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

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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Worked Solutions

Pearson

Please note that these worked solutions have neither been provided nor approved by Pearson Education and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

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Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

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

$(a^x)^y = a^{xy}$. When raising a power to a power, multiply the powers

x^{15}

(1)

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

$4x + 12 + 28 - 14x$ ← Expanding the brackets. $4 \times x = 4x$. $4 \times 3 = 12$. $7 \times 4 = 28$. $7 \times -2x = -14x$

Simplifying by collecting like terms. $4x - 14x = -10x$. $12 + 48 = 40$

$-10x + 40$

(2)

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

The highest common factor of both terms is $3x^2$. Bringing this out as a factor and dividing both terms by this, leaving the result in a bracket

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

(2)

(Total for Question 1 is 5 marks)

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2
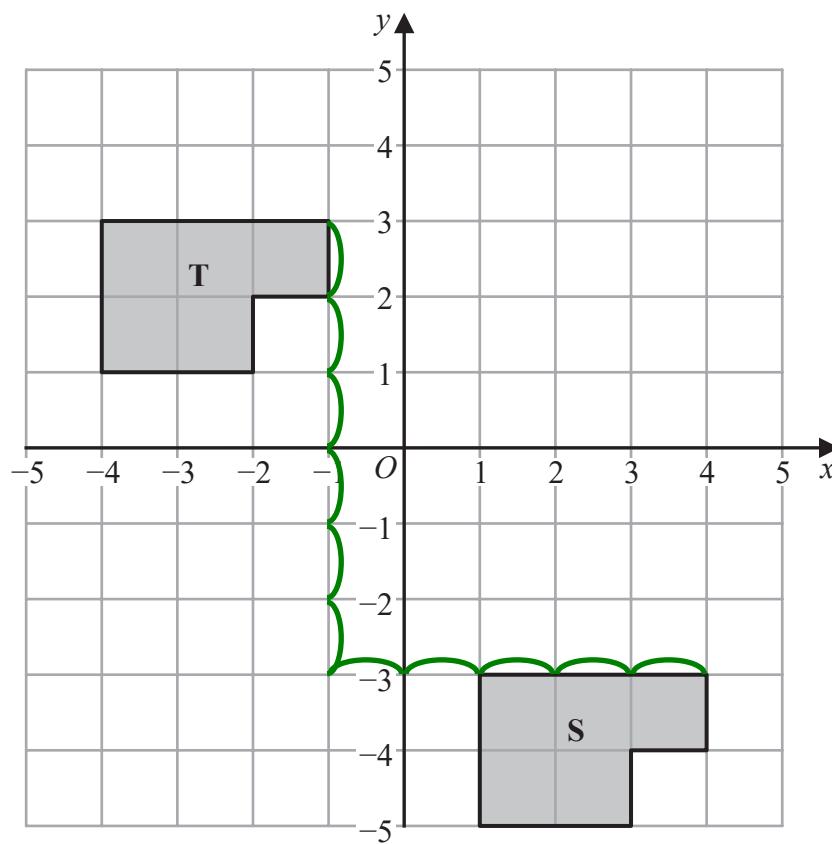
Describe fully the single transformation that maps shape **S** onto shape **T**.

Translation by $\binom{-5}{6}$

It must be a translation as it has been moved without changing size or the way up it is.
Counting the jumps from one of the corners on S to the same corner on T. It is 5 jumps
to the left, which is -5 in the x-direction. It is 6 jumps up, which is 6 in the y-direction

(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.

$90 \pm \frac{1}{2}$

Adding and subtracting half of the resolution works out the upper and lower bound.
The resolution is what the measurement can go up in or is to the nearest, which is 1m

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 $80\,000\,\text{m}^2$
The greatest number of people allowed to attend Festival A is 425

Festival B will be in a rectangular field $700\,\text{m}$ by $2000\,\text{m}$.
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.

$80000 \div 425 = \dfrac{3200}{17}$

> This is the area per person for Festival A. Area per person means to divide the area by the number of people

2000×700

> This is the area for Festival B. Area of rectangle = length x width

$1400000 \div 6750 = \dfrac{5600}{27}$

> This is the area per person for Festival B. Area per person means to divide the area by the number of people

$\dfrac{5600}{27} - \dfrac{3200}{17}$

> Subtracting the area per person of Festival A from the area per person for Festival B works out how much greater the area per person for Festival B is than Festival A

> 19.17... is rounded to the nearest whole metre

$\underset{\text{.................................}}{19}$ m^2

(4)

Callum says,

"$300\,\text{cm}^2$ is the same as $3\,\text{m}^2$ because there are $100\,\text{cm}$ in $1\,\text{m}$ so you divide by 100"

Callum's method is wrong.

(b) Explain why.

Should divide by 100^2

> There are 100cm in 1m, however the unit is squared so the amount needed to divide by to convert is also squared

(1)

(Total for Question 4 is 5 marks)

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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.

$4-(-3)$ ← This works out that the distance between L and M in the x-direction is 7

$7÷2$ ← 2 parts of the ratio represent the distance between L and M. Dividing the 7 by 2 works out that 1 part of the ratio is worth 3.5 in the x-direction

$3.5×3$ ← Multiplying the value of 1 part by 3 works out that the 3 parts which represent the distance between M and N in the x-direction is 10.5

$4+10.5=14.5$ ← Adding the distance between M and N in the x-direction to the x-coordinate of M works out the x-coordinate of N

$9-1$
$8÷2$ ← Doing the same method but for the y-direction
$4×3$
$9+12=21$

(14.5 , 21)

(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.

$679×\left(\dfrac{100-4}{100}\right)^3$ ← 100% is the full amount. Subtracting 4% works out the percentage it decreases to. Putting this over 100 converts it into a fraction, which reduces the £679 by 4% when it is multiplied by. Raising the fraction to the power of 3 as it needs to be decreases by 4% 3 times

The answer of 600.735... is rounded to the nearest penny

£ 600.74

(Total for Question 6 is 3 marks)

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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

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

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

$27 \times 0.85 = 22.95$ ← Each euro is £0.85 so multiplying the 27 euros by 0.85 converts it to £22.95

$18 \div 4.5 = 4$ ← Every 4.5 litres is 1 gallon so dividing the 18 litres by 4.5 works out how many lots of 4.5 litres it is and therefore how many gallons it is

$22.95 \times 2 = 45.90$ ← 8 gallons is 2 lots of 4 gallons so multiplying the price of 4 gallons by 2 works out the price of 8 gallons

No ← The petrol in Spain is not cheaper than in Wales as it costs £45.90 for 8 gallons and Wales is less than this for 8 gallons

(Total for Question 7 is 4 marks)

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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.

Type it into the calculator exactly as it is

The answer of 0.7393... is rounded to 3 significant figures. The third significant figure is rounded using the fourth then everything after the third significant figure is set to 0 and ignored. The 0 at the start is not a significant figure

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.

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

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.

$P \overset{F}{} A$ ← Converting the pressure formula in to a formula triangle

$180 \div 187.5$ ← Area = force ÷ pressure

$0.96 \div 1.2$ ← Area of rectangle = length x width. So width = area of rectangle ÷ length

$x =$ 0.8

(Total for Question 9 is 3 marks)

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

Online store

Lowest value · Lower quartile · Median · Upper quartile · Highest value

Sales (£000s)
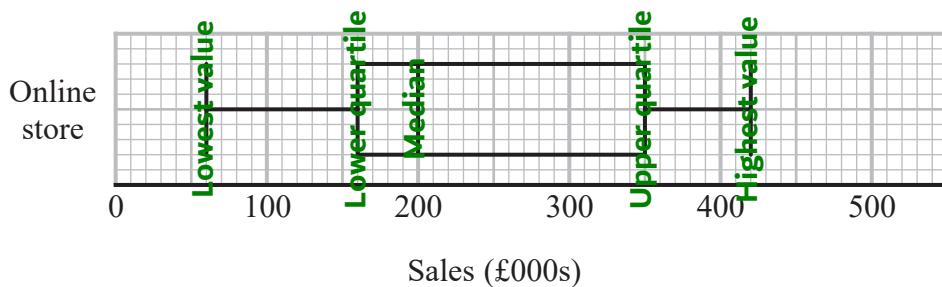
Andrew says,

"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.

It is two quarters

The data is split in to quarters. A quarter lies between the lowest value and the lower quartile, a quarter between the lower quartile and median, a quarter between the median and upper quartile and a quarter between the upper quartile and highest value

(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.

Shop

Sales (£000s)

(2)

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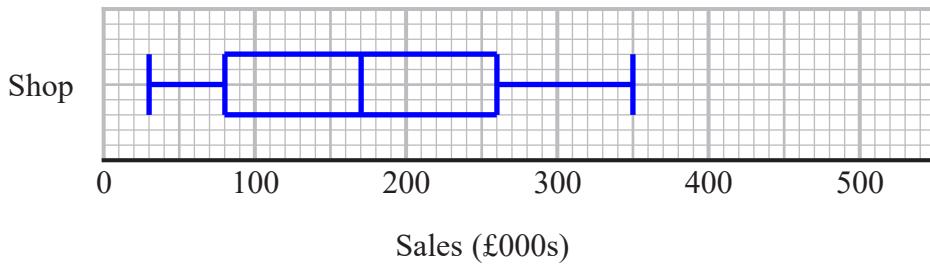
(c) Compare the distribution of the sales of the online store with the distribution of the sales in the shop.

Median and interquartile range is greater for online

The median for online is 200 and the median for the shop is 170. Interquartile range is the difference between the upper and lower quartiles. The interquartile range for online is 350 - 160 = 190 and for the shop it is 260 - 80 = 180

(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.

$6 \times 14\frac{1}{2}$

Multiplying the 6 workers by the $14^1/_2$ days works out that 87 days worth of work will need to be done

$87 \div 13 = 6.6...$

Dividing the 87 days worth of work by the 13 workers shows that it will take 6.6... days to do the work, which is less than 7 days

(Total for Question 11 is 3 marks)

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12 The equation of the line **L₁** is $y = 2x + 3$

The equation of the line **L₂** is $5y - 10x + 4 = 0$

Show that these two lines are parallel.

The general equation of a straight line is y = mx + c, where m is the gradient and c is the y-intercept. The second equation is not in this form so it needs to be put into this form to work out its gradient

$5y = 10x - 4$ ← Adding 10x and subtracting 4 from both sides to get the y term on its own

$y = 2x - \frac{4}{5}$ ← Dividing both sides by 5 to get y on its own

Both lines have gradient of 2 ← As m is 2 in both equations. As they have the same gradient they must be parallel

Multiplying the vector from the centre of enlargement to each corner on the shape by the scale factor works out the new vector from the centre of enlargement

(Total for Question 12 is 2 marks)

13

$\binom{-3}{-2} x -2 = \binom{6}{4}$

$\binom{-5}{-2} x -2 = \binom{10}{4}$

$\binom{-2}{-4} x -2 = \binom{4}{8}$

$\binom{-6}{-4} x -2 = \binom{12}{8}$
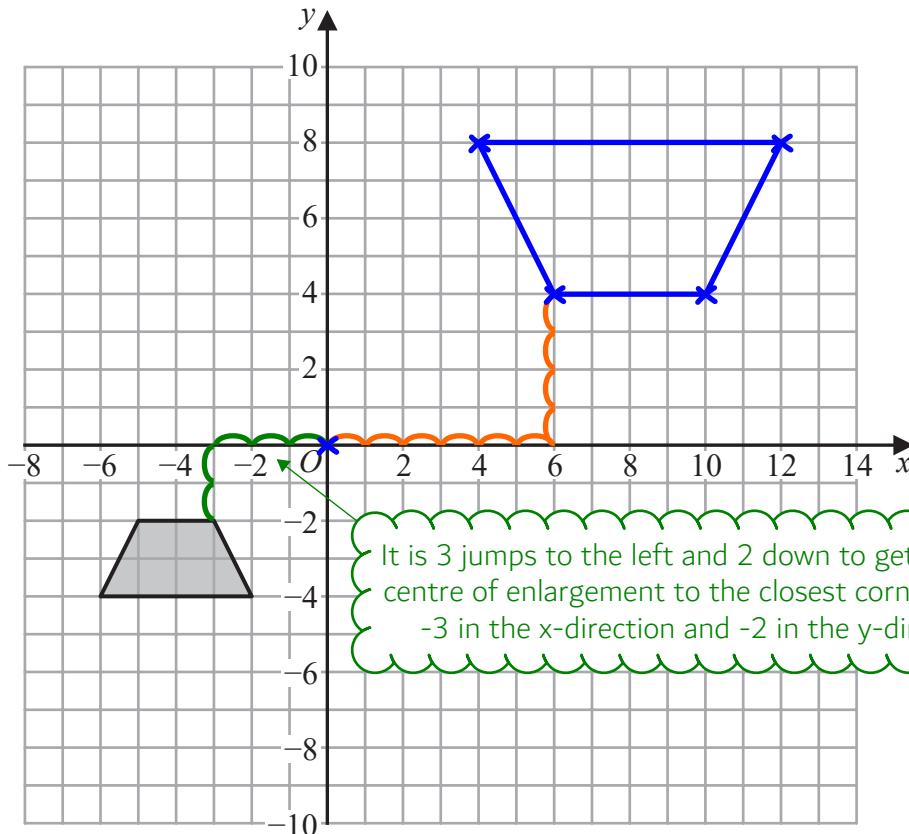
It is 3 jumps to the left and 2 down to get from the centre of enlargement to the closest corner. This is -3 in the x-direction and -2 in the y-direction

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

(Total for Question 13 is 2 marks)

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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.

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

Let x be the total number of fish in the lake. It can be estimated that 45/180 of the total number of fish was 305 as this was the fraction of the tagged which were caught on Saturday

$$x = 305 \div \frac{45}{180}$$

Rearranging to find x by dividing both sides by 45/180

.... 1220 ....

(Total for Question 14 is 3 marks)

.CG Maths.

Turn over ▶

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.

$$m = \frac{k}{5} \times 6$$

Let m be the hourly pay for Marta before the increase and k be the hourly pay for Khalid before the increase. 5 parts of the first ratio represent k so dividing this by 5 expresses the value of 1 part. Multiplying this by 6 gives the 6 parts which represent m. Writing this as an equation

$$m + 1.50 = \frac{k + 1.50}{11} \times 13$$

Adding £1.50 to m and k increases them by £1.50 and expresses the hourly pays after the increase. 11 parts of the second ratio represent k + 1.50 so dividing this by 11 expresses the value of 1 part. Multiplying this by 13 gives the 13 parts which represent m + 1.50. Writing this as an equation

$$1.50 = \frac{k + 1.50}{11} \times 13 - \frac{k}{5} \times 6$$

Solving the equations simultaneously by subtracting the first equation from the second equation

$$1.50 \times 11 \times 5 = 5(k + 1.50) \times 13 - 11 \times k \times 6$$

Multiplying all terms by 11 and 5 to eliminate the denominators

$$82.5 = 65k + 97.5 - 66k$$

Simplifying and expanding the bracket

$$-15 = -k$$

Subtracting 97.5 from both sides and collecting like terms

$$k = 15$$

$$\frac{15}{5} \times 6$$

Dividing both sides by -1 finds that k = 15 so Khalid's pay before the increase was £15

Marta £ .... 18 ....

Khalid £ .... 15 ....

(Total for Question 15 is 4 marks)

Going back to the original equation to work out Marta's pay before the increase

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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,
  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.
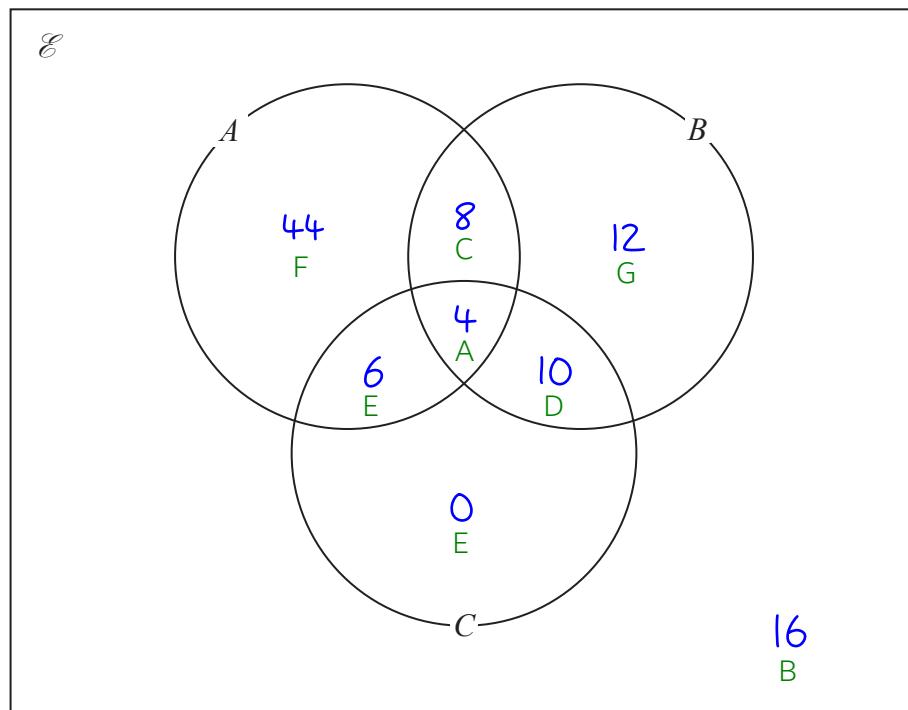
(4)

One of the customers is chosen at random.

The letters in green do not need to be written. See next page for what these are about

Given that this customer uses type A,

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

62 customers use type A. Out of these, 12 also use type B (as the 8 and 4 are both in B)

$$\frac{12}{62}$$

(2)

(Total for Question 16 is 6 marks)

.CG Maths.

A: 4 use all three types

B: 16 do not use any of type A, type B or type C

C: 8 use both type A and type B, but not type C

D: 14 use both type B and type C. This includes the 4 who use all three types so this needs to be subtracted

E: All 20 who use type C also use at least one of type A and type B. So 0 use just type C. Subtracting the other numbers in the C ring leaves 6

F: 62 in total use type A. Subtracting the other numbers in the A ring leaves 44

G: There are 100 customers in total. Subtracting all of the other numbers from 100 leaves 12

.CG Maths.

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

y cm

7 cm
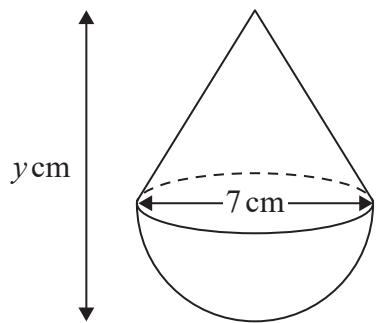
Volume of sphere = $\frac{4}{3}\pi r^3$
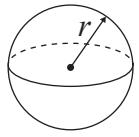
Volume of cone = $\frac{1}{3}\pi r^2 h$
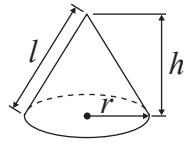
The diameter of the base of the cone is 7 cm.
The diameter of the hemisphere is 7 cm.

The total volume of **T** is 120π cm³
The total height of **T** is y cm.

(a) Calculate the value of y.
Give your answer correct to 3 significant figures.

$$\frac{1}{2}\times\frac{4}{3}\pi\times\left(\frac{7}{2}\right)^3 + \frac{1}{3}\pi\times\left(\frac{7}{2}\right)^2 h = 120\pi$$

Adding the volume of the hemisphere and cone must be equal to the volume of T

Volume of the hemisphere. A hemisphere is half of a sphere. The radius is half the diameter

Volume of the cone. The radius is half the diameter

$$h = \frac{120\pi - \frac{1}{2}\times\frac{4}{3}\pi\times\left(\frac{7}{2}\right)^3}{\frac{1}{3}\pi\times\left(\frac{7}{2}\right)^2}$$

Rearranged to find h, the height of the cone. Subtracting the volume of the hemisphere from both sides then dividing both sides by everything h was multiplied by

$$y = \frac{1097}{49} + \frac{7}{2}$$

Adding the height of the hemisphere, which is it's radius, to the height of the cone gives y

The answer of 25.88... is rounded to 3 significant figures

$y = $ ....25.9.......

(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).

$$\frac{120\pi - \frac{1}{2}\times\frac{4}{3}\pi\times\left(\frac{8}{2}\right)^3}{\frac{1}{3}\pi\times\left(\frac{8}{2}\right)^2} + \frac{8}{2} = 18.5$$

*Repeating the calculation using a diameter of 8cm instead of 7cm. 18.5 is now the value of y and this is less than 25.9*

It would decrease

(1)

(Total for Question 17 is 5 marks)

14

18 *PQR* and *QRS* are triangles.

P

27° A

11 cm b

Q

a

9.4 cm C

R 88° B

b

When labelling the triangles, side a is opposite angle A

A

41°

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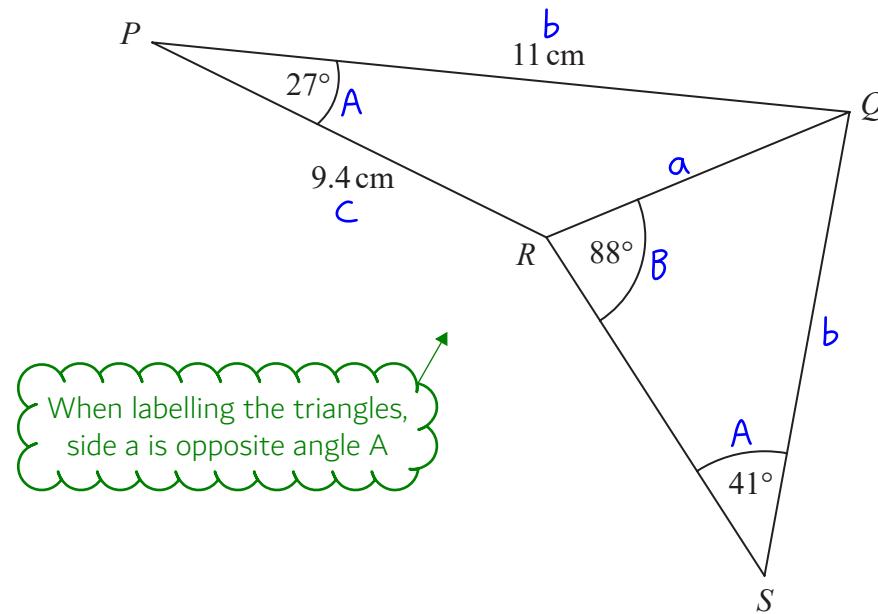
Calculate the length of *QS*.
Give your answer correct to 3 significant figures.
You must show all your working.

$$a^2 = b^2 + c^2 - 2bc\cos A$$

There are not opposite pairs of sides and angles in triangle PQR so the sine rule cannot be used. The cosine rule can be used instead

$$RQ = \sqrt{11^2 + 9.4^2 - 2 \times 11 \times 9.4 \times \cos 27}$$

Labelling the triangle. Square rooting both sides to make side a the subject and substituting in the values

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

There are opposite pairs of sides and angles in triangle RQS so the sine rule can be used

$$QS = \frac{5.0...}{\sin 41} \times \sin 88$$

Labelling the triangle. Multiplying both sides by sinB to make b the subject and substituting in the values. Using the exact value of side RQ

Rounding the answer of 7.631... to 3 significant figures

.....................7.63..................... cm

(Total for Question 18 is 4 marks)

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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)

$\sqrt[3]{2 \times 16 - 5}$ ← Substituting 16 for x in g(x)

.... 3
(1)

(b) Find hg^{-1}(x)
   Give your answer in terms of x in its simplest form.

$x = \sqrt[3]{2y - 5}$ ← Finding the inverse function g^{-1}(x) by switching g(x) with x and x with y then rearranging to find y

$2y - 5 = x^3$ ← Cubing both sides

$2y = x^3 + 5$ ← Adding 5 to both sides

$y = \dfrac{x^3 + 5}{2}$ ← Dividing both sides by 2. The right side of the equation is g^{-1}(x)

$1 \div \dfrac{x^3 + 5}{2}$ ← Substituting g^{-1}(x) for x in h(x) to find the composite function hg^{-1}(x)

$1 \times \dfrac{2}{x^3 + 5}$ ← To divide by a fraction, change the division sign to multiplication and flip the fraction

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

(Total for Question 19 is 4 marks)

.CG Maths.

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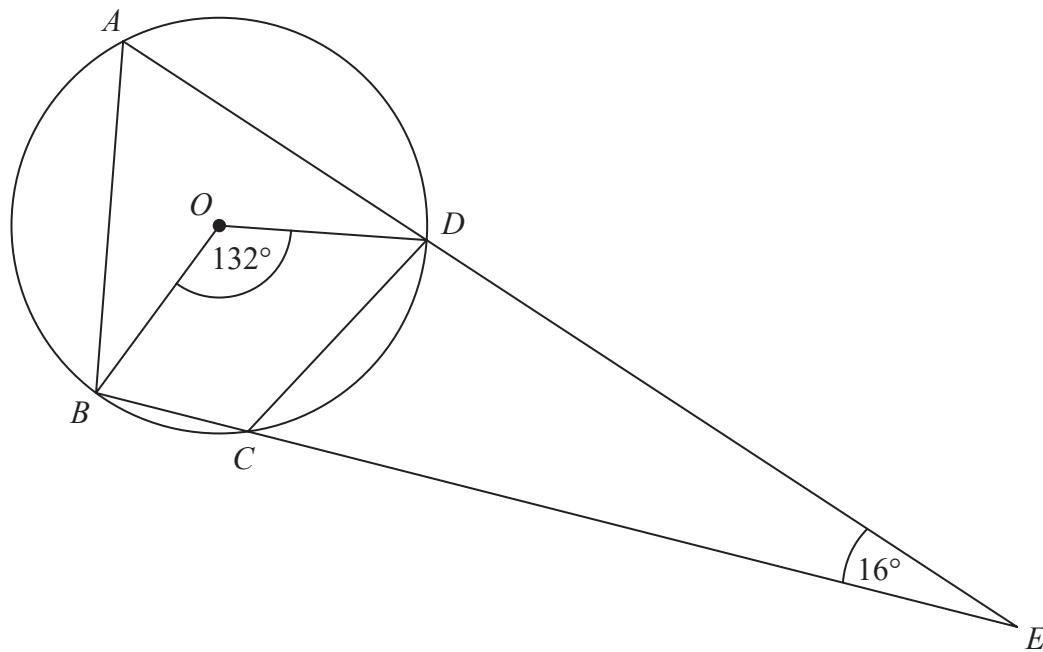
Work out the size of angle *CDE*.
Give a reason for each stage of your working.

132 ÷ 2 = 66
Angle BAD = 66° as the angle at the circumference is half the angle at the centre

Angle BOD is the angle at the centre and angle BAD is the angle at the circumference

180 - 66 = 114
Angle BCD = 114° as opposite angles in a cyclic quadrilateral add up to 180°

A cyclic quadrilateral is a four sided shape where all of its corners are on the circumference of a circle. Angle BAD and angle BCD are opposite angles in the cyclic quadrilateral so subtracting angle BAD from 180 leaves angle BCD

180 - 114 = 66
Angle DCE = 66° as angles around a point on a straight line add up to 180°

Angles BCD and DCE lie around the point C on the straight line BCE. Subtracting angle BCD from 180 leaves angle DCE

180 - 66 - 16 = 98
Angle CDE = 98° as angles in a triangle add up to 180°

.......98....... °

(Total for Question 20 is 4 marks)

Angles CDE, DCE and DEC are the three angles in triangle DCE. Subtracting the known angles leaves angle CDE

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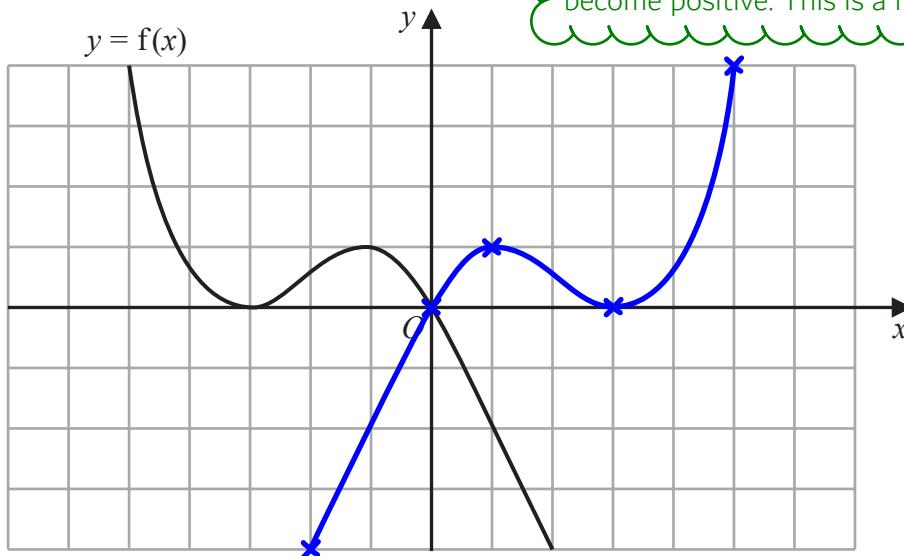
$y = f(x)$

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

(1)

Here is a sketch of the graph of $y = \tan x°$
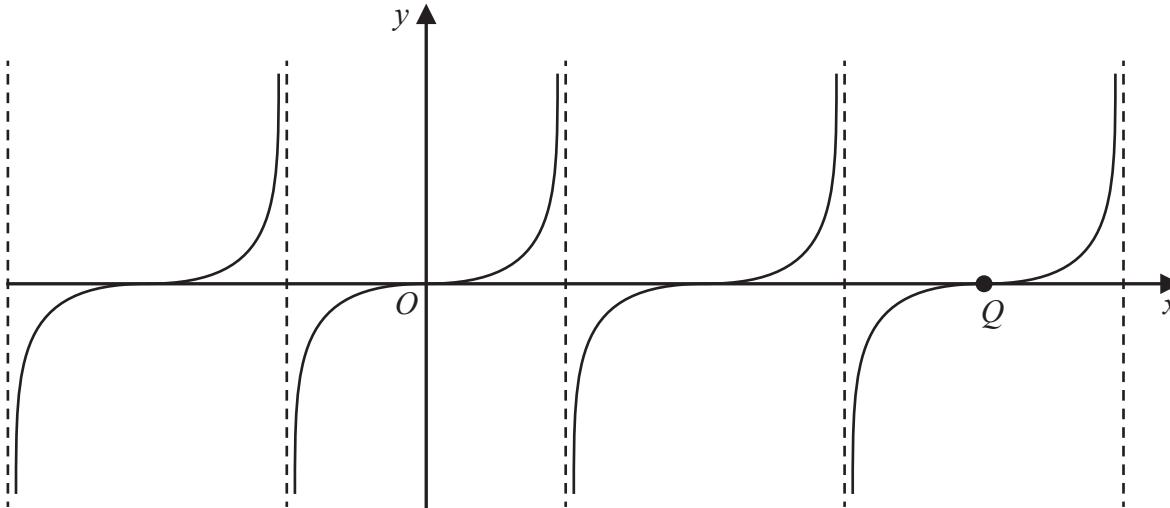
The graph of $y = \tan x°$ is translated to give the graph of $y = g(x)$.

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.

$\tan(x+270) - 5$

(2)

(Total for Question 21 is 3 marks)

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22 Find algebraically the set of values of x for which

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

$x^2 > 49$ ← Adding 49 to both sides to get the x^2 on its own

$x > 7 \text{ or } x < -7$ ← Square rooting both sides. When square rooting and getting a negative result, the inequality symbol must flip

$\dfrac{-(31) \pm \sqrt{(-31)^2 - 4 \times 5 \times (-72)}}{2 \times 5}$ ← Using the quadratic formula to solve when $5x^2 - 31x - 72 = 0$
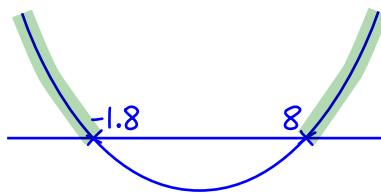
$-1.8 \qquad 8$ ← Drawing a quadratic curve and indicating the solutions. It is highlighted green where it is greater than 0

$x < -1.8 \text{ or } x > 8$ ← Describing the range of values where it is highlighted green in the x-direction

These are the values which satisfy all of the inequalities at the same time

$x < -7 \text{ or } x > 8$

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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