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Candidate surname		Other names	
Centre Number		Candidate Number	

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

Wednesday 11 June 2025

Morning (Time: 1 hour 30 minutes)	Paper reference	1MA1/3H
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Mathematics
PAPER 3 (Calculator)
Higher Tier



You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB or B pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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.

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 should be written in the exam.

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

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

Answer ALL questions.

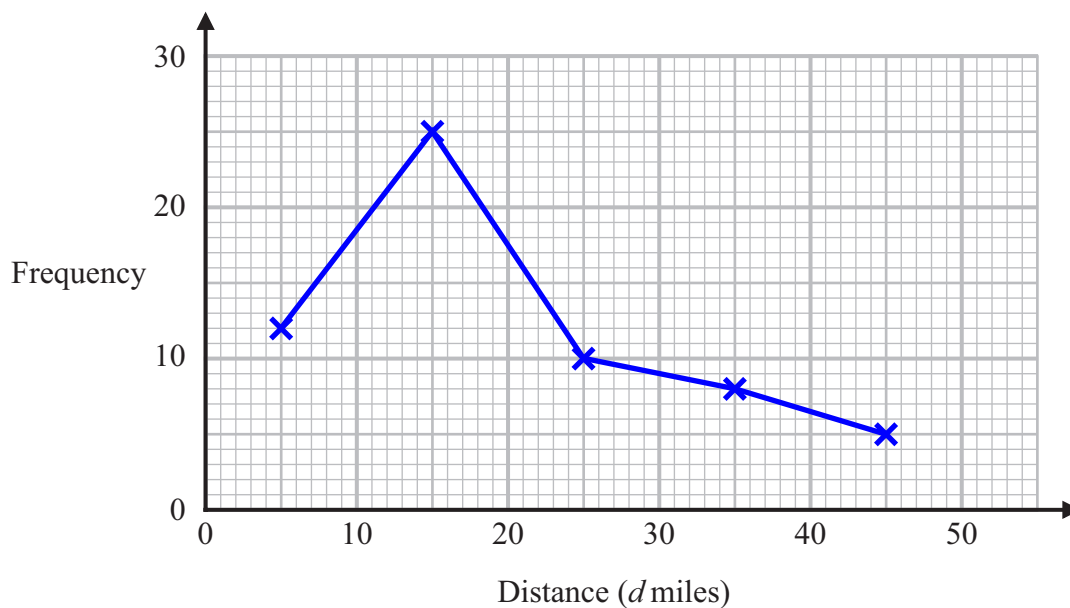
Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The table shows information about the distances that 60 people travel to work.

Distance (d miles)	Frequency
$0 < d \leq 10$	12
$10 < d \leq 20$	25
$20 < d \leq 30$	10
$30 < d \leq 40$	8
$40 < d \leq 50$	5

Draw a frequency polygon for the information in the table.



(Total for Question 1 is 2 marks)

Plotting the frequencies at the midpoint of each interval then joining them up with a series of straight lines

- 2 Ben is trying to make m the subject of $p = \frac{m}{3} + 5$

Here is his working.

$$p - 5 = \frac{m}{3}$$

$$3 \times p - 5 = m \quad \leftarrow \text{This line should be } 3 \times p - 15 = m, \text{ as the } -5 \text{ should also be multiplied by } 3$$

$$m = 3p - 5$$

Ben's answer is wrong.

- (a) What mistake has Ben made?

Did not multiply the -5 by 3

(1)

- (b) Factorise fully $2x^3y + 4xy^2$

The highest common factor of $2x^3y$ and $4xy^2$ is $2xy$, as 2 is the HCF of 2 and 4, x is the highest power of x which is in common to both, and y is the highest power of y in common to both. Bringing the HCF out as a factor, dividing both terms by it and leaving the result in a bracket

$$2xy(x^2 + 2y)$$

(2)

(Total for Question 2 is 3 marks)

3 Mia pays £25 for 200 oranges.

Mia puts the oranges into bags.
She puts 5 oranges into each bag.

Mia sells all the bags of oranges for £1 each bag.

Work out Mia's percentage profit.

$200 \div 5$ ← Dividing the 200 oranges by the 5 oranges in each bag finds that there are 40 bags

40×1 ← Multiplying the 40 bags by the £1 Mia sells each bag for finds that Mia's income is £40

$\frac{40 - 25}{25} \times 100$ ← Subtracting the £25 paid from the £40 income expresses the profit.
Putting this over the original £25 paid expresses the profit as a fraction. Multiplying this by 100 converts the fraction to a percentage

.....60.....%

(Total for Question 3 is 3 marks)

- 4 In London, 2 kg of carrots cost £3.75
In New York, 5 lbs of carrots cost 4.90 US dollars.

£1 = 1.20 US dollars

1 kg = 2.2 lbs

In which city are carrots better value for money, London or New York?

You must show how you get your answer.

$375 \div 2 = 187.5$ ← £3.75 = 375p. Dividing this by the 2 kg find that 1 kg costs 187.5p in London

$5 \div 2.2$ ← Dividing the 5 lbs by the 2.2 converts it to 2.27 kg

$4.90 \div 2.27$ ← 2.27 kg = 4.90 US dollars. Dividing both sides by 2.27 gets finds that 1 kg costs 2.156 US dollars

$2.156 \div 1.20$ ← Dividing the 2.156 US dollars by the 1.20 convert it to £1.796

$1.796 \times 100 = 179.6$ ← £1 = 100p. Multiplying the £1.796 by 100 converts it to 179.6p

New York ← 179.6p for 1 kg is less than 187.5p for 1 kg

(Total for Question 4 is 4 marks)

- 5 Karim rounds a number, n , to 1 decimal place.
The result is 23.8

Complete the error interval for n .

$$23.8 \pm \frac{0.1}{2}$$

Adding and subtracting half of what it has been rounded to the nearest gives the upper and lower bound. It has been rounded to the nearest 0.1 as this is the place value of the 1st decimal place

$$\dots\dots\dots 23.75 \leq n < 23.85 \dots\dots\dots$$

(Total for Question 5 is 2 marks)

- 6 A plane takes 2 hours 24 minutes to fly from Luton to Alicante.
The plane flies a distance of 1512 kilometres.

Work out the average speed of the plane.
Give your answer in kilometres per hour.

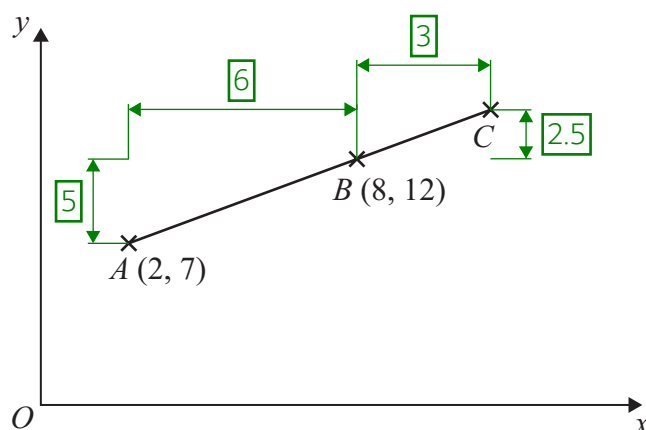
$$1512 \div 2^{\circ}24^{\circ}$$

Kilometres per hour means distance in kilometres divided by time in hours. Entering the 2 hours 24 minutes as a sexagesimal

$$\dots\dots\dots 630 \dots\dots\dots \text{ kilometres per hour}$$

(Total for Question 6 is 3 marks)

7 ABC is a straight line.



Point A has coordinates $(2, 7)$

Point B has coordinates $(8, 12)$

$$BC = \frac{1}{2} AB$$

Find the coordinates of point C .

$$8 - 2$$

Subtracting the x-coordinate of A from the x-coordinate of B finds that AB is 6 in the x-direction

$$6 \div 2$$

BC is half of AB so BC is 3 in the x-direction

$$8 + 3$$

Adding the 3 in the x-direction from B to C to the x-coordinate of B finds that the x-coordinate of C is 11

$$12 - 7$$

Subtracting the y-coordinate of A from the y-coordinate of B finds that AB is 5 in the y-direction

$$5 \div 2$$

BC is half of AB so BC is 2.5 in the y-direction

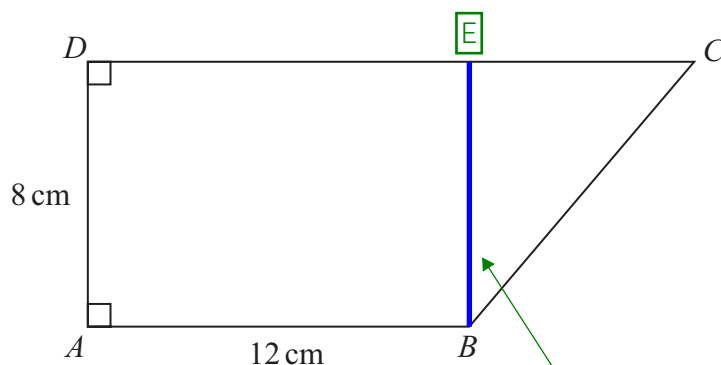
$$12 + 2.5$$

Adding the 2.5 in the y-direction from B to C to the y-coordinate of B finds that the y-coordinate of C is 14.5

(..... 11 , ... 14.5)

(Total for Question 7 is 3 marks)

8 The diagram shows trapezium $ABCD$.



Drawing a line here splits the shape into a rectangle and a right-angled triangle

$$AB = 12 \text{ cm}$$

$$AD = 8 \text{ cm}$$

The trapezium has an area of 112 cm^2

Work out the perimeter of the trapezium.

Give your answer correct to 3 significant figures.

$$12 \times 8 \leftarrow \text{Area of rectangle} = \text{base} \times \text{height} = 96 \text{ cm}^2$$

$$112 - 96 \leftarrow \text{Subtracting the area of the rectangle from the area of the trapezium finds that the area of the triangle is } 16 \text{ cm}^2$$

$$\frac{1}{2} \times B \times 8 = 16 \leftarrow \text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height. Let B be the base EC. EB is the height}$$

$$B = 4 \leftarrow \text{Dividing both sides by } \frac{1}{2} \times 8 \text{ gets B on its own. So EC is } 4 \text{ cm}$$

$$8^2 + 4^2 = BC^2 \leftarrow \text{Using Pythagoras' Theorem in the right-angled triangle to find BC. } a^2 + b^2 = c^2, \text{ where a and b are the shorter sides and c is the longest side}$$

$$BC = \sqrt{80} \leftarrow \text{Square rooting both sides finds BC}$$

$$12 + 8 + 12 + 4 + \sqrt{80} \leftarrow \text{Adding all the outside lengths finds the perimeter. } AB + AD + DE + EC + BC$$

44.94... is rounded correct to 3 significant figures

44.9

cm

(Total for Question 8 is 5 marks)

- 9 (a) Write 5.73×10^6 as an ordinary number.

Typing it into the calculator converts it to an ordinary number

5730000

(1)

- (b) Write 0.035 in standard form.

0.035 must be multiplied by ten 2 times to get 3.5, which is at least 1 and less than 10. Multiplying by 10^{-2} has the effect of dividing by ten 2 times so keeps it equal

3.5×10^{-2}

(1)

(Total for Question 9 is 2 marks)

- 10 Use your calculator to work out $\frac{(1.8^3 \times \cos 35^\circ)^2}{\sqrt[3]{17.4 - \tan 85^\circ}}$

Give your answer correct to 3 significant figures.

Type it into the calculator exactly as it is above

12.58... is given correct to 3 significant figures

12.6

(Total for Question 10 is 2 marks)

11 $\frac{3^n \times 3^{20}}{3^8} = 3^{14}$

(a) Find the value of n .

$3^n \times 3^{20} = 3^{22}$ ← Multiplying both sides by 3^8 eliminates the denominator on the left. $3^{14} \times 3^8 = 3^{14+8} = 3^{22}$

$3^n = 3^2$ ← Dividing both sides by 3^{20} gets 3^n on its own. $3^{22} \div 3^{20} = 3^{22-20} = 3^2$

n must be 2 so that both sides are equal

$n = \dots\dots\dots 2$
(2)

(b) Write $(64m^{12})^{\frac{2}{3}}$ in the form am^b where a and b are integers.

Raising both the 64 and the m^{12} to the power of $2/3$.
Using the calculator: $64^{2/3} = 16$. $(m^{12})^{2/3} = m^{12 \times 2/3} = m^8$

$16m^8$
(2)

(Total for Question 11 is 4 marks)

12 The price of a holiday is increased by 10%

After the increase, the price of the holiday is £440

Jim says,

“10% of £440 is £44 so the price of the holiday before the increase was £396”

(a) Is Jim correct?

Explain your answer.

No, £44 is not 10% of £396

The 10% is of the original price, not of the £440

(1)

Tina sells bikes.

In November, Tina sold 25% fewer bikes than she sold in October.

In December, Tina sold 50% more bikes than she sold in November.

In December, Tina sold 180 bikes.

(b) How many bikes did Tina sell in October?

$$x \times 0.75 \times 1.5 = 180$$

Let x be the number of bikes sold in October. Multiplying this by 0.75 reduces it by 25% then multiplying the result by 1.5 increases the result by 50%. This must give 180 bikes.

To find the multipliers: $100\% - 25\% = 75\%$, then dividing by 100 gives 0.75. $100\% + 50\%$ gives 150%, then dividing by 100 gives 1.5

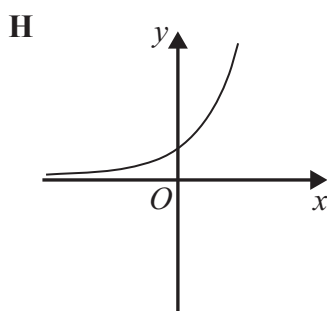
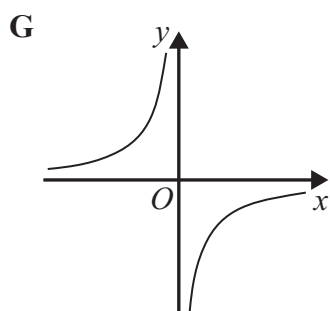
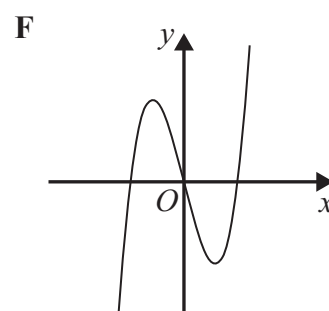
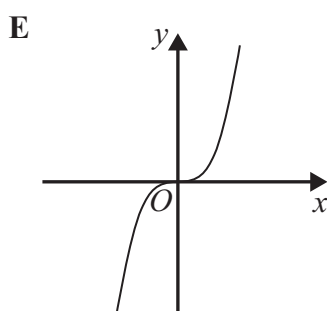
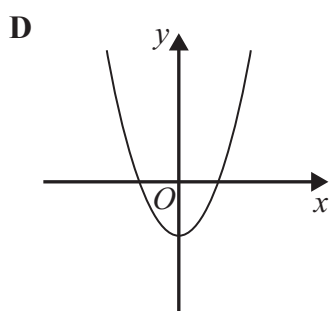
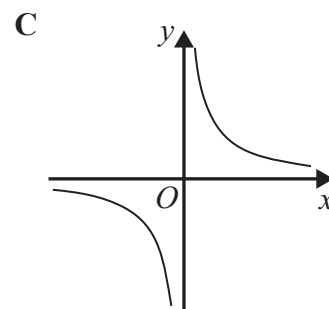
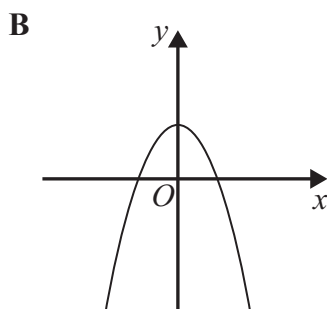
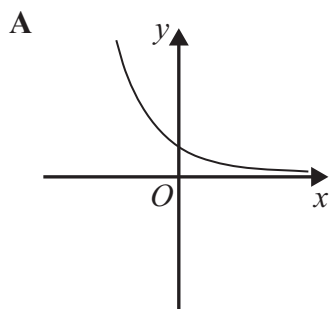
Dividing both sides by 0.75×1.5 gets x on its own. x was the number of bikes sold in October

160

(3)

(Total for Question 12 is 4 marks)

13 Here are some graphs.



Each equation in the table is the equation of one of the graphs.

Complete the table.

Equation	Letter of graph
$y = x^3$	E
$y = \frac{2}{x}$	C
$y = 5 - x^2$	B
$y = 3^x$	H

The shapes of typical graphs could be memorised.
Alternatively using table mode on the calculator to give a table of values for each graph helps to visualise what they look like.
Start: -5. End: 5. Step: 1. See next page for explanations

(Total for Question 13 is 3 marks)

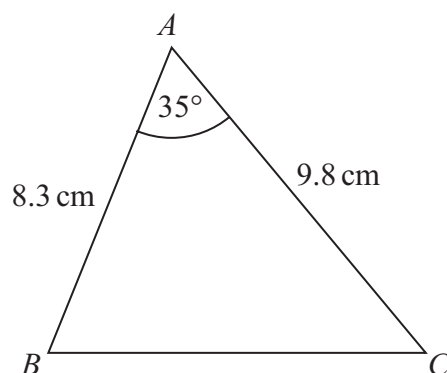
$y = x^3$: when x is negative, y is negative. It goes through $(0, 0)$. When x is positive, y is positive. It could only be graph E.

$y = 2/x$: there is an error when $x = 0$ so it does not meet the y -axis, so it could only be C or G. When x is positive, y is positive, so it must be C.

$y = 5 - x^2$: crosses the y -axis at $(0, 5)$. Decreases to the left and to the right from this point. It could only be graph B.

$y = 3^x$: crosses the y -axis at $(0, 1)$ and continually increases. It could only be graph H

14 Here is triangle ABC .



Calculate the area of triangle ABC .

Give your answer correct to 3 significant figures.

$$\frac{1}{2} \times 8.3 \times 9.8 \times \sin 35$$

Area of triangle = $\frac{1}{2} ab \sin C$, where a and b are two sides and C is the angle between them

..... 23.3 cm^2

(Total for Question 14 is 2 marks)

15 There are only 7 blue pens and 3 red pens in a box.

Raja takes at random one of the pens.

He notes the colour of the pen and puts the pen back into the box.

Raja does this two more times.

Show that the probability that Raja takes at least two blue pens is $\frac{98}{125}$

BBB, BBR, BRB, RBB

Systematically listing the outcomes which result in at least two blue pens. Blue AND blue AND blue OR blue AND blue AND red OR blue AND red AND blue OR red AND blue AND blue

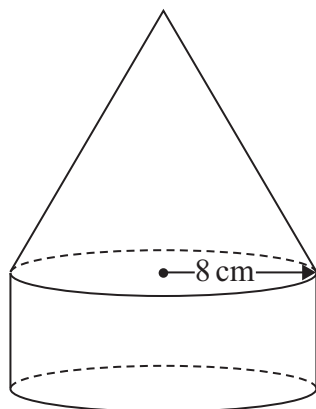
$$\frac{7}{10} \times \frac{7}{10} \times \frac{7}{10} + \frac{7}{10} \times \frac{7}{10} \times \frac{3}{10} + \frac{7}{10} \times \frac{3}{10} \times \frac{7}{10} + \frac{3}{10} \times \frac{7}{10} \times \frac{7}{10} = \frac{98}{125}$$

B & B & B OR B & B & R OR B & R & B OR R & B & B

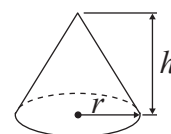
AND means to multiply the probabilities. OR means to add the probabilities

(Total for Question 15 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.

$$\frac{1}{3} \pi \times 8^2 \times h + \pi \times 8^2 \times \frac{1}{3} h$$

Adding the volume of the cone and the volume of the cylinder gives the total volume of the solid shape

Volume of cylinder = area of circle $\times$ height. Area of circle = $\pi \times \text{radius}^2$. The height of the cylinder is $\frac{1}{3}$ the height of the cone so is $\frac{1}{3} h$

This expresses the volume of the cone. Substituting in the radius and h for the vertical height of the cone into the formula for the cone

$$\frac{128}{3} \pi h = 640\pi$$

Typing everything above into the calculator while ignoring h . Then putting h back into the answer. This expresses the volume of the solid shape, which must be equal to the $640\pi \text{ cm}^3$

$$h = 640\pi \div \frac{128}{3} \pi$$

Dividing both sides by what h was multiplied by on the left gets h on its own. h was the vertical height of the cone

.....15..... cm

(Total for Question 16 is 4 marks)

17 Solve $\frac{5x}{3x-1} - \frac{2x}{3x+1} = 1$

$$5x - \frac{2x(3x-1)}{3x+1} = 3x-1 \leftarrow \text{Multiplying all terms on both sides by } 3x-1 \text{ to eliminate the 1st denominator}$$

$$5x(3x+1) - 2x(3x-1) = (3x-1)(3x+1) \leftarrow \text{Multiplying all terms on both sides by } 3x+1 \text{ to eliminate the 2nd denominator}$$

$$15x^2 + 5x - 6x^2 + 2x = 9x^2 + 3x - 3x - 1 \leftarrow \text{Expanding the brackets on both sides}$$

$$9x^2 + 7x = 9x^2 - 1 \leftarrow \text{Collecting like terms on the left and collecting like terms on the right}$$

$$7x = -1 \leftarrow \text{Subtracting } 9x^2 \text{ from both sides}$$

Dividing both sides by 7 to get x on its own

$$x = \dots\dots\dots -\frac{1}{7}$$

(Total for Question 17 is 3 marks)

18 Magda carried out a survey to find out the drinks that people like.

She asked 100 people if they like coffee (C) or tea (T) or hot chocolate (H). H

32 people like all three drinks. A

15 people like coffee and hot chocolate but **not** tea. B

43 people like coffee and tea. C

39 people like tea and hot chocolate. D

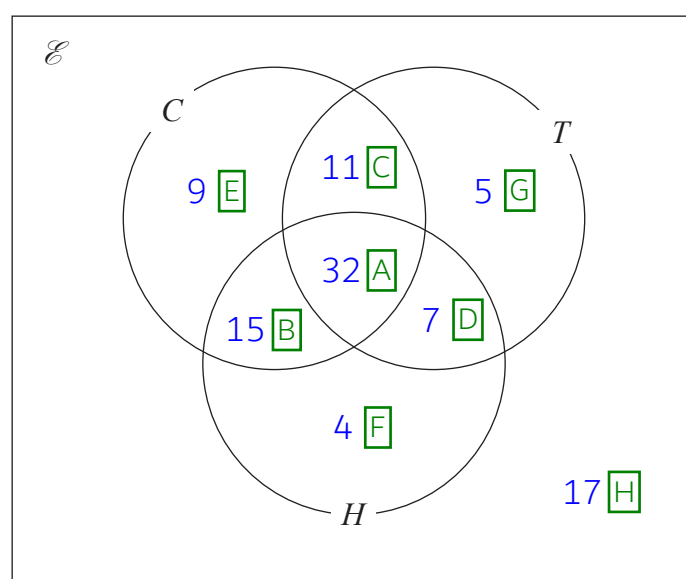
67 people like coffee. E

58 people like hot chocolate. F

5 people like **only** tea. G

Must subtract the numbers already in the set

(a) Complete the Venn diagram for this information.



(4)

One of the people is chosen at random.

Given that this person likes coffee,

(b) find the probability that this person also likes hot chocolate.

$$\frac{15 + 32}{9 + 11 + 32 + 15}$$

Adding all the numbers in both rings C and H

Adding all the numbers in ring C

47 out of the 67 people who like coffee also likes hot chocolate

$$\frac{47}{67}$$

(2)

(Total for Question 18 is 6 marks)

19 There are some sheets of paper in a pile.

The height of the pile is 10.4 cm, correct to the nearest mm.

The thickness of each sheet of paper is 0.17 mm, correct to 2 significant figures.

Calculate the upper bound for the number of sheets of paper in the pile.

You must show all your working.

$$10.4 \times 10 \leftarrow 1 \text{ cm} = 10 \text{ mm. So multiplying the } 10.4 \text{ cm by } 10 \text{ converts it to } 104 \text{ mm}$$

$$104 + \frac{1}{2} \leftarrow \text{Adding half of } 1 \text{ mm (as it is to the nearest } 1 \text{ mm) to the } 104 \text{ mm expresses the upper bound for the height of the pile}$$

$$0.17 - \frac{0.01}{2} \leftarrow \text{Subtracting half of } 0.01 \text{ mm (as this is the place value of the 2nd significant figure) from the } 0.17 \text{ mm expresses the lower bound for the thickness of each sheet of paper}$$

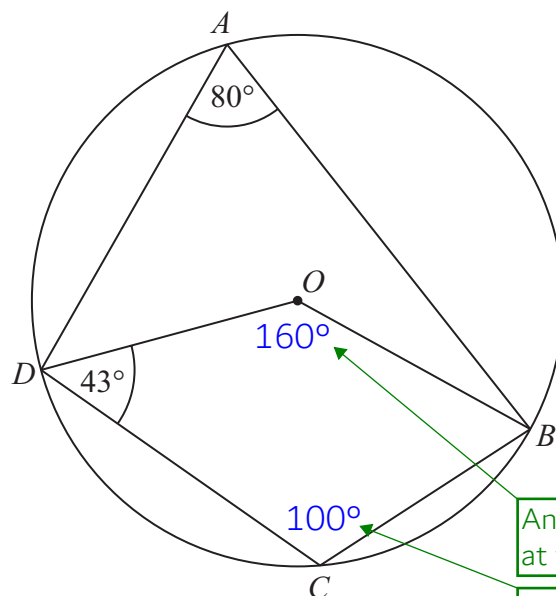
Dividing the upper bound of the height of the pile by the lower bound of the thickness of each sheet of paper finds the upper bound for the number of sheets of paper in the pile. Dividing by less makes the amount greater

633.3.... is rounded down to 633 as the number of sheets of paper must be a whole number. Rounding up to 634 would be above the upper bound so would be too many

633

(Total for Question 19 is 3 marks)

20 A, B, C and D are points on a circle with centre O .



Angle at the centre is double the angle at the circumference. $80 \times 2 = 160$

Opposite angles in a cyclic quadrilateral add up to 180° . $180 - 80 = 100$

Find the size of angle OBC .

Write down any circle theorems that you use.

$$360 - 43 - 160 - 100$$

Angles in a quadrilateral add up to 360° . So subtracting the known angles in quadrilateral $OBCD$ from 360° leaves angle OBC

Angle at the centre is double the angle at the circumference

Opposite angles in a cyclic quadrilateral add up to 180°

Writing down the circle theorems used

21 Solve algebraically the simultaneous equations

$$3x^2 + 2y^2 = 44 \quad \leftarrow \text{1st equation}$$

$$3x + y = 2 \quad \leftarrow \text{2nd equation}$$

$$y = 2 - 3x \quad \leftarrow \text{Subtracting } 3x \text{ from both sides of the 2nd equation to get } y \text{ on its own}$$

$$(2 - 3x)(2 - 3x) \quad \leftarrow \text{Expressing } y^2 \text{ by squaring } 2 - 3x$$

$$4 - 6x - 6x + 9x^2 \quad \leftarrow \text{Expanding the brackets}$$

$$2(4 - 12x + 9x^2) \quad \leftarrow \text{Collecting like terms and multiplying by 2 to express } 2y^2$$

$$3x^2 + 8 - 24x + 18x^2 = 44 \quad \leftarrow \text{Expanding the brackets and substituting it for } 2y^2 \text{ in the 1st equation}$$

$$21x^2 - 24x - 36 = 0 \quad \leftarrow \text{Collecting like terms and subtracting 44 from both sides to get it into the quadratic form } ax^2 + bx + c = 0$$

$$x = \frac{-24 \pm \sqrt{(-24)^2 - 4 \times 21 \times -36}}{2 \times 21} \quad \leftarrow \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \leftarrow \text{Solved using the quadratic formula. So } x = 2 \text{ or } x = -6/7$$

$$y = 2 - 3(2) \quad \leftarrow \text{Substituting both values of } x \text{ into } y = 2 - 3x \text{ to find the } y \text{ values}$$

$$y = 2 - 3\left(-\frac{6}{7}\right)$$

$$x = 2, y = -4 \quad x = -\frac{6}{7}, y = \frac{32}{7}$$

(Total for Question 21 is 5 marks)

22 C is a circle with centre (0, 0)

The straight line with equation $3x - 2y = 52$ is the tangent to C at the point P.

Find the coordinates of P.

$$-2y = -3x + 52 \quad \leftarrow \text{Subtracting } 3x \text{ from both sides}$$

$$y = 1.5x - 26 \quad \leftarrow \text{Dividing both sides by } -2 \text{ to get } y \text{ on its own. It is now in the form } y = mx + c, \text{ where } m \text{ is the gradient and } c \text{ is the } y\text{-intercept. So the gradient of the tangent is } 1.5$$

$$-1 \div 1.5 \quad \leftarrow \text{The radius is perpendicular to the tangent. So doing the negative reciprocal of the gradient of the tangent finds that the gradient of the radius is } -2/3$$

$$y = -\frac{2}{3}x \quad \leftarrow \text{This is the equation of the radius. The general equation of a straight line is } y = mx + c, \text{ where } m \text{ is the gradient and } c \text{ is the } y\text{-intercept. The gradient of the radius is } -2/3 \text{ and the } y\text{-intercept is } 0 \text{ as it goes through } (0, 0)$$

$$1.5x - 26 = -\frac{2}{3}x \quad \leftarrow \text{Both } 1.5x - 26 \text{ and } -2/3 x \text{ are equal to } y. \text{ So they must be equal to each other}$$

$$\frac{13}{6}x = 26 \quad \leftarrow \text{Adding } 2/3 x \text{ to both sides to get all the } x \text{ on the same side. Adding } 26 \text{ to both sides to get the } x \text{ term on its own}$$

$$x = 12 \quad \leftarrow \text{Dividing both sides by } 13/6 \text{ gets } x \text{ on its own}$$

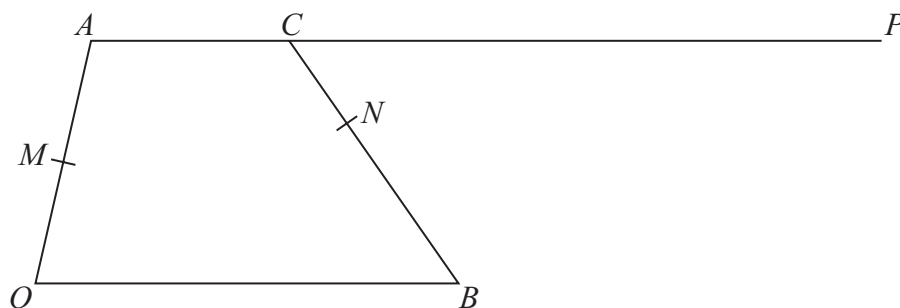
$$y = -\frac{2}{3} \times 12 \quad \leftarrow \text{Substituting } 12 \text{ for } x \text{ in } y = -2/3 x \text{ finds } y$$

$$x = 12 \text{ and } y = -8$$

$$(\dots\dots\dots 12 \dots\dots\dots, \dots\dots\dots -8 \dots\dots\dots)$$

(Total for Question 22 is 4 marks)

- 23 $OACB$ is a quadrilateral.
 ACP is a straight line.



M is the midpoint of OA .

N is the point on BC such that $BN:NC = 5:3$

$$\vec{OA} = \mathbf{a} \quad \vec{OB} = 3\mathbf{b} \quad \vec{AC} = 2\mathbf{b}$$

$$\vec{CP} = k \times \vec{AC} \quad \text{where } k \text{ is a scalar.}$$

Given that MNP is a straight line, find the value of k .

You must show all your working.

$$\vec{CB} = -2\mathbf{b} - \mathbf{a} + 3\mathbf{b} \quad \leftarrow \quad \boxed{\vec{CB} = \vec{CA} + \vec{AO} + \vec{OB}. \vec{CA} = -\vec{AC}, \vec{AO} = -\vec{OA}}$$

$$= \mathbf{b} - \mathbf{a} \quad \leftarrow \quad \boxed{\text{Collecting like terms}}$$

$$\vec{MN} = \frac{1}{2}\mathbf{a} + 2\mathbf{b} + \frac{3}{8}(\mathbf{b} - \mathbf{a}) \quad \leftarrow \quad \boxed{\vec{MN} = \vec{MA} + \vec{AC} + \vec{CN}. \vec{MA} = \frac{1}{2}\vec{OA}, \text{ as } M \text{ is the midpoint of } OA. \vec{CN} = \frac{3}{8}\vec{CB}, \text{ as } 3 \text{ out of the } 8 \text{ parts in the ratio represent } CN}$$

$$= \frac{1}{8}\mathbf{a} + \frac{19}{8}\mathbf{b} \quad \leftarrow \quad \boxed{\text{Expanding the brackets and collecting like terms}}$$

$$\vec{NP} = -\frac{3}{8}(\mathbf{b} - \mathbf{a}) + k \times 2\mathbf{b} \quad \leftarrow \quad \boxed{\vec{NP} = \vec{NC} + \vec{CP}. \vec{NC} = -\frac{3}{8}\vec{CB} \text{ as it is going in the opposite direction to } \vec{CN}. \vec{CP} = k \times \vec{AC}}$$

$$= \frac{3}{8}\mathbf{a} + (2k - \frac{3}{8})\mathbf{b} \quad \leftarrow \quad \boxed{\text{Expanding the brackets and collecting like terms}}$$

$$\frac{19}{8} \times 3 = 2k - \frac{3}{8} \quad \leftarrow \quad \boxed{MNP \text{ is a straight line. So } \vec{NP} \text{ must be something multiplied by } \vec{MN}. \vec{MN} \text{ must have been multiplied by } 3 \text{ as } \frac{1}{8}\mathbf{a} \text{ becomes } \frac{3}{8}\mathbf{a}. \text{ So multiplying the } \frac{19}{8} \text{ by } 3 \text{ must give the same number of } \mathbf{b} \text{ as in } \vec{NP}}$$

$$2k = \frac{15}{2} \quad \leftarrow \quad \boxed{\text{Adding } \frac{3}{8} \text{ to both sides}}$$

Dividing both sides by 2 gets k on its own

$$k = \frac{15}{4}$$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS