



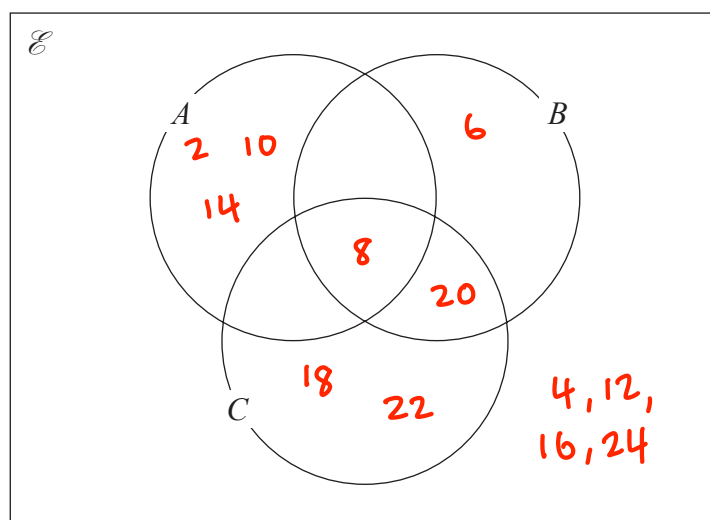
1 $\mathcal{E} = \{\text{even numbers between 1 and 25}\}$

$$A = \{2, 8, 10, 14\}$$

$$B = \{6, 8, 20\}$$

$$C = \{8, 18, 20, 22\}$$

(a) Complete the Venn diagram for this information.



(4)

A number is chosen at random from $\mathcal{E}$.

(b) Find the probability that the number is a member of $A \cap B$.

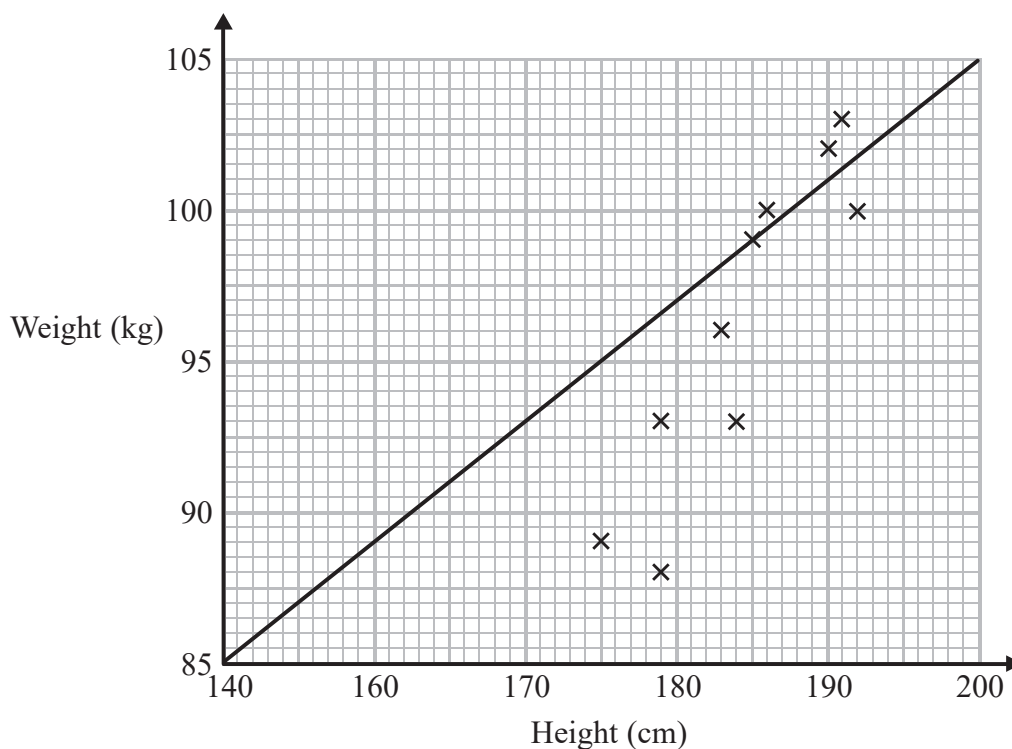
$$\frac{1}{12}$$

(2)

(Total for Question 1 is 6 marks)



- 2 Sean has information about the height, in cm, and the weight, in kg, of each of ten rugby players. He is asked to draw a scatter graph and a line of best fit for this information. Here is his answer.



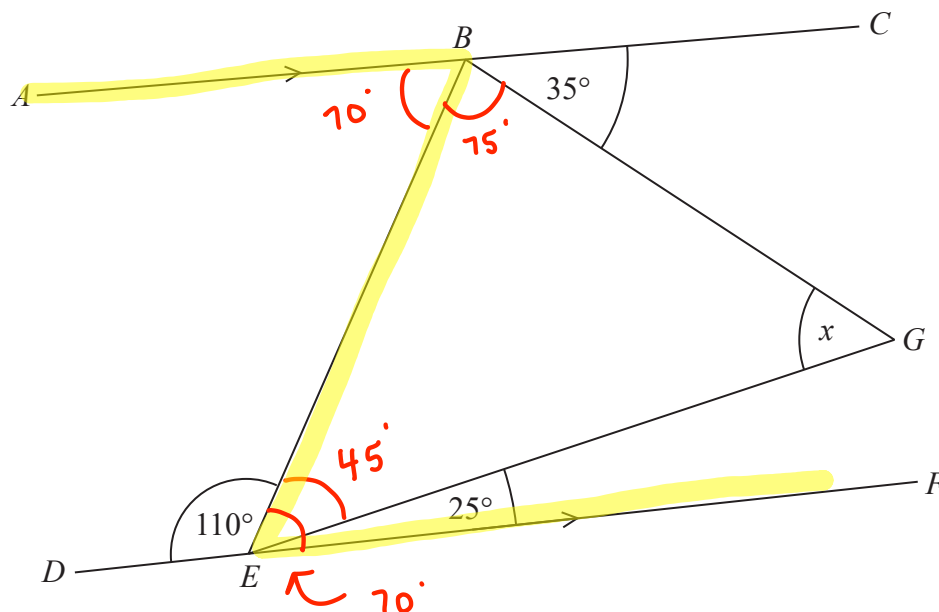
Sean has plotted the points accurately.

Write down two things that are wrong with his answer.

- 1 Line of best fit is incorrect
- 2 missing 150 on height axis

(Total for Question 2 is 2 marks)

3 BEG is a triangle.



ABC and DEF are parallel lines.

Work out the size of angle x .

Give a reason for each stage of your working.

$\angle BEG = 45^\circ$ as angles on a straight line add to 180°

$\angle ABE = 70^\circ$ as alternate angles are equal

$\angle EBG = 75^\circ$ as angles on a straight line add to 180°

$x = 180 - 75 - 45 = 60^\circ$ (Angles in a triangle add to 180°)

(Total for Question 3 is 4 marks)



- 4 Northern Bank has two types of account.
Both accounts pay compound interest.

Cash savings account
Interest
2.5% per annum

Shares account
Interest
3.5% per annum

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

- (a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

Ali :

$$2000 \times 1.025^3$$

$$= 2153.78$$

$$2153.78 - 2000$$

$$= \underline{153.78}$$

Ben :

$$1600 \times 1.035^3$$

$$= 1773.95$$

$$1773.95 - 1600$$

$$= \underline{173.95}$$

Ben will earn the
most interest

(4)

In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

- (b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

No, Ben already gets more interest and so he will just get even more

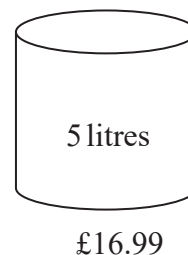
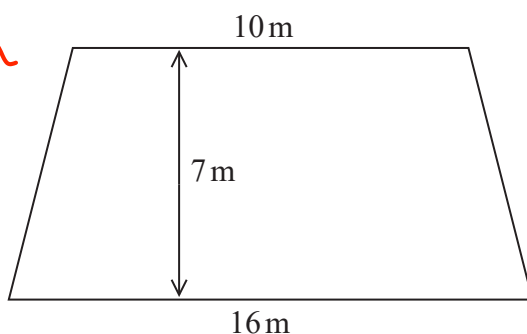
(1)

(Total for Question 4 is 5 marks)



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

$$\frac{1}{2}(a+b)h$$



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.

$$\text{Area Trapezium} = \frac{1}{2}(10+16) \times 7 = 91\text{m}^2$$

$$\begin{aligned} 1\text{ L} &= 2\text{m}^2 \\ 45.5\text{ L} &= 91\text{m}^2 \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} \times 45.5$$

$$45.5 \div 5 = 9.1 \rightarrow 10 \text{ tins}$$

$$10 \times £16.99 = £169.90$$

NO, he needs £9.90 more

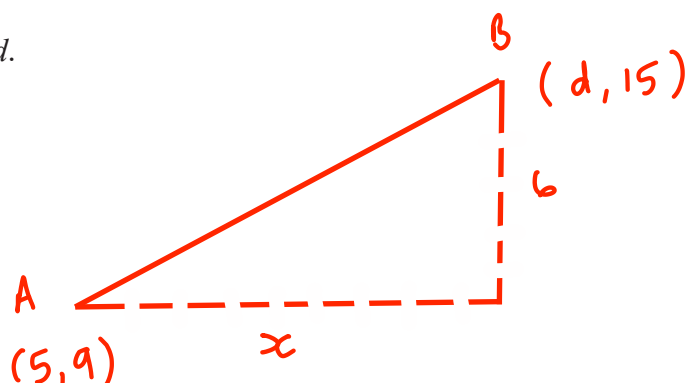
(Total for Question 5 is 5 marks)



- 6 A is the point with coordinates $(5, 9)$
 B is the point with coordinates $(d, 15)$

The gradient of the line AB is 3

Work out the value of d .



$$\frac{6}{x} = 3$$

$$\therefore x = 2$$

$$5 + 2 = 7$$

7

(Total for Question 6 is 3 marks)

- 7 (a) Write the number 0.000 086 23 in standard form.

$$8.623 \times 10^{-5}$$

(1)

- (b) Work out $\frac{3.2 \times 10^3 + 5.1 \times 10^{-2}}{4.3 \times 10^{-4}}$

Give your answer in standard form, correct to 3 significant figures.

$$= 7441979.07$$

$$7.44 \times 10^6$$

(2)

(Total for Question 7 is 3 marks)

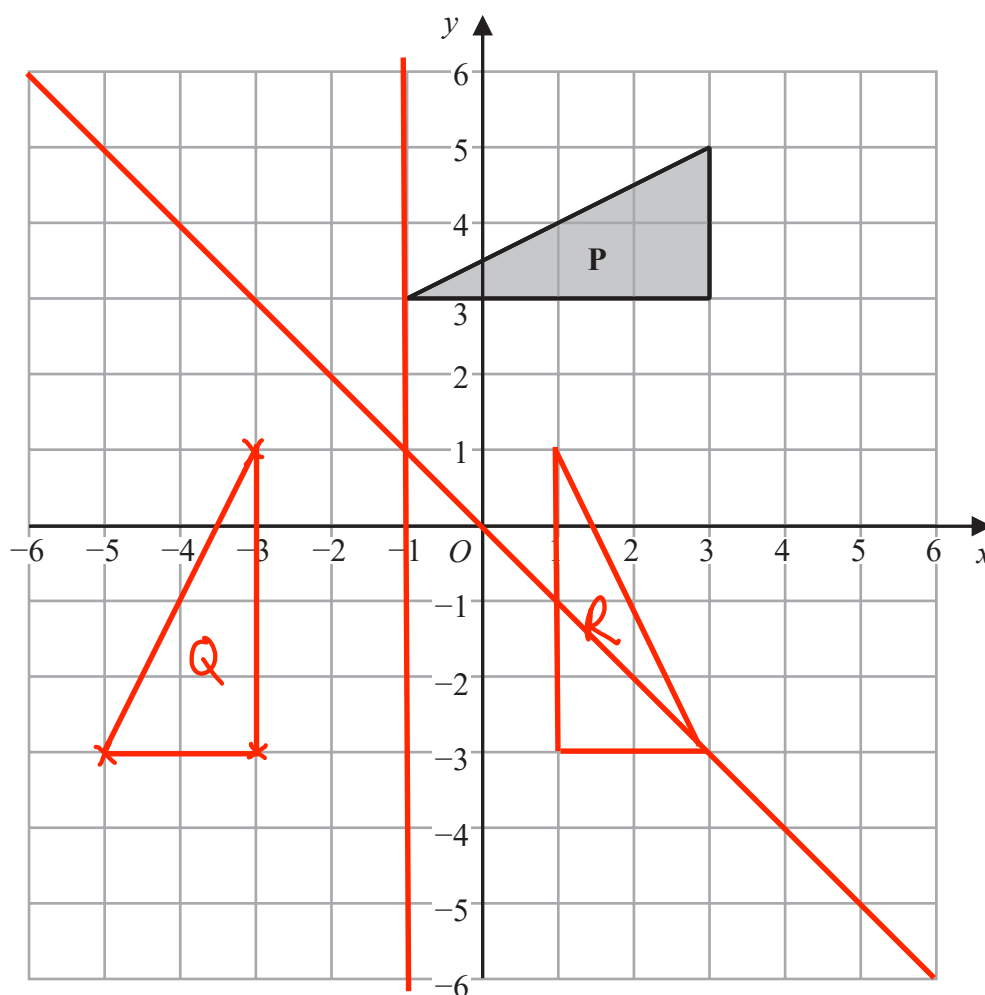
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8



Triangle **P** is reflected in the line $y = -x$ to give triangle **Q**.
Triangle **Q** is reflected in the line $x = -1$ to give triangle **R**.

Describe fully the single transformation that maps triangle **R** to triangle **P**.

Rotated 90° anticlockwise about $(-1, 1)$

(Total for Question 8 is 3 marks)

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- 9 Martin truncates the number N to 1 digit.
The result is 7

Write down the error interval for N .

$$7 \leq N < 8$$

(Total for Question 9 is 2 marks)



- 10 Robert makes 50 litres of green paint by mixing litres of yellow paint and litres of blue paint in the ratio 2:3

Yellow paint is sold in 5 litre tins.
Each tin of yellow paint costs £26

Blue paint is sold in 10 litre tins.
Each tin of blue paint costs £48

Robert sells all the green paint he makes in 10 litre tins. (5 tins)
He sells each tin of green paint for £66.96

Work out Robert's percentage profit on each tin of green paint he sells.

$$50 \div 5 = 10$$

$$\begin{array}{l} 4:6 \\ 20:30 \end{array}$$

$$\text{Need 4 yellow tins} \rightarrow 26 \times 4 = £104$$

$$\text{Need 3 blue tins} \rightarrow 48 \times 3 = £144$$

$$\underline{£248} \quad (\text{cost})$$

$$5 \times £66.96 = £334.80 \quad (\text{Sales})$$

Percentage Change:

$$\frac{\text{Change}}{\text{original}} \times 100$$

$$\frac{334.80 - 248}{248} \times 100 = 35$$

35 %

(Total for Question 10 is 5 marks)

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11 In a restaurant there are

- 9 starter dishes
- 15 main dishes
- 8 dessert dishes

Janet is going to choose one of the following combinations for her meal.

- a starter dish and a main dish
- or a main dish and a dessert dish
- or a starter dish, a main dish and a dessert dish

Show that there are 1335 different ways to choose the meal.

$$\begin{array}{rcl} & 9 \times 15 & = 135 \\ + & 15 \times 8 & = 120 \\ & 9 \times 15 \times 8 & = 1080 \\ \hline & & 1335 \end{array}$$

(Total for Question 11 is 3 marks)

- 12 (a) Write $\frac{4x^2 - 9}{6x + 9} \times \frac{2x}{x^2 - 3x}$ in the form $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

$$\frac{(2x-3)(\cancel{2x+3})}{3(\cancel{2x+3})} \times \frac{\cancel{2x}}{x(x-3)}$$

Tip: When you have an algebraic fraction that can be factorised, factorise it first!

$$\frac{2x-3}{3} \times \frac{2}{x-3} = \frac{4x-6}{3x-9}$$

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- (b) Express $\frac{3}{x+1} + \frac{1}{x-2} - \frac{4}{x}$ as a single fraction in its simplest form.

Tip: Don't forget you need the same denominator!

$$\frac{3x(x-2)}{x(x+1)(x-2)} + \frac{x(x+1)}{x(x+1)(x-2)} - \frac{4(x+1)(x-2)}{x(x+1)(x-2)}$$

$$= \frac{3x^2 - 6x + x^2 + x - 4(x^2 - x - 2)}{x(x+1)(x-2)}$$

$$= \frac{4x^2 - 5x - 4x^2 + 4x + 8}{x(x+1)(x-2)} = \frac{8-x}{x(x+1)(x-2)}$$

(3)

(Total for Question 12 is 6 marks)

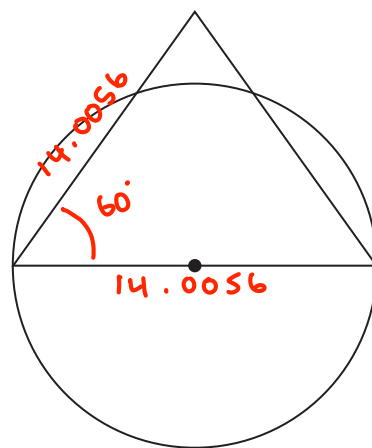


13 The diagram shows a circle and an equilateral triangle.

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.



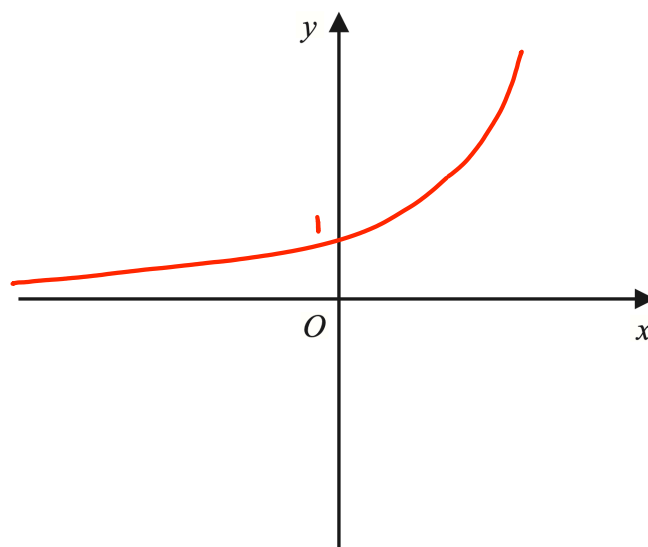
$$\begin{array}{r|l} \pi \times d & = 44 \\ \div \pi & \div \pi \\ \hline d & = 14.0056 \end{array}$$

$$\begin{aligned} \frac{1}{2} ab \sin c &= \frac{1}{2} (14.0056)^2 \times \sin(60) \\ &= 84.938 \dots \end{aligned}$$

84.9 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.



Tip: Anything to the power of 0 = 1

(Total for Question 14 is 2 marks)

15 The equation of a circle is $x^2 + y^2 = 42.25$

Find the radius of the circle.

$$\sqrt{42.25} = 6.5$$

6.5

(Total for Question 15 is 1 mark)

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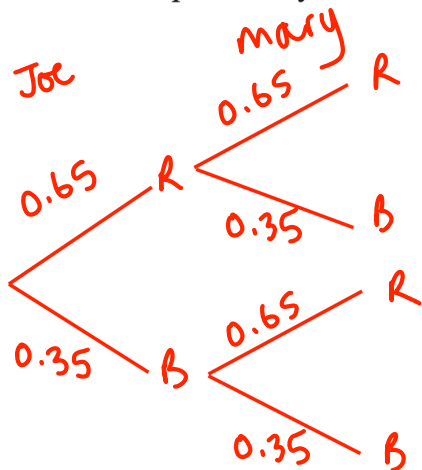
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16 There are only red counters and blue counters in a bag.

Joe takes at random a counter from the bag.
 The probability that the counter is red is 0.65
 Joe puts the counter back into the bag.

Mary takes at random a counter from the bag.
 She puts the counter back into the bag.

(a) What is the probability that Joe and Mary take counters of different colours?



$$P(R, B) = 0.65 \times 0.35 = 0.2275$$

$$P(B, R) = 0.35 \times 0.65 = 0.2275$$

$$\underline{0.455}$$

$$\underline{0.455}$$

(2)

There are 78 red counters in the bag.

(b) How many blue counters are there in the bag?

$$\begin{array}{l} \div 65 \quad 65\% = 78 \\ \quad \quad 1\% = 1.2 \\ \times 35 \quad 35\% = 42 \end{array}$$

$$\underline{42}$$

(2)

(Total for Question 16 is 4 marks)



17 p and q are two numbers such that $p > q$

When you subtract 5 from p and subtract 5 from q the answers are in the ratio 5 : 1

When you add 20 to p and add 20 to q the answers are in the ratio 5 : 2

Find the ratio $p : q$

Give your answer in its simplest form.

$$p - 5 : q - 5 = 5 : 1$$

$$p + 20 : q + 20 = 5 : 2$$

$$\text{so, } \frac{p-5}{q-5} = \frac{5}{1} \quad \text{and} \quad \frac{p+20}{q+20} = \frac{5}{2}$$

Now we can cross multiply

$$\begin{array}{r|l} p-5 & = 5q-25 \\ -5q & -5q \\ \hline p-5q-5 & = -25 \\ +5 & +5 \\ \hline p-5q & = -20 \end{array}$$

$$\begin{array}{r|l} 2p+40 & = 5q+100 \\ -5q & -5q \\ \hline 2p-5q+40 & = 100 \\ -40 & -40 \\ \hline 2p-5q & = 60 \end{array}$$

Now we have simultaneous equations

$$\begin{array}{r} 2p - 5q = 60 \\ - \\ p - 5q = -20 \\ \hline p = 80 \end{array}$$

$$\begin{array}{r|l} 80-5q & = -20 \\ +5q & +5q \\ \hline 80 & = -20+5q \\ +20 & +20 \\ \hline 100 & = 5q \\ 20 & = q \end{array}$$

$$\begin{array}{l} p : q \\ 80 : 20 \\ 4 : 1 \end{array}$$

$$4 : 1$$

(Total for Question 17 is 5 marks)

- 18 The straight line L_1 passes through the points with coordinates (4, 6) and (12, 2)
 The straight line L_2 passes through the origin and has gradient -3

The lines L_1 and L_2 intersect at point P .

Find the coordinates of P .

$$L_1 : \text{Gradient} = \frac{\text{Change in } y}{\text{Change in } x} = \frac{6 - 2}{4 - 12} = -\frac{1}{2}$$

$$y = -\frac{1}{2}x + c$$

$$2 = -\frac{1}{2}(12) + c$$

$$2 = -6 + c$$

$$8 = c$$

$$y = -\frac{1}{2}x + 8$$

$$L_2 : y = -3x$$

Tip: When two lines in the form $y = mx + c$ intersect, you can find the coordinate of intersection by making them equal to each other and solving (simultaneous equations)

$$-3x = -\frac{1}{2}x + 8$$

$$+\frac{1}{2}x \quad +\frac{1}{2}x$$

$$-\frac{5}{2}x = 8$$

$$\div -\frac{5}{2} \quad \div -\frac{5}{2}$$

$$x = -\frac{16}{5}$$

$$\text{If } y = -3x$$

$$y = -3(-\frac{16}{5}) = \frac{48}{5}$$

$$(-\frac{16}{5}, \frac{48}{5})$$

(Total for Question 18 is 4 marks)



19 Solve $22 < \frac{m^2 + 7}{4} < 32$

Show all your working.

$$22 < \frac{m^2 + 7}{4} < 32$$

 $\times 4$
 $\times 4$
 $\times 4$

$$88 < m^2 + 7 < 128$$

 -7
 -7
 -7

$$81 < m^2 < 121$$

 $\sqrt{}$
 $\sqrt{}$
 $\sqrt{}$

$$\pm 9 < m < \pm 11$$

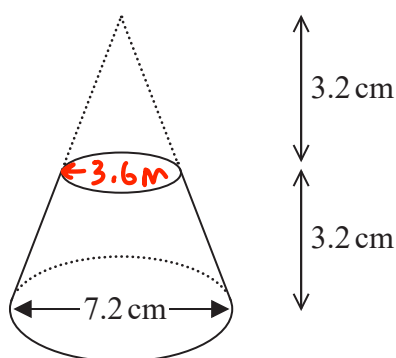
$$9 < m < 11$$

and

$$-11 < m < -9$$

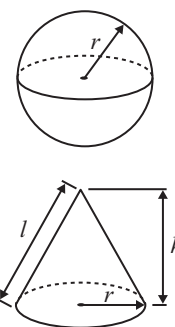
(Total for Question 19 is 5 marks)

20 Here is a frustum of a cone.



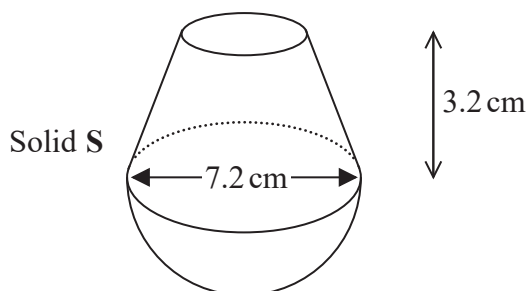
$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

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



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.

Volume of frustum =

$$\text{Large cone} = \frac{1}{3} \pi (3.6)^2 (6.4) = 86.859 \text{ cm}^3$$

$$\text{Small cone} = \frac{1}{3} \pi (1.8)^2 (3.2) = 10.851 \text{ cm}^3$$

$$86.859 - 10.851 = 76.002 \text{ cm}^3$$

Volume of hemisphere =

$$\frac{1}{2} \times \frac{4}{3} \times \pi \times (3.6)^3 = 97.716 \text{ cm}^3$$



Frustum

$$D = 2.4$$

$$M = 182.4048$$

$$V = 76.002$$

Hemisphere

$$D = 4.8$$

$$M = 469.0368$$

$$V = 97.716$$

$$M = D \times V$$

$$D = \frac{M}{V} = \frac{182.4048 + 469.0368}{76.002 + 97.716}$$

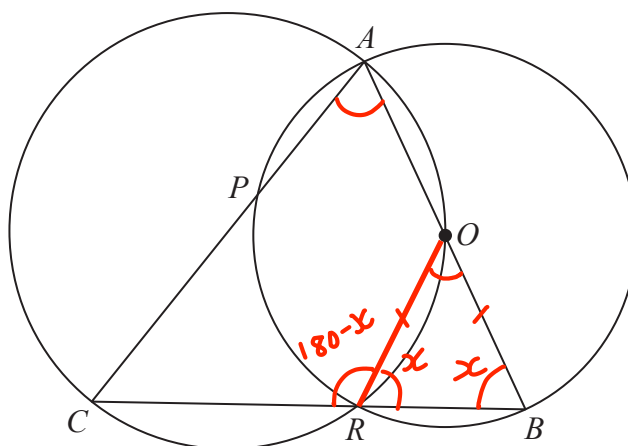
$$= 3.74999..$$

$$\underline{\underline{3.75}} \text{ g/cm}^3$$

(Total for Question 20 is 5 marks)



21



A, B, R and P are four points on a circle with centre O .

A, O, R and C are four points on a different circle.

The two circles intersect at the points A and R .

CPA , CRB and AOB are straight lines.

Prove that angle CAB = angle ABC .

$$\text{Let } \angle ABC = x$$

$\angle ORB = x$ as base angles in an isosceles triangle are the same

$\angle ORC = 180 - x$ as angles on a straight line add to 180°

$\angle CAB = x$ as opposite angles in a cyclic quadrilateral add to 180°

$$\therefore \angle CAB = \angle ABC$$

(Total for Question 21 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS