.29 = \frac{AOB}{360} \times \pi \times 5.29^2$ or $\frac{AOB}{360} \times \pi \times 2 \times 5.29 = 2 \times \pi \times 3.88$ or $\frac{AOB}{360} \times 5.29 = 3.88$	
		A1	answer in the range 263.9 to 264.1	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
9	2820	P1	for start to process to find height of triangle, eg $\tan(40) = \frac{h}{5}$ oe or equivalent process to find the height of the triangle or start to process to find slant height, eg $\frac{10}{\sin 100} = \frac{x}{\sin 40}$	
		P1	for complete process to find height of triangle, eg $5 \tan 40$ (= 4.19...) or complete process to find the slant height, eg $\frac{10}{\sin 100} \times \sin 40$ (= 6.5...)	Accept 4.2
		P1	for start of process to find volume of prism, eg $10 \times 20 \times 12$ (= 2400) or $0.5 \times 10 \times "4.19..." \times 20$ (= 419....) or $\frac{1}{2} \times 10 \times "6.52..." \times \sin 40 \times 20$ (419....) or process to find total area of cross section, eg $0.5 \times 10 \times "4.19..." + 10 \times 12$ (= 140.9...) or $\frac{1}{2} \times "6.52..." \times "6.52..." \times \sin 100 + 10 \times 12$ (= 140.9...)	$10 \times 20 \times 12$ may be seen as part of a calculation to find the volume of the prism
		P1	for complete process to find total volume, eg $(0.5 \times 10 \times "4.19..." + 10 \times 12) \times 20$	
		A1	for an answer in the range 2810 to 2820	If an answer is given in the range in working and then rounded incorrectly award full marks.



Paper: 1MA1/2H				
Question	Answer	Mark	Mark scheme	Additional guidance
17 (a)	25.9	P1	for process to find volume of hemisphere, eg $\frac{1}{2} \times \frac{4}{3} \times \pi \times 3.5^3$ (=89.797...) $\left(\frac{343\pi}{12}\right)$ or for a correct expression for the volume of the cone, eg $\frac{1}{3} \times \pi \times 3.5^2 (y - 3.5)$ or $\frac{1}{3} \times \pi \times 3.5^2 \times h$	'y - 3.5' may be seen as a new variable, but cannot be just y Condone missing brackets Accept decimals rounded or truncated to 1dp
		P1	for setting up an equation linking all three aspects, eg $\frac{1}{2} \times \frac{4}{3} \times \pi \times 3.5^3 + \frac{1}{3} \times \pi \times 3.5^2 (y - 3.5) = 120\pi$ or "89.797..." + "12.828..."(y - 3.5) = "376.99 ..." or "28.5833..." π + "4.0833..." π (y - 3.5) = 120 π	$120\pi - "89.797..." = 287.193... \text{ or } \frac{1097\pi}{12}$ π may be missing throughout Award of this mark implies award of the previous May be seen in multiple steps
		P1	for process to isolate y or (y - 3.5) or h in their equation, eg $120\pi - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3.5^3 + \frac{1}{3} \times \pi \times 3.5^2$ or $\frac{1}{3} \pi \times 3.5^2$ or "376.99..." - "89.797..." + "44.898..." or "12.828..." or $120\pi - "28.5833..." \pi + "14.291..." \pi$ oe or "4.083..." π	
		A1	for answer in range 25.8 to 26.3 SCB3 for an answer in the range 22.3 to 22.8 or $\frac{1097}{49}$	If an answer is given in the range in working and then rounded incorrectly award full marks.



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
18	98.8	P1	for process to find the radius of the top of the frustum eg $6 \div 10 \times 3 (= 1.8)$	Accept rounded or truncated values Accept multiples of π for process marks.
		P1	for process to find the curved surface area of the frustum eg $3 \times \pi \times 10 - "1.8" \times \pi \times 6 (= 60.3...)$	
		P1	for process to find the area of either circular face eg $\pi \times 3^2 (= 28.27...)$ or $\pi \times "1.8"{}^2 (= 10.1...)$	
		P1	for a process to find the curved surface area + the area of at least one circular face eg $3 \times \pi \times 10 - "1.8" \times \pi \times 6 + \pi \times 3^2 (= 88.5...)$ or $3 \times \pi \times 10 - "1.8" \times \pi \times 6 + \pi \times "1.8"{}^2 (= 70.49....)$	
		A1	for an answer in the range 98.7 to 98.8	
19	Statement	C1	for explanation Acceptable examples should go through (0, 1) should not go through (0, 0) it has touched the x-axis $3^0 = 1$ $3^0 \neq 0$ Not acceptable examples the graph has been drawn wrong axes are not labelled	

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
21	2.5	P1	for forming an equation using the volume, eg $20wh = 300$ or $wh = 15$ oe or for $300 \div 20 (= 15)$	Can use any variables for height and width
		P1	for forming an equation using the surface area, eg $20w + 20w + 20h + 20h + hw + hw = 370$ oe or $20w + 20w + 20h + 20h + 30 = 370$ oe	Use of 30 in this equation implies 1st P1
		P1	for eliminating one variable, eg $40h + \frac{600}{h} + 30 = 370$ or $40h^2 - 340h + 600 (= 0)$ or $2h^2 - 17h + 30 (= 0)$	
		P1	for process to solve quadratic equation, eg $(2h - 5)(h - 6) (= 0)$ or $\frac{17 \pm \sqrt{(-17)^2 - 4 \times 2 \times 30}}{2 \times 2}$	Award P4 for answer of 6 if 2.5 and 6 identified and supported by working that involves both volume and surface area
		A1	for 2.5 oe	Do not award A1 for 2.5 if it is not supported by working that involves both volume and surface area

Paper: 1MA1/1H				
Question	Answer	Mark	Mark scheme	Additional guidance
23 (a)	4000	P1	for process to identify the common ratio, eg $400\sqrt{5} \div 200 (= 2\sqrt{5})$ or $200 \div 400\sqrt{5} (= \frac{1}{2\sqrt{5}})$ or for a process to find the next term of the sequence, eg $200 \times (200 \div 10)$	May use any 2 consecutive terms
(b)	5	A1	cao	
		P1	for process to find the ratio of the 4th and 6th terms, eg $\frac{5\sqrt{2}}{8} \div \frac{5\sqrt{2}}{4} (= \frac{1}{2})$ or $\frac{5\sqrt{2}}{4} \div \frac{5\sqrt{2}}{8} (= 2)$ or for finding that the 2nd term is $\frac{5\sqrt{2}}{2}$	
		P1	for complete process to find 1st term, eg $\frac{5\sqrt{2}}{4} \div \left(\frac{1}{\sqrt{2}}\right)^3$	
		A1	cao	Award 0 marks for a correct answer with no supportive working
24 (a)	1 : 4	P1	for process to equate the two volumes, $\frac{4}{3}\pi r^3 = \frac{1}{3}\pi r^2 h$	
		A1	cao	
(b)	1 : $\sqrt{8}$	P1	for process to equate surface areas, eg $4\pi r^2 = \pi r^2 + \pi r l$	Can be implied by $3r = l$
		P1	for process to substitute $l = \sqrt{h^2 + r^2}$, eg $4\pi r^2 = \pi r^2 + \pi r \sqrt{h^2 + r^2}$	
		P1	for process to isolate term in r^2 after substituting for l , eg $8r^2 = h^2$	
		A1	for 1 : $\sqrt{8}$	

Question 9(b)

