L H   Worked Solutions

Candidate surname

Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number

Candidate Number

Time 1 hour 30 minutes

Paper reference **1MA1/2H**

Mathematics

PAPER 2 (Calculator)
Higher Tier

Summer 2022

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 ▶

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

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

$$= x^{3 \times 5}$$
$$= x^{15}$$

.... x^{15} ....

(1)

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

$$= 4x + 12 + 28 - 14x$$
$$= -10x + 40$$

$$or \quad 40 - 10x$$

.... $40 - 10x$ ....

(2)

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

$$3 \times 5 \times x \times x \times x \quad + \quad 3 \times x \times x \times y$$

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

....

(2)

(Total for Question 1 is 5 marks)

2
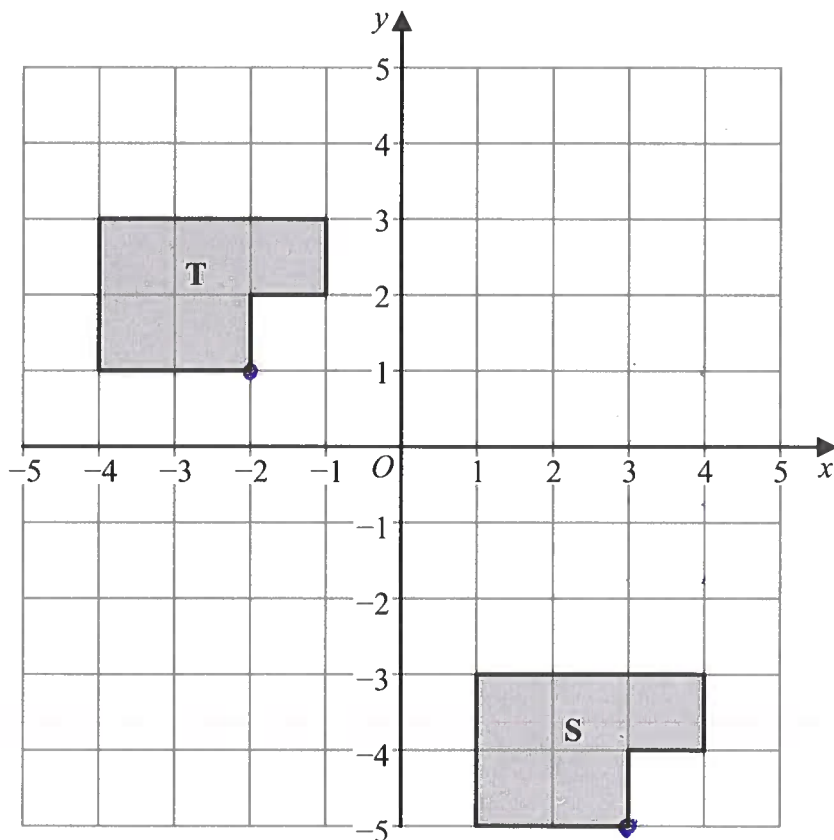
Describe fully the single transformation that maps shape **S** onto shape **T**.
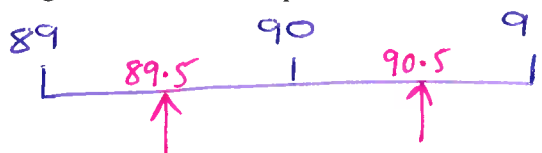
Translation $\begin{pmatrix} -5 \\ 6 \end{pmatrix}$

(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.

89.5 m $\leqslant$ length $<$ 90.5 m

(Total for Question 3 is 2 marks)

4 Festival A will be in a rectangular field with an area of $80\,000\,m^2$
   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?
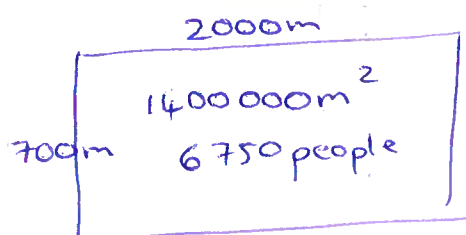   Give your answer correct to the <u>nearest whole number</u>.

Festival A

$80\,000\,m^2$
425 people

Festival B

2000m
700m $1\,400\,000\,m^2$ 6750 people
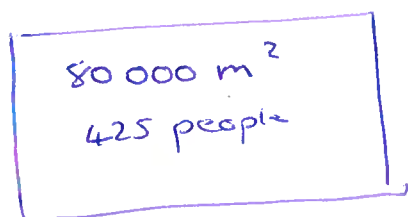
$80000\,m^2 \div 425$ people
$\div 425$
$188 \cdot 23529 \div 1$ person
m^2

$1400000\,m^2 \div 6750$ people
$\div 6750$
$207 \cdot 4074 \cdots \div 1$ person

Festival A $188 \cdot 235\,m^2$ per person
Festival B $207 \cdot 407\,m^2$ per person
   Difference $= 19 \cdot 17211329$
Festival B has <u>19 m^2</u> more per person

.... 19 .... m^2
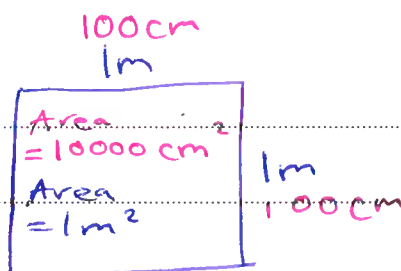
(4)

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.

$1\,m^2 = 10\,000\,cm^2$

100cm
1m
Area $=10000\,cm^2$
Area $=1\,m^2$
1m
100cm

(1)

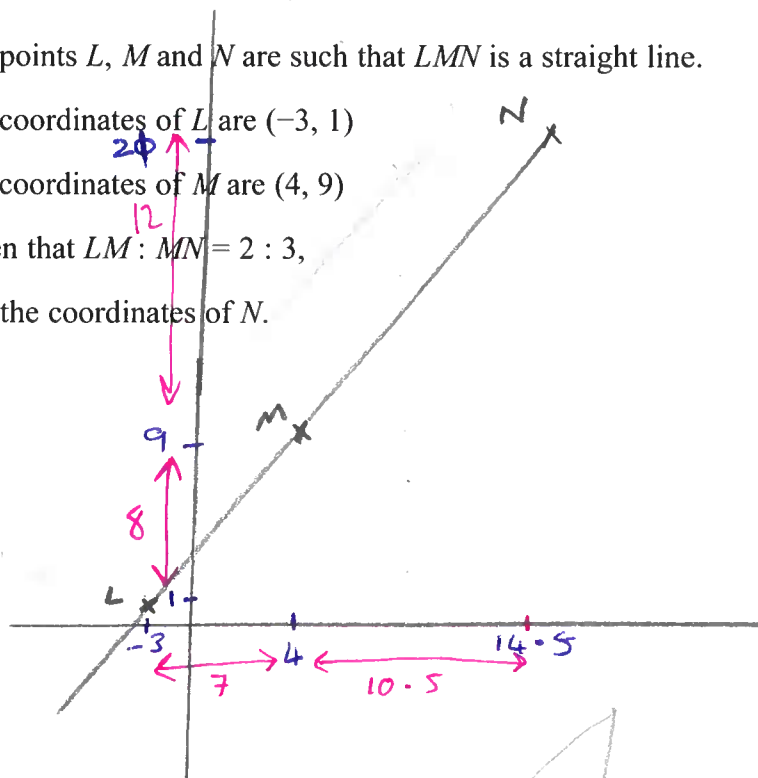**(Total for Question 4 is 5 marks)**

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.

(handwritten working on graph)

20
12
9
8
L 1
-3
4
7
10·5
14·5
N
M

OR

(handwritten triangle)
M
$\sqrt{113}$
8
L
7

x coordinate
$LM : MN$
$2 : 3$
$1 : 1·5$
$\times 7$ $\times 7$
$7 : 10·5$

y coordinate
$LM : MN$
$2 : 3$
$1 : 1·5$
$\times 8$ $\times 8$
$8 : 12$

(14·5 , 21)

(Total for Question 5 is 4 marks)

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6 A new phone cost £679
The value of the phone decreases at a rate of 4% per year.

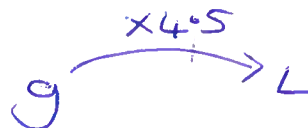Work out the value of the phone at the end of 3 years.

$$£679 \times 0.96^3 = 600.735744$$

£ 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 euro = £0.85
        4.5 litres = 1 gallon

    € —×0.85→ £   g —×4.5→ L

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

Is Sam correct?
You must show how you get your answer.

Spain
€27   18 L
£22·95 : 18 L
£1·275 : 1 L

Wales
£40·80   8 gallons
£40·80 : 36 L
£1·133 : 1L

Spain £1·28 per 1 Litre
Wales £1·13 per 1 Litre

Petrol is cheaper in Wales.
Sam is not correct.

(Total for Question 7 is 4 marks)

6

8 Use your calculator to work out

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

Give your answer correct to 3 significant figures.

0. 7393379403

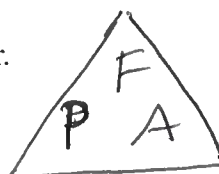0. 739

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

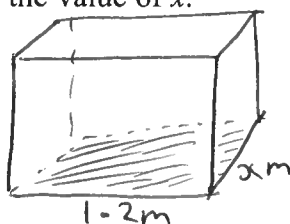The box exerts a force of 180 newtons on the floor.
The box exerts a pressure of 187.5 newtons/m² on the floor.

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

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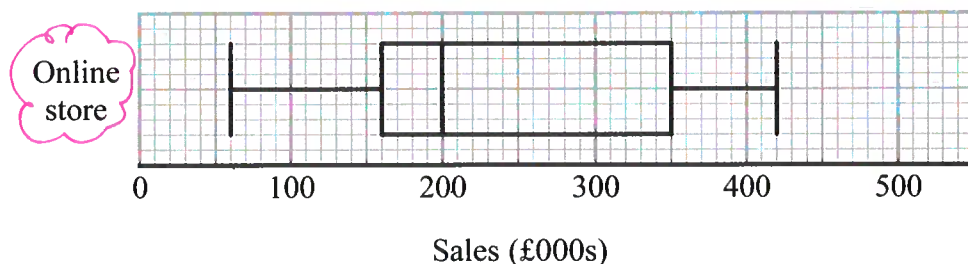
Work out the value of x.

Force = 180 N

Pressure = 187.5 N/m²

Area = $\frac{\text{Force}}{\text{Pressure}}$

= $\frac{180}{187.5}$

= 0.96 m²

∴ 1.2 × x = 0.96

1.2x = 0.96

x = $\frac{0.96}{1.2}$

= 0.8

$x =$ 0.8 m

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

Sales (£000s)

IQR = £190 000

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.

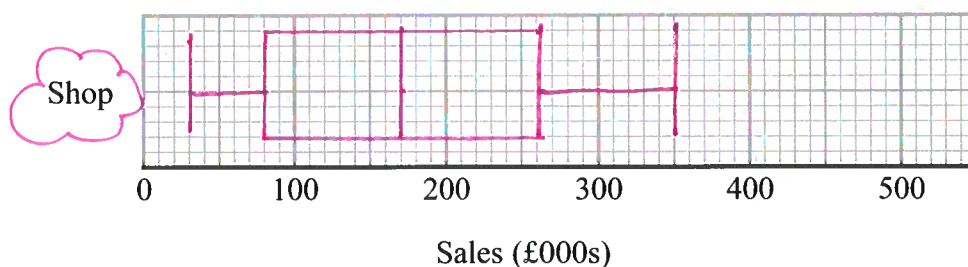three quartes lies between £60,000 and £350,000
50% lies between the LQ and UQ

(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

IQR = £180 000

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

Sales (£000s)

(2)

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

The median sales online £200000 is higher than the median sales in the shop £170000. This tells us that on average there are higher sales per month online. The IQR of sales in the shop is smaller (£180000) than online (£190000) showing more variation in sales online.

(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.

$\div 6$ ⎧ 6 workes : 14·5 day ⎫ ×6
⎩ 1 worker : 87 days ⎫
×13 ⎧ 13 workes : 6·692307 days ⎭ ÷13

13 workes will take 6·7 days which is less than 7 days.

(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.

$y = mx + c$
gradient

L_1 has gradient 2

L_2 $5y - 10x + 4 = 0$ rearrange to form $y = mx + c$
[-4]

$5y - 10x = -4$
[+10x]

$5y = -4 + 10x$
$5y = 10x - 4$ [÷5]

$y = \dfrac{10x}{5} - \dfrac{4}{5}$

$y = 2x - \dfrac{4}{5}$

gradient $= 2$

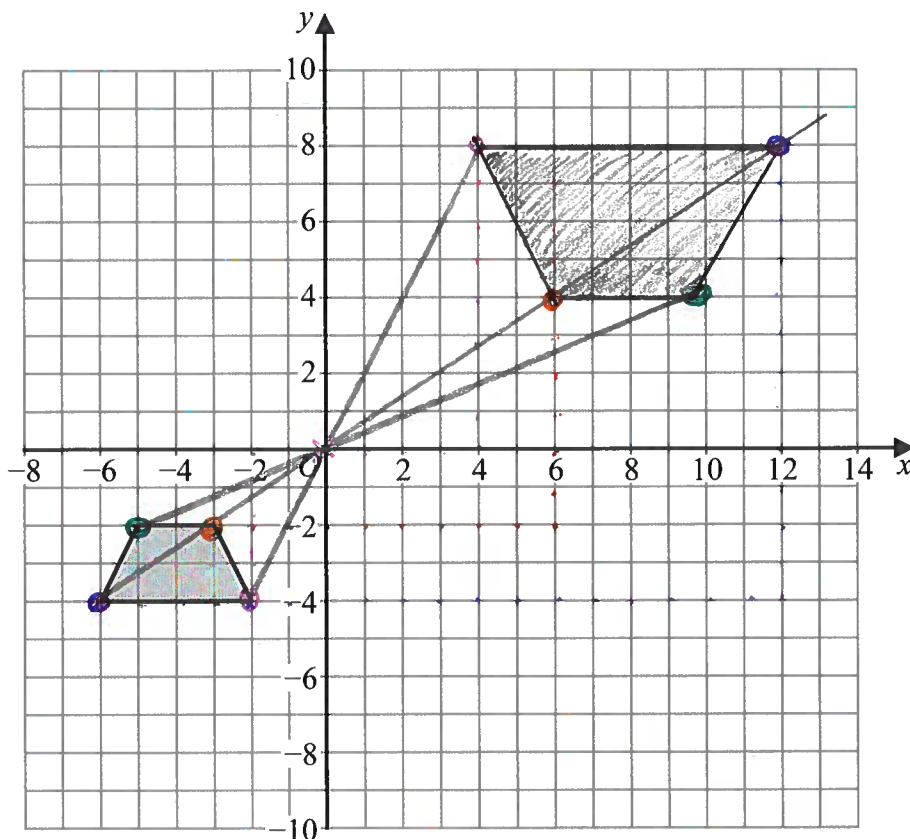L_1 and L_2 both have gradient 2 and are therefore parallel

(Total for Question 12 is 2 marks)

13

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.

Friday   Saturday

$$\frac{180}{N} = \frac{45}{305}$$

$$\frac{N}{180} = \frac{305}{45}$$
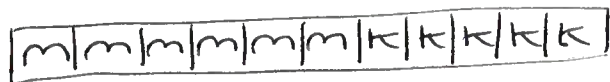
$$N = \frac{305}{45} \times 180$$

$$= 1220$$

.... 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.

$$\boxed{m|m|m|m|m|m|k|k|k|k|k}$$

Before   After

$m : k$ $m+1\cdot5 : k+1\cdot5$

$6 : 5$ $13 : 11$

$m : k = 6 : 5$ $m+1\cdot5 : k+1\cdot5 = 13 : 11$

$\dfrac{m}{k} = \dfrac{6}{5}$ $\dfrac{m+1\cdot5}{k+1\cdot5} = \dfrac{13}{11}$

$5m = 6k$ $11(m+1\cdot5) = 13(k+1\cdot5)$

$m = \dfrac{6}{5}k$ $11m + 16\cdot5 = 13k + 19\cdot5$

$11m - 13k = 3$

$11\left(\dfrac{6}{5}k\right) - 13k = 3$

$\dfrac{66}{5}k - 13k = 3$

$\dfrac{k}{5} = 3$

$m = \dfrac{6}{5} \times 15 = 18$ $k = 15$

Marta £ __18__

Khalid £ __15__

(Total for Question 15 is 4 marks)

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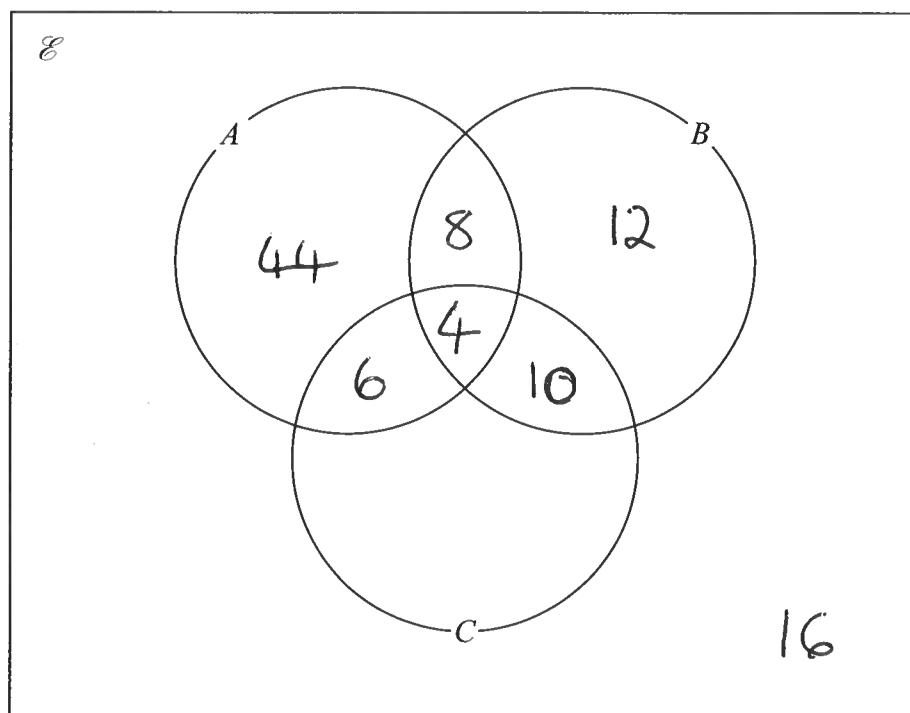 16 do not use any of type A, type B or type C
  8 use both type A and type B, but not type C
  14 use both type B and type C
  62 in total use type A
  all 20 who use type C also use at least one of type A and type B.

(a) Complete the Venn diagram for this information.

(4)

One of the customers is chosen at random.

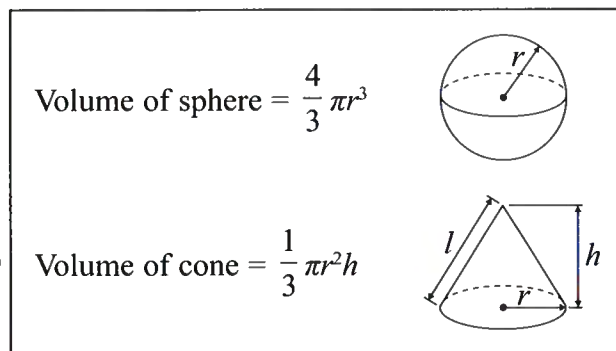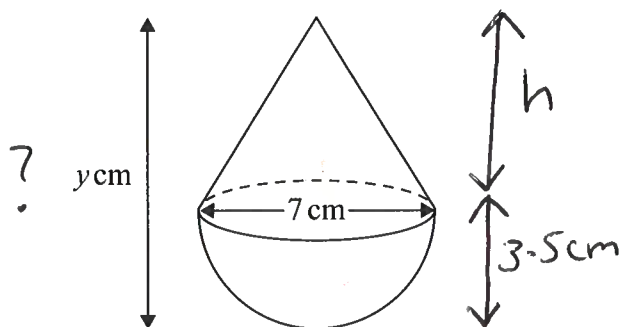Given that this customer uses type A,

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

$$\frac{12}{62} \quad \text{or} \quad \frac{6}{31}$$

(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.

? ycm

7 cm

h

3·5cm

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

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. Find the height
    Give your answer correct to 3 significant figures.

Cone

$V = \dfrac{\pi r^2 h}{3}$

$= \dfrac{\pi \times (3.5)^2 h}{3}$

$= \dfrac{49\pi}{12} h$

Hemisphere

$V = \dfrac{4\pi r^3}{3} \times \dfrac{1}{2}$

$= \dfrac{4 \times \pi \times (3.5)^3}{3} \times \dfrac{1}{2}$

$= \dfrac{343}{12}\pi$

Total Volume

V cone + V hemisphere = 120π

$\dfrac{49\pi}{12} h + \dfrac{343}{12}\pi = 120\pi$ [$\div \pi$]

$\dfrac{49}{12} h + \dfrac{343}{12} = 120$

$\dfrac{49}{12} h = \dfrac{1097}{12}$ [$-\dfrac{343}{12}$]

$h = \dfrac{1097}{49}$ [$\div \dfrac{49}{12}$]

or 22·387····

Total height
$= y$
$= 3.5 + \dfrac{1097}{49}$
$= 25.8877551$

25·9 cm

(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,

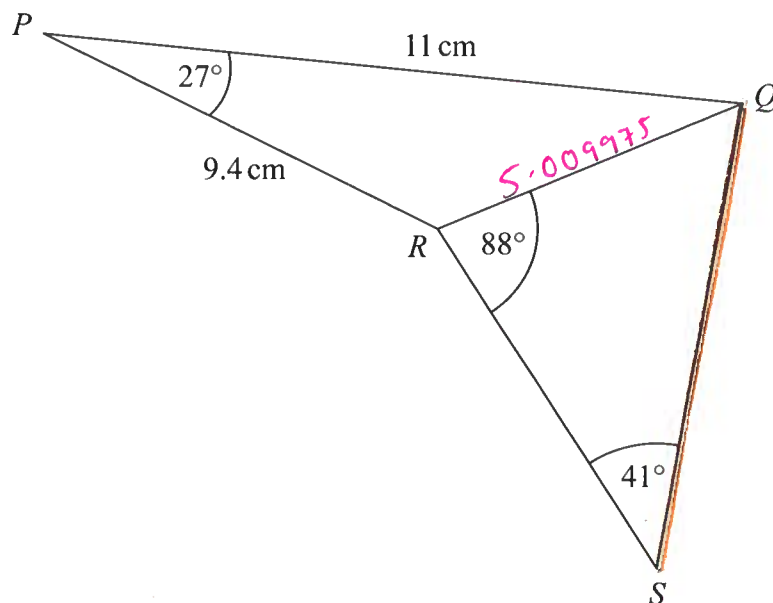(b) explain the effect this would have on your answer to part (a).

y would decrease
The solid would be wider and therefore the height would decrease to give the same volume.

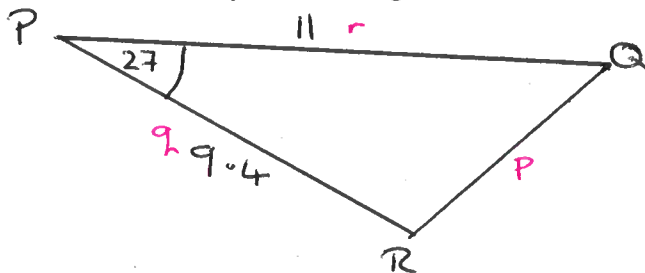(1)

(Total for Question 17 is 5 marks)
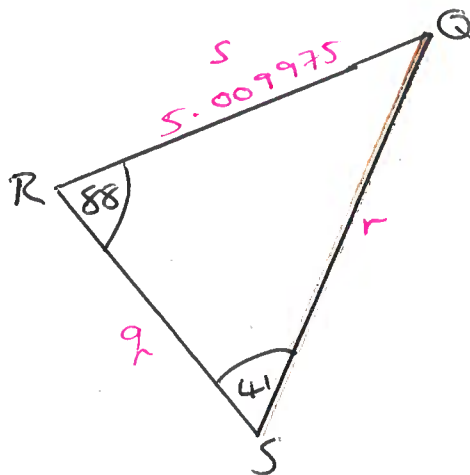
18 *PQR* and *QRS* are triangles.

P

27°

11 cm

Q

9.4 cm

5.009975

R 88°

41°

S

Calculate the length of *QS*.
Give your answer correct to 3 significant figures.
You must show all your working.

P 27 11 *r* Q

q 9.4

P

R

S 5.009975

R 88

q *r*

41

S

Q

r

"cosy" cosine rule

$$p^2 = r^2 + q^2 - 2rq \cos 27$$
$$= 11^2 + (9.4)^2 - 2 \times 11 \times 9.4 \times \cos 27$$
$$= 25.0998508$$
$$p = 5.009975......$$

Sine rule

$$\frac{r}{\sin R} = \frac{q}{\sin Q} = \frac{s}{\sin s}$$

$$\frac{QS}{\sin 88} = \frac{5.009975}{\sin 41}$$

$$QS = \frac{5.009975}{\sin 41} \times \sin 88$$

$$= 7.631818....$$

7.63 cm

(Total for Question 18 is 4 marks)

19 The functions g and h are such that

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

(a) Find g(16)

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

$$= \sqrt[3]{27}$$

.... 3

(1)

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

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

Step 1 Find $g^{-1}(x)$

let $\begin{cases} y = \sqrt[3]{2x - 5} \\ \\ x = \sqrt[3]{2y - 5} \\ \\ x = (2y - 5)^{1/3} \\ \\ x^3 = 2y - 5 \\ x^3 + 5 = 2y \\ \dfrac{x^3 + 5}{2} = y \end{cases}$

swap x and y

rearrange to make y the subject

[cube

[+5

[÷2

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

Step 2 Find $h\left[g^{-1}(x)\right]$

$$h\left[\frac{x^3 + 5}{2}\right] = \frac{1}{\frac{x^3 + 5}{2}}$$

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

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

(3)

(Total for Question 19 is 4 marks)

P 6 6 3 0 3 A 0 1 6 2 0

20 A, B, C and D are points on the circumference of a circle, centre O.
ADE and BCE are straight lines.
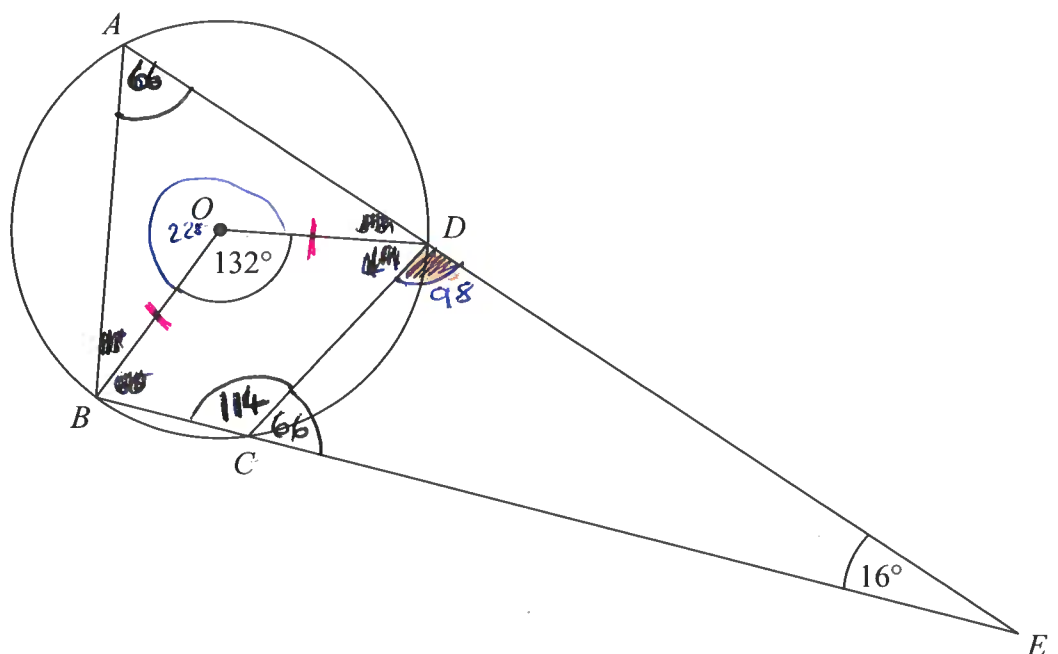
Work out the size of angle CDE.
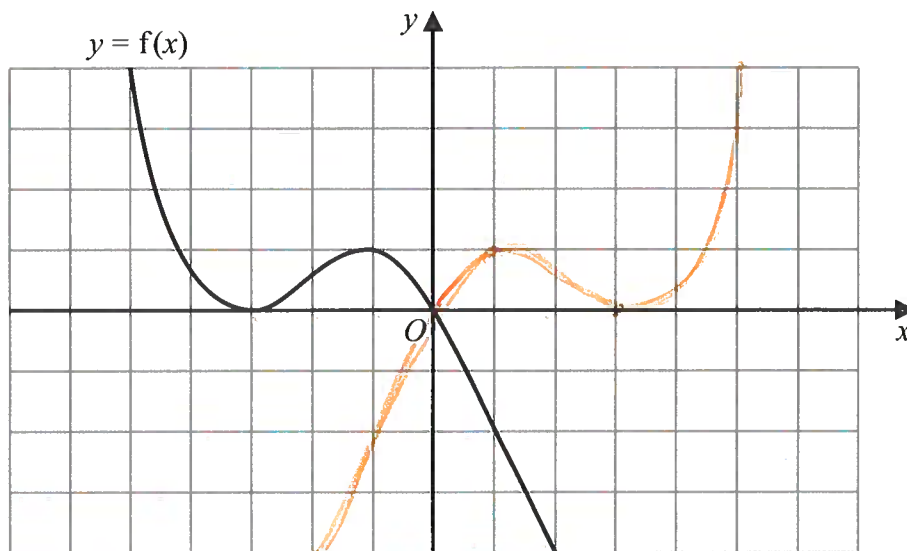Give a reason for each stage of your working.

angle $BAD = 66°$ (angle at centre twice angle at circumference)

angle $BCD = 114°$ (opposite angles in a cyclic quadrilateral add up to 180°)

angle $DCE = 66°$ (angles on a straight line add up to 180°)

angle $CDE = 98°$ (angles in a triangle add up to 180°)

..........98.......... °

(Total for Question 20 is 4 marks)

Turn over ▶

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

$y = f(x)$

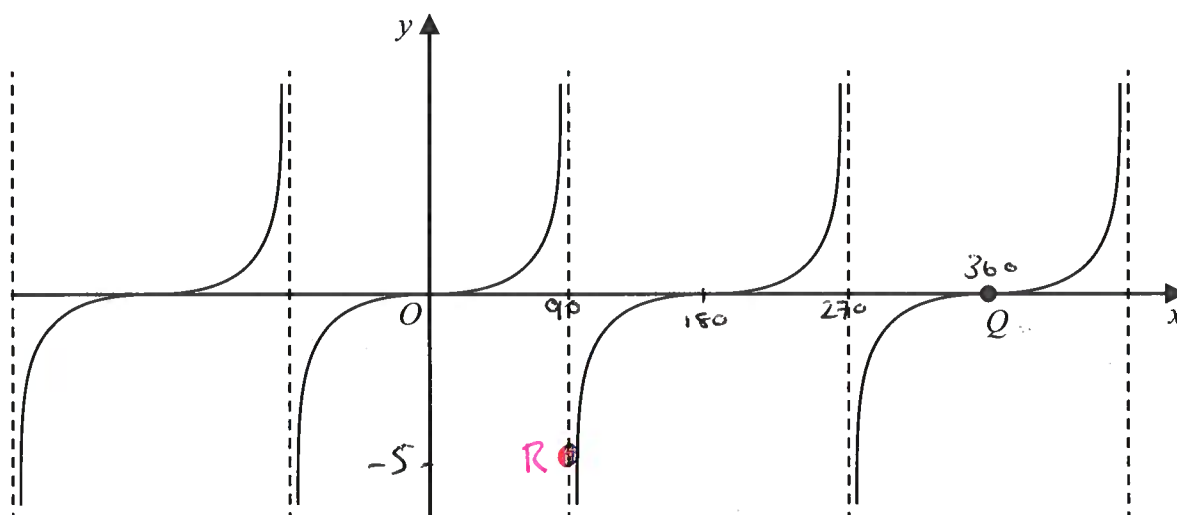(a) On the grid above, sketch the graph of $y = f(-x)$

reflection in y axis

(1)

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

The graph of $y = \tan x°$ 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.

LEFT 270°

DOWN 5

$\tan(x + 270) - 5$

(2)

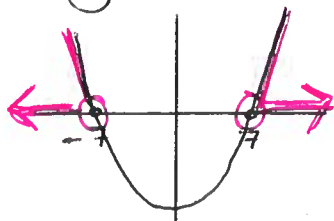**(Total for Question 21 is 3 marks)**

22 Find algebraically the set of values of x for which

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

$x^2 - 49 > 0$

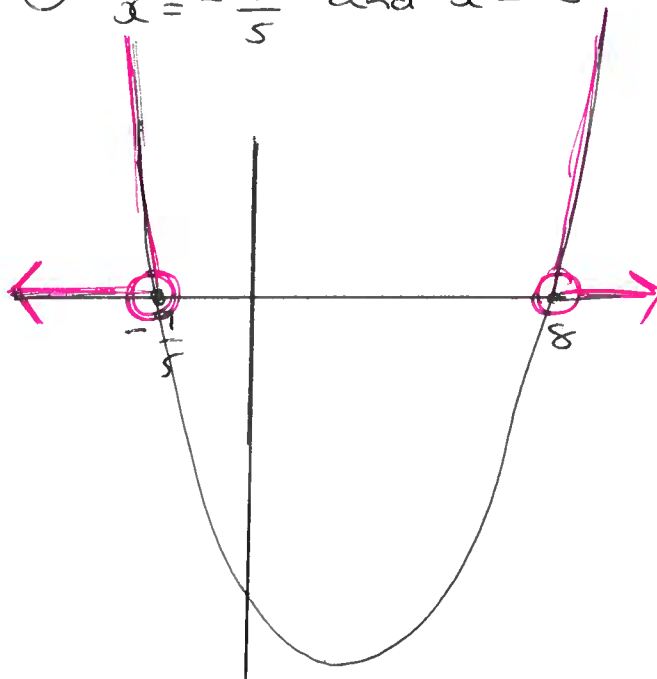$(x+7)(x-7) > 0$

key values -7 and 7

$x < -7, \ x > 7$

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

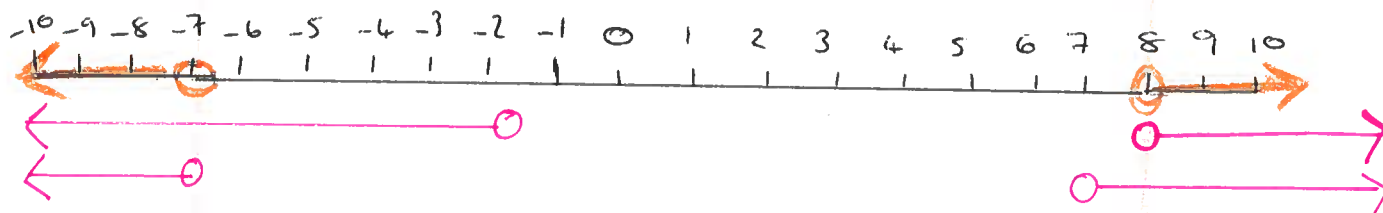$(5x + 9)(x - 8) > 0$

key values

$x = -\dfrac{9}{5}$ and $x = 8$

$x < -\dfrac{9}{5} \qquad x > 8$

must satisfy both

$x < -7, \ x > 8$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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