

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	
Pearson Edexcel Level 1/Level 2 GCSE (9–1)			
Time 1 hour 30 minutes		Paper reference 1MA1/2H	
Mathematics PAPER 2 (Calculator) Higher Tier			
You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.			Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- Good luck with your examination.

Turn over ►

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Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify $(x^3)^5$

$$(x^3)^5 = x^{3 \times 5} = x^{15} \quad \text{brackets so indices multiply} \quad x^{15} \quad (1)$$

(b) Expand and simplify $4(x + 3) + 7(4 - 2x)$

$$\begin{aligned} 4(x+3) + 7(4-2x) & \quad \text{expand brackets} \\ 4x + 12 + 28 - 14x & \\ 40 - 10x & \quad \text{collect like terms} \end{aligned} \quad 40 - 10x \quad (1)$$

(c) Factorise fully $15x^3 + 3x^2y$

find factors common to both terms: both terms have $3x^2$.

$$(1) \quad 3x^2(5x + y)$$

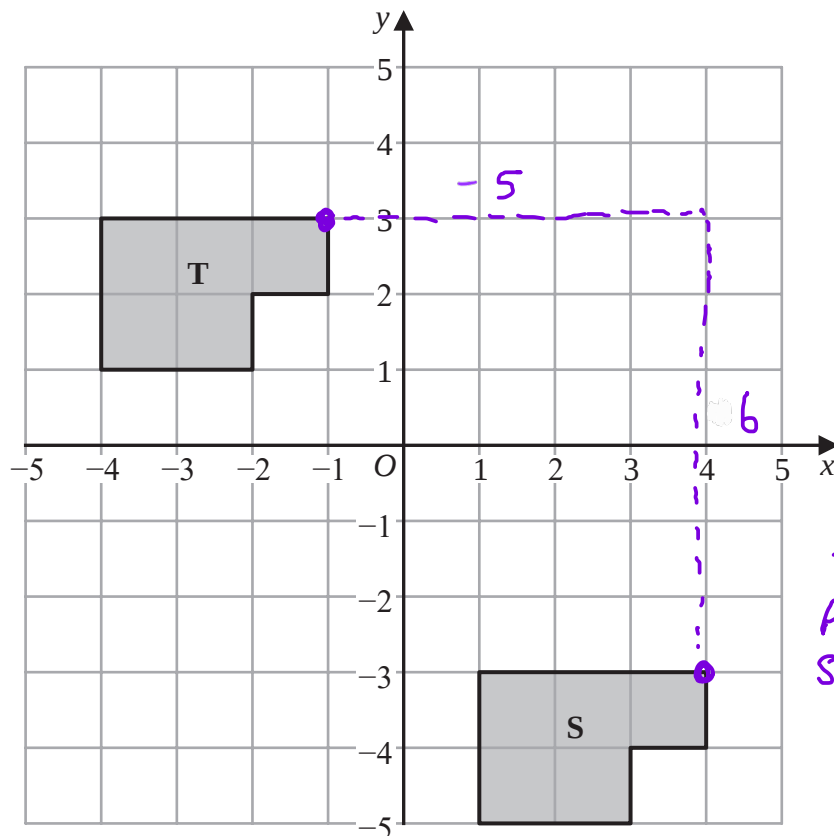
$\therefore$ take out factor of $3x^2$

$$3x^2(5x + y) \quad (1)$$

(Total for Question 1 is 5 marks)



2



follow the
path of a
single vertex:

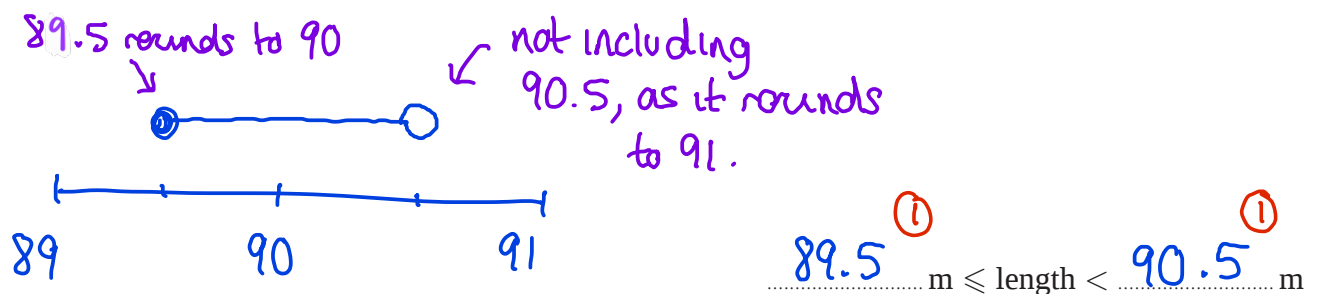
Describe fully the single transformation that maps shape S onto shape T.

translation by vector $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$

(Total for Question 2 is 2 marks)

3 The length of a football pitch is 90 metres, correct to the nearest metre.

Complete the error interval for the length of the football pitch.



(Total for Question 3 is 2 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.

Field A
area = $80,000\text{ m}^2$
max people = 425

area per person
= $\frac{80,000}{425} = 188.2...$ ①

Field B
area = $700 \times 2000 = 1,400,000$ ①
max people = 6750

area per person
= $\frac{1,400,000}{6750} = 207.4...$ ①

difference is $207.4... - 188.2...$
= $19.17...$

= 19 to the nearest
whole number ①

tip: 'per'
means 'divided by'

19 m²
(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.

Because there are $10,000\text{ cm}^2$ in 1 m^2 ①

$1\text{ m}^2 = 1\text{ m} \times 1\text{ m} = 100\text{ cm} \times 100\text{ cm} = 10,000\text{ cm}^2$.

(1)

(Total for Question 4 is 5 marks)



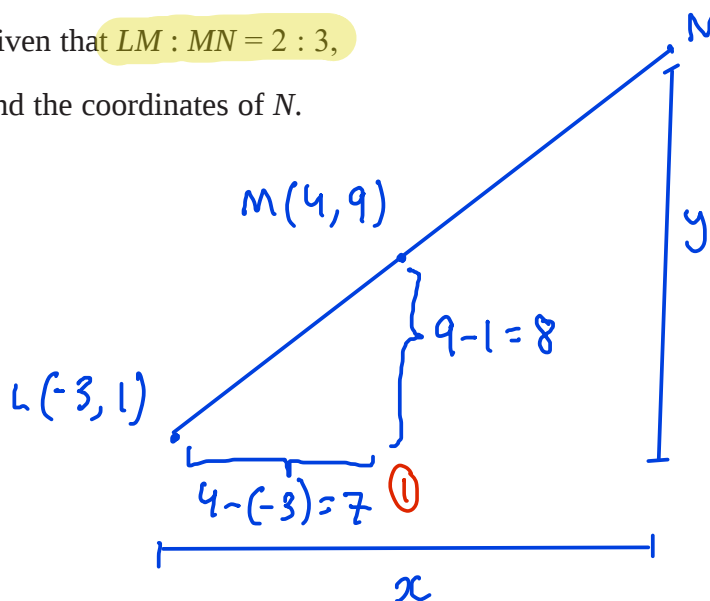
- 5 The points L , M and N are such that LMN is a straight line.

The coordinates of L are $(-3, 1)$

The coordinates of M are $(4, 9)$

Given that $LM : MN = 2 : 3$,

find the coordinates of N .



Method: find horizontal & vertical components of LM , then use the ratio to find horiz. & vert. components of LN , then use $\vec{ON} = \vec{OL} + \vec{LN}$.

$$N(-3 + 17.5, 1 + 20) \quad (1)$$

$$N(14.5, 21) \quad (1)$$

$$7 \text{ is } \frac{2}{5} \text{ of } x$$

$$8 \text{ is } \frac{2}{5} \text{ of } y$$

$$\therefore x = 7 \times \frac{5}{2} = 17.5 \quad (1) \quad \therefore y = 8 \times \frac{5}{2} = 20$$

$$(14.5, 21) \dots$$

(Total for Question 5 is 4 marks)

- 6 A new phone cost £679

The value of the phone decreases at a rate of 4% per year.

Work out the value of the phone at the end of 3 years.

Decreases at 4% per year,
so multiply by $1 - 0.04 = 0.96$
every year.

$$\text{cost after 3 years: } 679 \times 0.96^3 \quad (2)$$

$$= 600.735\dots$$

$$= \pounds 600.74 \quad (1)$$

$$\pounds 600.74$$

(Total for Question 6 is 3 marks)



- 7 In Spain, Sam pays 27 euros for 18 litres of petrol.
In Wales, Leo pays £40.80 for 8 gallons of the same type of petrol.

$$1 \text{ euro} = \text{£}0.85$$

$$4.5 \text{ litres} = 1 \text{ gallon}$$

Sam thinks that petrol is cheaper in Spain than in Wales.

Is Sam correct?

You must show how you get your answer.

convert Sam's 18 litres into gallons:

$$\begin{array}{l} 4.5 \text{ litres} : 1 \text{ gallon} \\ 18 \text{ litres} : 4 \text{ gallons} \end{array} \quad \downarrow \times 4$$

$$\text{scale factor: } \frac{18}{4.5} = 4$$

so Sam pays for 4 gallons ①

convert Sam's 27 euros into pounds:

$$\begin{array}{l} 1 \text{ euro} : \text{£}0.85 \\ 27 \text{ euros} : \text{£}22.95 \end{array} \quad \downarrow \times 27$$

scale factor: 27

so Sam pays £22.95 for 4 gallons ①

Sam in Spain:

$$\begin{array}{l} \text{£}22.95 : 4 \text{ gallons} \\ \text{£}5.74 \text{ (2dp)} : 1 \text{ gallon} \end{array} \quad \downarrow \div 4$$

①

Leo in Wales:

$$\begin{array}{l} \text{£}40.80 : 8 \text{ gallons} \\ \text{£}5.10 : 1 \text{ gallon} \end{array} \quad \downarrow \div 8$$

NO, Sam is incorrect as 1 gallon costs

£5.74 in Spain but £5.10 in Wales, which is cheaper. ①

(Total for Question 7 is 4 marks)



- 8 Use your calculator to work out

$$\frac{\sqrt[3]{1.57^4 + \tan 60^\circ}}{7.2^{\frac{1}{2}}}$$

Give your answer correct to 3 significant figures.

$$= \sqrt[3]{7.6077...} \div \sqrt{7.2} \quad (1)$$

$$= 0.7393379...$$

$$= 0.739 \text{ (3sf)} \quad (1)$$

0.739

(Total for Question 8 is 2 marks)

- 9 A box in the shape of a cuboid is placed on a horizontal floor.

The box exerts a force of 180 newtons on the floor.

The box exerts a pressure of 187.5 newtons/m² on the floor.

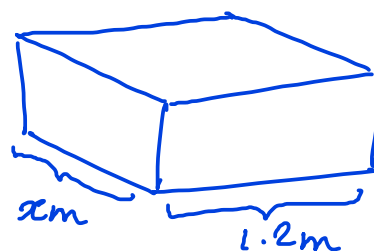
The face in contact with the floor is a rectangle of length 1.2 metres and width x metres.

Work out the value of x .

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

using area = $\frac{\text{force}}{\text{pressure}}$

$$= \frac{180}{187.5} = 0.96 \text{ m}^2 \quad (1)$$



x $\boxed{A = 0.96}$ $x = \frac{0.96}{1.2} = 0.8 \text{ m} \quad (1)$

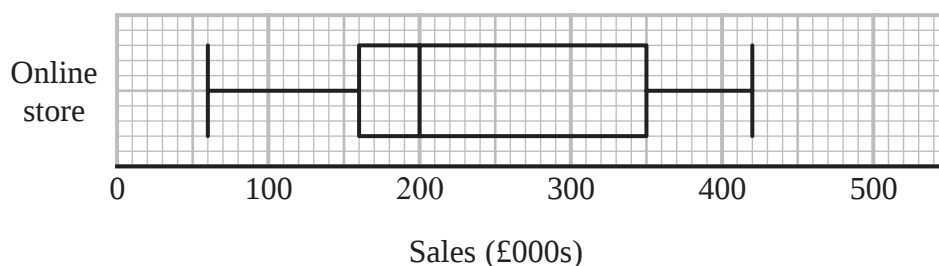
1.2

$x = 0.8$

(Total for Question 9 is 3 marks)



- 10 The box plot shows information about the sales, in thousands of pounds (£000s), of an online store each month.



Andrew says,

“Three quarters of the given data lies between 160 000 and 350 000 because these are the values of the lower quartile and the upper quartile.”

Andrew is wrong.

(a) Explain why.

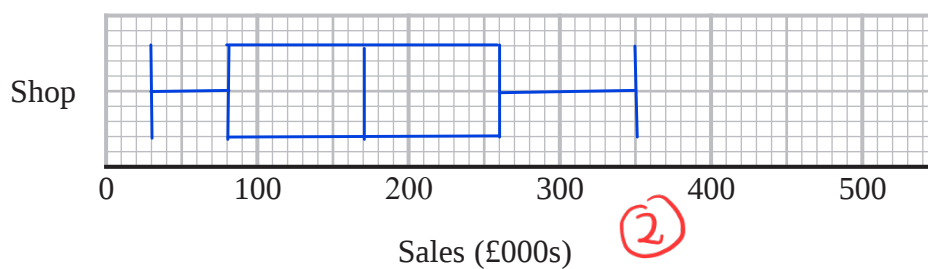
The interquartile range is half the data not $\frac{3}{4}$ ①

(1)

The table shows information about the sales, in £000s, in a shop each month.

	Sales (£000s)
least value	30
lower quartile	80
median	170
upper quartile	260
greatest value	350

(b) On the grid below, draw a box plot for this information.



(2)



(c) Compare the distribution of the sales of the online store with the distribution of the sales in the shop.

1. The median sales for online is greater than the median for the shop, so on average the shop takes less money. (1)

2. The interquartile range of sales for the online store is greater than the IQR of the shop, so the sales per month online are more spread out. (1)

(2)

(Total for Question 10 is 5 marks)

11 Kieron has 13 workers he can use for a job.

He knows that 6 workers would take $14\frac{1}{2}$ days to complete this job.

Show that Kieron has enough workers to finish this job in less than 7 days.

$\times \frac{13}{6}$ 6 workers : 14.5 days $\rightarrow \times \frac{6}{13}$ Number of workers and days taken are inversely proportional.
13 workers : 6.69... days

$$14.5 \times 6 = 87 \quad (1)$$

$$87 \div 13 = 6.69... \quad (1)$$

so 13 workers can complete the job in 6.69... days, which is less than 7 days. (1)

(Total for Question 11 is 3 marks)



12 The equation of the line L_1 is $y = 2x + 3$

The equation of the line L_2 is $5y - 10x + 4 = 0$

Show that these two lines are **parallel**.

$L_1: y = 2x + 3$ has gradient 2.

Two lines are parallel
if and only if they
have the same gradient.

$L_2: 5y - 10x + 4 = 0$

$$5y = 10x - 4 \quad (1)$$

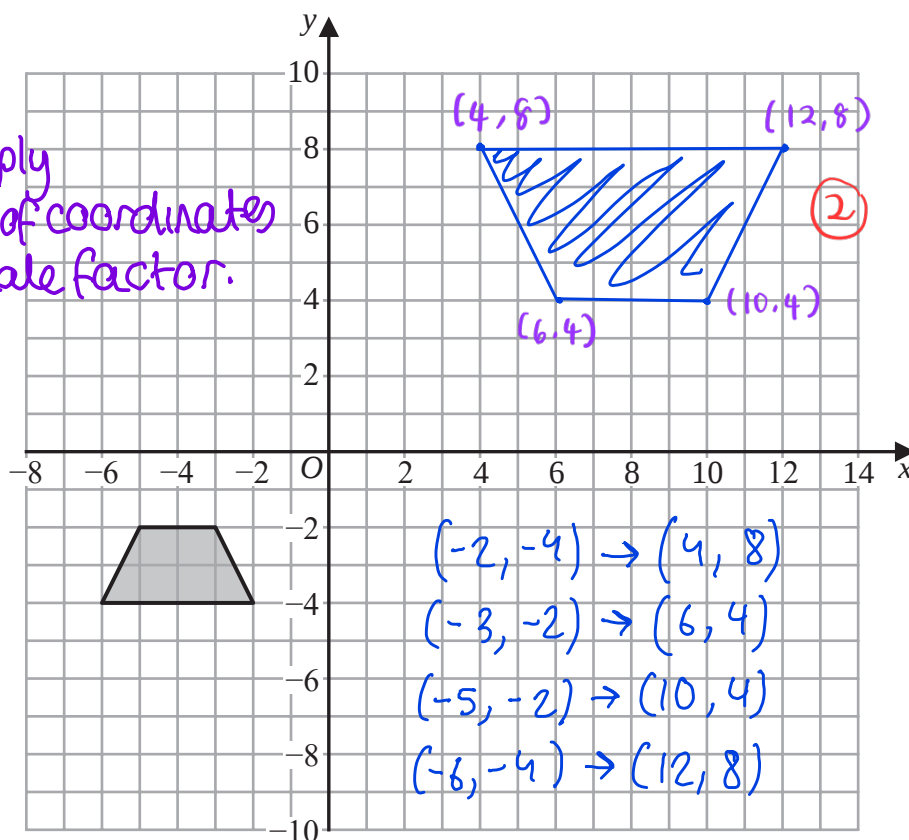
$y = 2x - \frac{4}{5}$ has gradient 2.

both lines have gradient 2
so they are parallel. (1)

(Total for Question 12 is 2 marks)

13

tip: multiply
each set of coordinates
by the scale factor.



Enlarge the shaded shape by **scale factor -2** with centre of enlargement $(0, 0)$

(Total for Question 13 is 2 marks)



- 14 Saffron wants to work out an estimate for the total number of fish in a lake.

On Friday, Saffron catches 180 fish from the lake.

She puts a tag on each of these fish and puts them back into the lake.

On Saturday, Saffron catches 305 fish from the same lake.

She finds that 45 of the 305 fish are tagged.

Work out an estimate for the total number of fish in the lake.

let x be the total number of fish in the lake.

$$\frac{180}{x} = \frac{45}{305} \quad (1)$$

$$\therefore x = \frac{180 \times 305}{45} = 1220 \text{ fish} \quad (1)$$

1220

(Total for Question 14 is 3 marks)



15 The ratio of Marta's hourly pay to Khalid's hourly pay is 6 : 5

Both Marta and Khalid get an increase of £1.50 in their hourly pay.

The ratio of Marta's hourly pay to Khalid's hourly pay after this increase is 13 : 11

Work out the hourly pay before the increase for Marta and for Khalid.

Marta : Khalid

6 : 5

£ 6x : £5x want to find x.

↓ increase of £1.50

£ 6x + 1.5 : £ 5x + 1.5 (1)
13 : 11

$$\Rightarrow \frac{11}{13} = \frac{5x+1.5}{6x+1.5} \quad (1)$$

$$66x + 16.5 = 65x + 19.5$$

$$x = 19.5 - 16.5$$

$$x = 3$$

(1)

If two ratios are equivalent, one ratio is a scaled up version of the other. So, their fractional equivalents are the same.

so the original ratio was

$$£ 6 \times 3 : £ 5 \times 3$$

$$£ 18 : £ 15 \quad (1)$$

Marta £ 18

Khalid £ 15

(Total for Question 15 is 4 marks)

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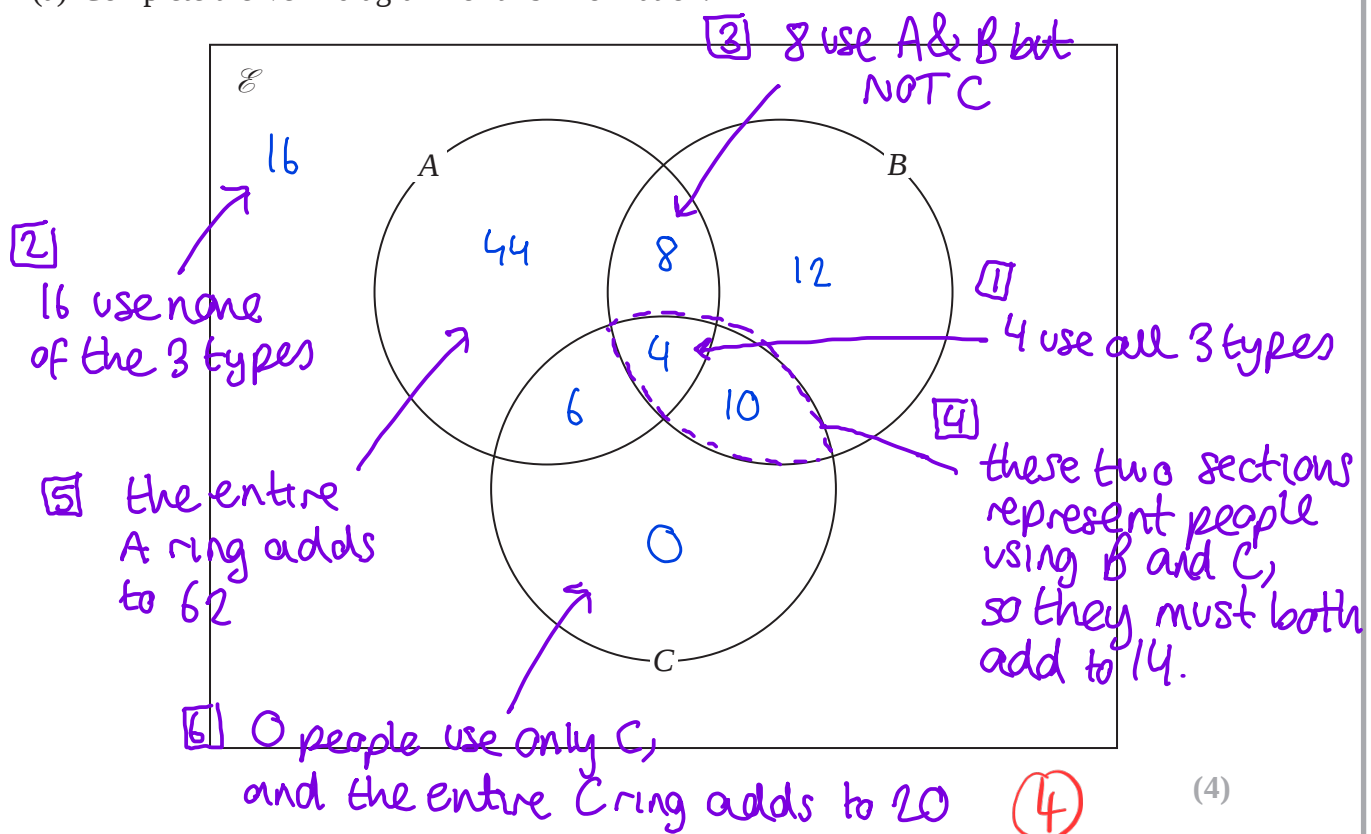
16 A shop manager wants to advertise special offers on social media platforms.

The manager asks 100 customers which of type A, type B or type C they use.

Of these customers,

- 1 4 use all three types
- 2 16 do not use any of type A, type B or type C
- 3 8 use both type A and type B, but not type C
- 4 14 use both type B and type C
- 5 62 in total use type A
- 6 all 20 who use type C also use at least one of type A and type B.

(a) Complete the Venn diagram for this information.



One of the customers is chosen at random.

Given that this customer uses type A,

(b) find the probability that this customer also uses type B.

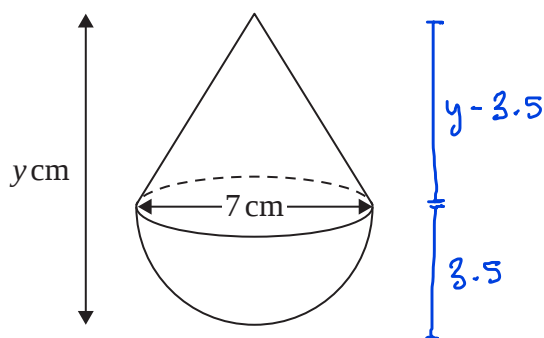
$$\text{Prob (B given A)} = \frac{\text{Prob (A and B)}}{\text{Prob (A)}} = \frac{8+4}{62} = \frac{12}{62}$$

(2)

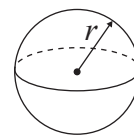
(Total for Question 16 is 6 marks)



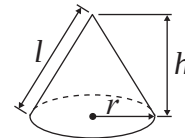
17 A solid cone is joined to a solid hemisphere to make the solid **T** shown below.



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



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



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.

Method: find area of **T** in terms of y .

Diameter of hemisphere = 7 cm

so radius = 3.5 cm

$\therefore$ height of cone = $y - 3.5$

$$\begin{aligned} \text{Volume of cone} &= \frac{1}{3} \pi (3.5)^2 (y - 3.5) \\ &= \frac{49\pi}{12} (y - 3.5) \end{aligned}$$

given area **T**
= 120π so equate
& cancel $\pi \Rightarrow 120 =$

$$\begin{aligned} \therefore \text{Volume of T} &= \frac{49\pi}{12} (y - 3.5) + \frac{343}{12} \pi \\ &= \frac{49\pi}{12} y + \frac{343}{24} \pi \\ &= \frac{49y}{12} + \frac{343}{24} \quad (1) \end{aligned}$$

$$y = \frac{12}{49} (120 - \frac{343}{24}) = 25.88 \dots \quad (1)$$

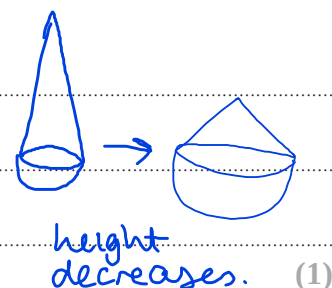
$$\text{volume of hemisphere} = \frac{1}{2} \times \frac{4}{3} \pi (3.5)^3 = \frac{343}{12} \pi \quad (1) \quad y = 25.9 \quad (4)$$

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).

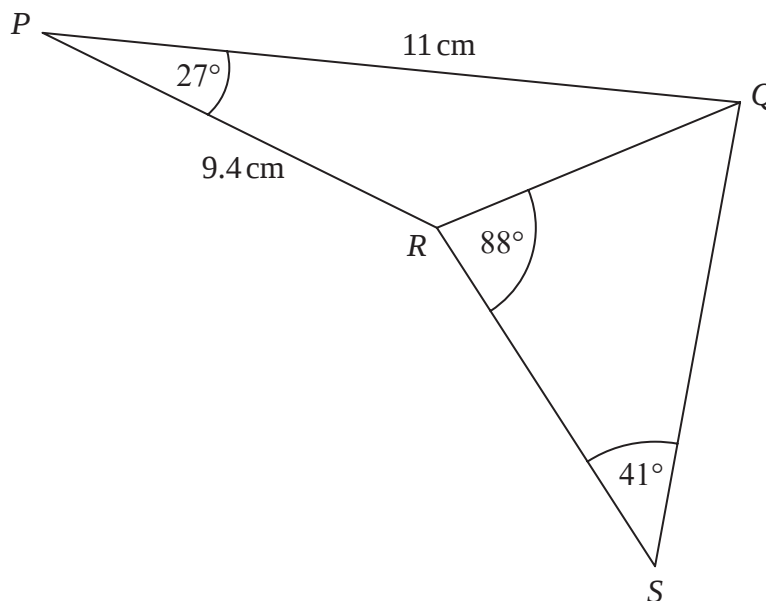
The height would decrease (1)



(Total for Question 17 is 5 marks)



18 PQR and QRS are triangles.



Calculate the length of QS.

Give your answer correct to 3 significant figures.

You must show all your working.

Using cosine rule to find QR.

$$QR^2 = 11^2 + 9.4^2 - 2 \times 11 \times 9.4 \times \cos 27^\circ \quad (1)$$

$$QR = \sqrt{25.09...} \quad (1)$$

$$\approx 5 \text{ cm}$$

Using sine rule to find QS

$$\frac{QS}{\sin 88^\circ} = \frac{QR}{\sin 41^\circ} \quad (1)$$

$$\Rightarrow QS = \frac{\sqrt{25.09...} \times \sin 88^\circ}{\sin 41^\circ}$$

$$QS = 7.6318...$$

$$= 7.63 \text{ (3sf)} \quad (1)$$

$$\dots\dots\dots 7.63 \dots\dots\dots \text{ cm}$$

(Total for Question 18 is 4 marks)



19 The functions g and h are such that

$$g(x) = \sqrt[3]{2x-5} \quad h(x) = \frac{1}{x}$$

(a) Find $g(16)$

$$g(16) = \sqrt[3]{2(16)-5} = \sqrt[3]{27} = 3$$

3 (1)
(1)

(b) Find $hg^{-1}(x)$

Give your answer in terms of x in its simplest form.

find $g^{-1}(x)$:

$$g(x) = \sqrt[3]{2x-5}$$

$$x = \sqrt[3]{2y-5}$$

$$x^3 = 2y - 5$$

$$x^3 + 5 = 2y$$

$$y = \frac{x^3 + 5}{2}$$

$$g^{-1}(x) = \frac{x^3 + 5}{2} \quad (1)$$

$$hg^{-1}(x) = \frac{1}{\frac{x^3+5}{2}} \quad (1)$$

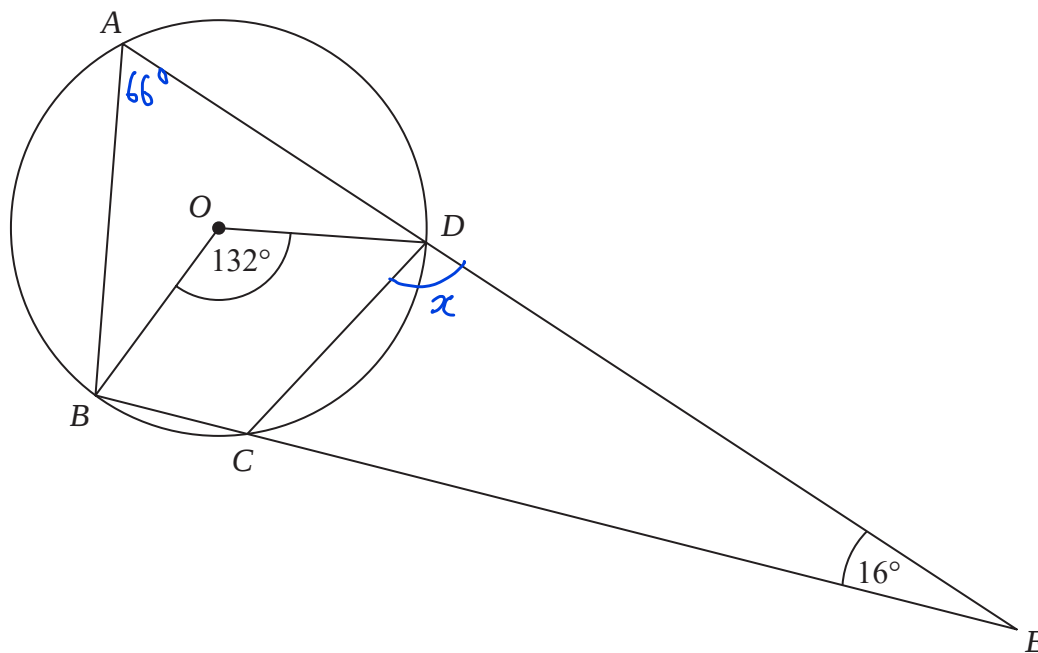
$$= \frac{2}{x^3+5} \quad (1)$$

$$hg^{-1}(x) = \frac{2}{x^3+5} \quad (3)$$

(Total for Question 19 is 4 marks)



- 20 A, B, C and D are points on the circumference of a circle, centre O.
ADE and BCE are straight lines.



Work out the size of angle CDE.
Give a reason for each stage of your working.

$$\angle BAD = \frac{1}{2} \times 132 = 66^\circ \quad (\text{angle at the centre is double the angle at the circumference}) \quad (1)$$

$$\angle BCD = 180 - 66 = 114^\circ \quad (\text{opposite angles of a cyclic quadrilateral add up to } 180^\circ) \quad (1)$$

$$\angle DCE = 180 - 114 = 66^\circ \quad (\text{angle in a straight line} = 180^\circ)$$

$$66 + x + 16 = 180^\circ \quad (\text{angles in a triangle add up to } 180^\circ)$$

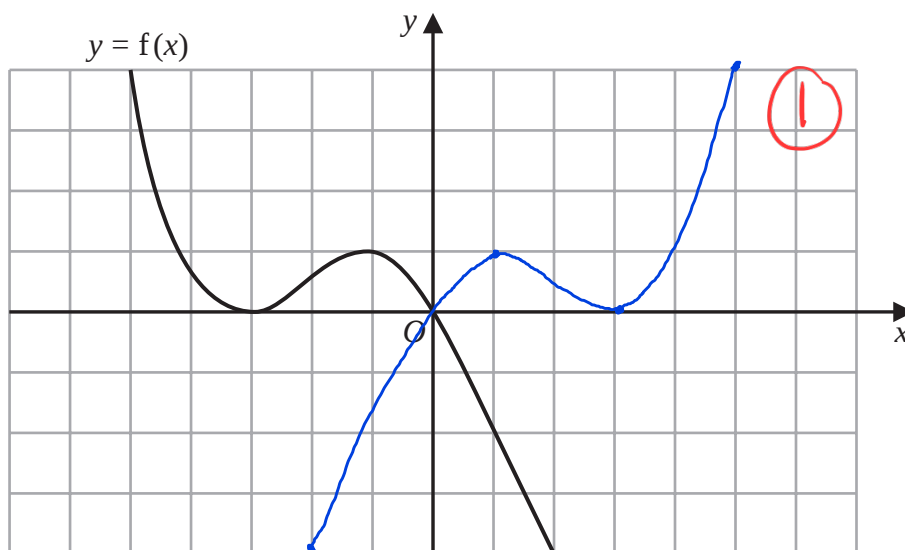
$$x = 98^\circ \quad (1)$$

98

(Total for Question 20 is 4 marks)

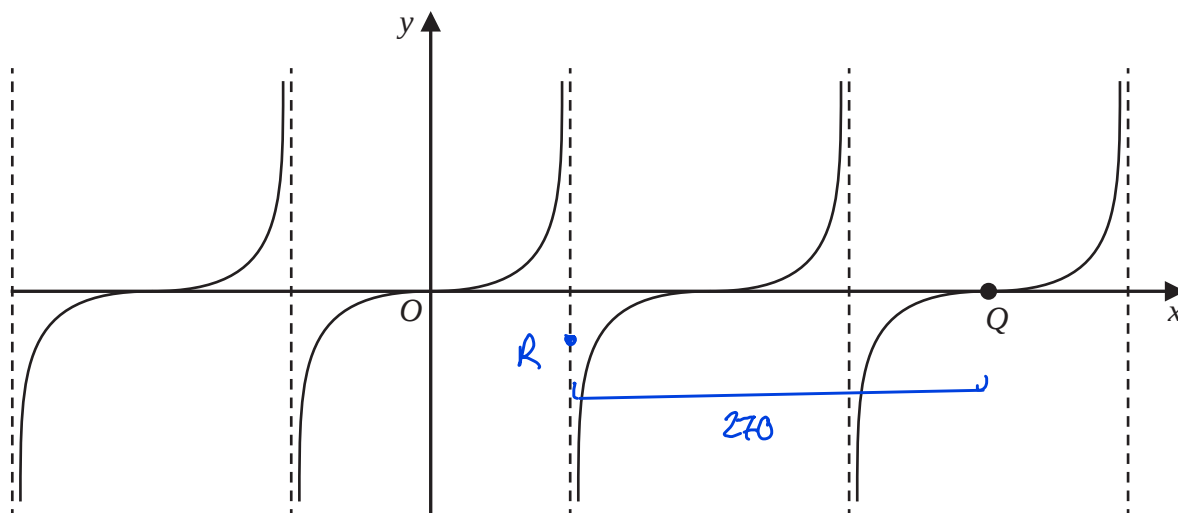


21 The graph of $y = f(x)$ is shown on the grid below.



- (a) On the grid above, sketch the graph of $y = f(-x)$ -reflection in y-axis (1)

Here is a sketch of the graph of $y = \tan x^\circ$



The graph of $y = \tan x^\circ$ is translated to give the graph of $y = g(x)$

Following the translation the point Q, shown on the graph above, moves to point R. Point R has coordinates $(90, -5)$

- (b) Find an expression for $g(x)$ in terms of x .

Q has coordinates $(360, 0)$

so graph has shifted left by

$$360 - 90 = 270 \quad \textcircled{1}$$

and shifted down by 5.

$$g(x) = \tan(x + 270^\circ) - 5 \quad \textcircled{1}$$

(2)

(Total for Question 21 is 3 marks)

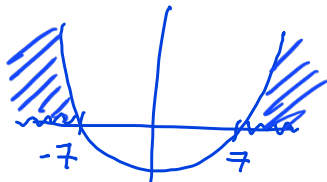


22 Find algebraically the set of values of x for which

$$x^2 - 49 > 0 \quad \text{and} \quad 5x^2 - 31x - 72 > 0$$

$$x^2 - 49 > 0$$

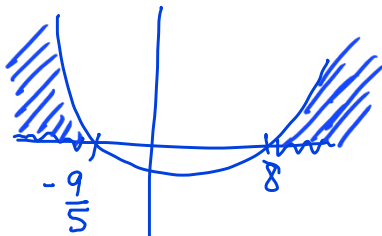
$$(x+7)(x-7) > 0 \quad \textcircled{1}$$



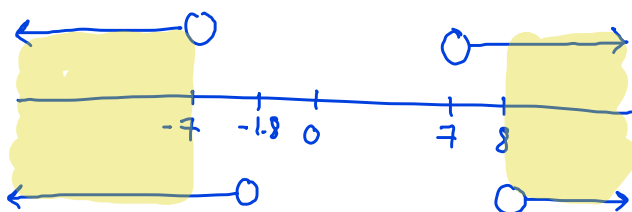
$$\therefore x > 7 \text{ or } x < -7 \quad \textcircled{1}$$

$$5x^2 - 31x - 72 > 0$$

$$(x-8)(5x+9) > 0 \quad \textcircled{1}$$



$$x > 8 \text{ or } x < -\frac{9}{5} \quad \textcircled{1}$$



from $x^2 > 49$

from $5x^2 - 31x - 72 > 0$

Solution set is the overlap of the two inequalities, i.e. where there are two lines.

$$x < -7, x > 8 \quad \textcircled{1}$$

$$x < -7, x > 8$$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS



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