| Candidate surname | Other names |
|---|---|
| | |

Maths Planner

Edexcel

2024 Practice Paper

# Mathematics

## PAPER 2 (Calculator)

## Higher Tier

**Time** 1 hour 30 minutes

Worked Written Solutions ✓

Total Marks

80

| Q | Topic(s) | Marks |
|---|---|---|
| 1 | Lowest Common Multiple (LCM) | / 2 |
| 2 | Standard Form | / 3 |
| 3 | Error Intervals | / 2 |
| 4 | Scatter Graphs | / 2 |
| 5 | Column Vectors | / 4 |
| 6 | Probability | / 4 |
| 7 | Laws of Indices/Change the Subject | / 6 |
| 8 | Compound/Simple Interest | / 4 |
| 9 | Area and Perimeter | / 4 |
| 10 | Product Rule for Counting | / 2 |
| 11 | Calculating with Speed | / 3 |
| 12 | Mean from Frequency Table | / 4 |
| 13 | Enlargement | / 2 |

| Q | Topic(s) | Marks |
|---|---|---|
| 14 | Trigonometry/Circumference | / 4 |
| 15 | Quadratic Graphs | / 4 |
| 16 | Probability Trees | / 5 |
| 17 | Quadratic nth Term | / 3 |
| 18 | Circle Theorems | / 4 |
| 19 | Quadratic Inequalities | / 5 |
| 20 | Iteration | / 4 |
| 21 | MDV/Bounds | / 4 |
| 22 | Volume of Prism | / 5 |

Maths Planner

# Marking Codes

| Mark | What does it mean? |
|---|---|
| M1 | **Method mark**. This mark is generally given for an appropriate method in the context of the question. *This mark is given for showing your working and may be awarded even if working is incorrect.* |
| A1 | **Accuracy mark**. This mark is generally given for a correct answer following correct working. |
| B1 | **Working mark**. This mark is usually given when working and the answer cannot easily be separated. |
| C1 | **Communication mark.** This mark is given for explaining your answer or giving a conclusion in context supported by your working |
| P1 | **Process Mark.** This mark is generally given for setting up an appropriate process to find a solution in the context of the question |

# Student Warning

**The questions in this paper will not be in the exam**

These topics are **not guaranteed** to show up in your Paper 2 exam. Please make sure to revise **all topic areas**, especially since topics covered in Paper 1 can still come up.

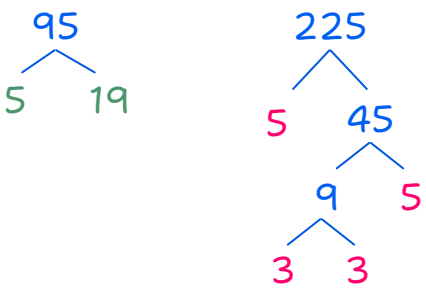
These questions have been selected using analysis on previous official exam papers.

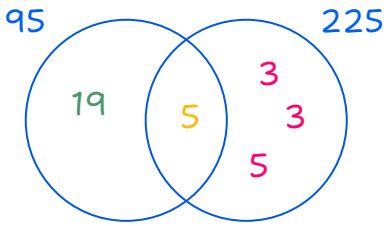
**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all stages in you working.**

**1** Find the lowest common multiple (LCM) of 95 and 225




$95 = 5 \times 19$ ✓ M1

$225 = 3 \times 3 \times 5 \times 5$

LCM = $19 \times 5^2 \times 3^2$

$= 4275$

4275 ✓ A1

**(Total marks for Question 1 is 2 marks)**

---

**2** (a) Write $7.5 \times 10^{-6}$ as an ordinary number.

0.000007.5

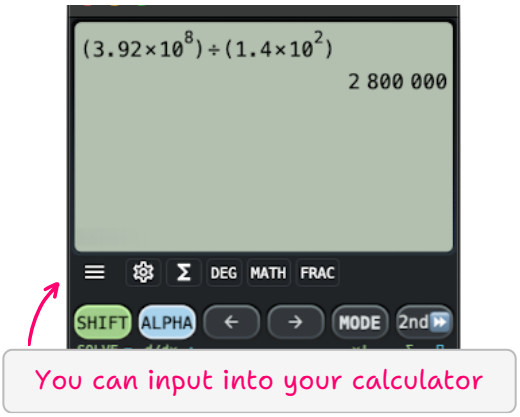
0.0000075

0.0000075 ✓ B1

(1)

(b) Work out $(3.92 \times 10^8) \div (1.4 \times 10^2)$

Give your answer in standard form.




You can input into your calculator

2800000. ✓ P1

2.800000

$2.8 \times 10^6$ ✓ B1

(2)

**(Total marks for Question 2 is 3 marks)**

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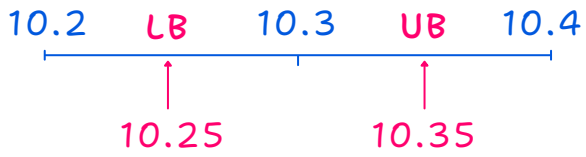
**3** The number, $n$, is rounded to 1 decimal place.

The result is 10.3

Complete the error interval for $n$.




✓ B1 ✓ B1

10.25 ..... $\leq n <$ ..... 10.35

**(Total marks for Question 3 is 2 marks)**

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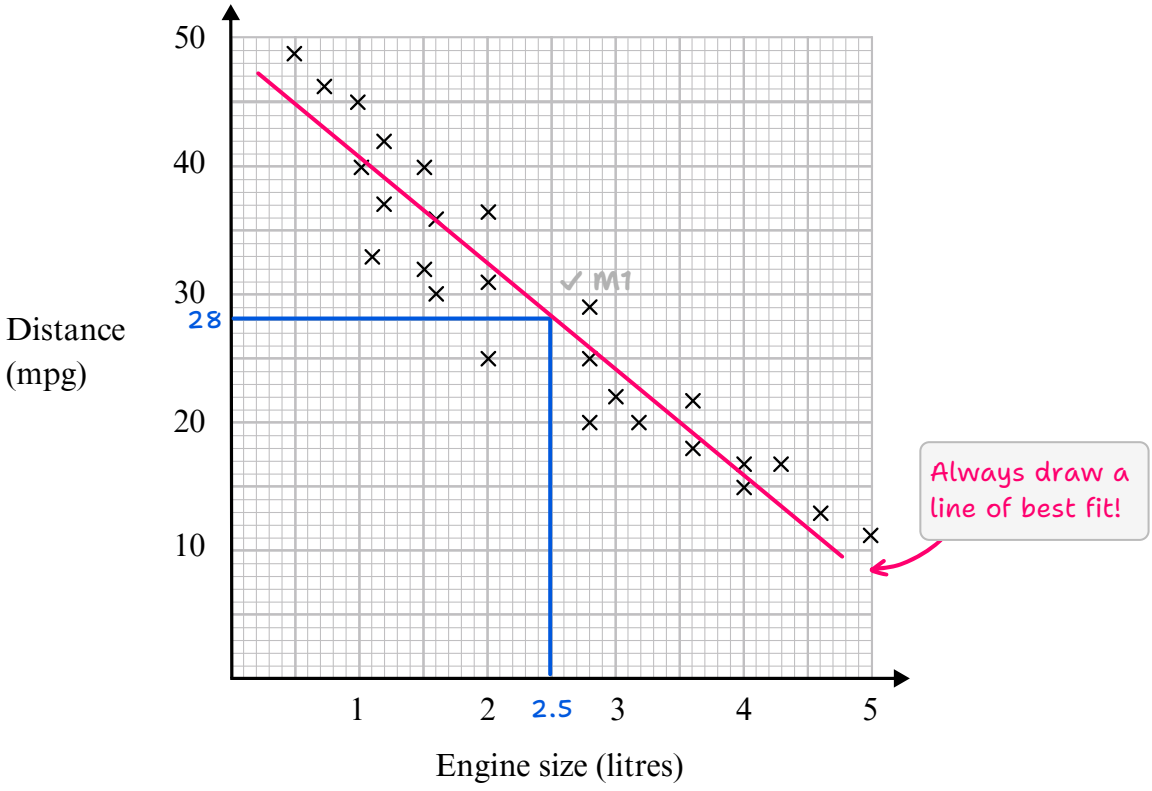
**4** The scatter graph shows information on the distance cars travel (per gallon of fuel) and their engine size.




Using the scatter graph, find an estimate for the expected mpg for a 2.5 litre engine.

25-30 ✓ A1 ..... mpg

**(Total marks for Question 4 is 2 marks)**

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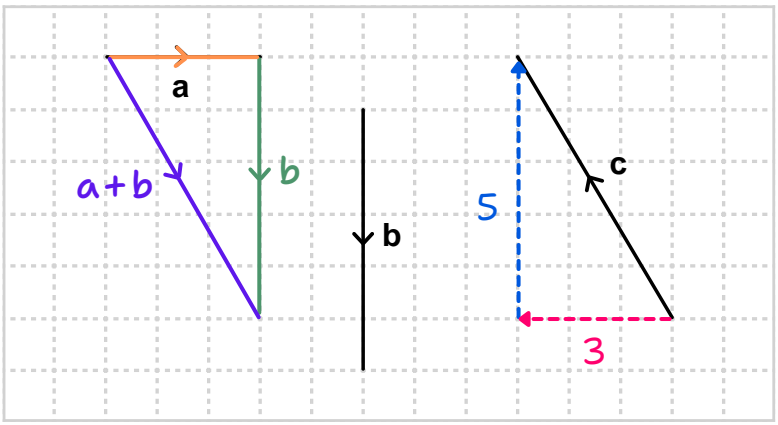
**5** The diagram shows the vectors **a**, **b** and **c**.




(a) What is **c** as a column vector?

✓ B1

$\begin{pmatrix} -3 \\ 5 \end{pmatrix}$

(1)

(b) Work out **a** + **b** as a column vector.

$\begin{pmatrix} 3 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ -5 \end{pmatrix} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$

✓ M1

✓ B1

$\begin{pmatrix} 3 \\ -5 \end{pmatrix}$

(2)

(c) What mathematical word describes the relationship of the resultant vector **a** + **b** and vector **c**?

They are parallel. ✓ C1

This is because they have the same $x$ and y numbers, with the opposite signs (opposite direction)

(1)

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

**6** A bag contains coloured counters.

The table gives information on the probabilities that, when a counter is take at random from the bag, the counter will be red or the counter will be purple.

| Colour | red | blue | yellow | purple |
|---|---|---|---|---|
| Probability | 0.3 | 0.36 | 0.12 | 0.22 |

=1

The ratio

number of blue counters : number of yellow counters = 3 : 1

There are 60 red counters in the bag.
Work out the number of blue counters in the bag.

1 - (0.3 + 0.22) = 0.48 ✓ M1

| B | : | Y | total |
|---|---|---|---|
| 3 | : | 1 | 4 |
| 0.36 | : | 0.12 | 0.48 |

x 0.12 ↓ ↓ x 0.12 ✓ M1

0.3 x 100 = 30% 0.36 x 100 = 36%

30% = 60 counters ✓ M1

÷0.12 ↓ ↓ ÷0.12

1% = 2 counters

x36 ↓ ↓ x36

36% = 72 counters

✓ A1

72 counters

**(Total marks for Question 6 is 4 marks)**

**7** (a) Simplify $\dfrac{5x^2 \times x^{-5}}{x^{-7}}$

$a^n \times a^m = a^{n+m}$ $a^n \div a^m = a^{n-m}$

$\dfrac{5x^2 \times x^{-5}}{x^{-7}} = \dfrac{5x^{-3}}{x^{-7}} = 5x^4$ ✓ A1

$-3-(-7) = 4$

$5x^4$ ✓ A1

(2)

(b) Simplify $(3xy^2)^4$

$(a^n)^m = a^{nm}$

$(3xy^2)^4 = 3^4x^4y^8$ ✓ B1 (for at least two correct terms)

$= 81x^4y^8$

$81x^4y^8$ ✓ A1

(2)

(c) Make $a$ the subject of the formula $s = vt - \frac{1}{2}at^2$

$s = vt - \frac{1}{2}at^2$

$-vt$ ↓ ↓ $-vt$

$s - vt = -\frac{1}{2}at^2$

$\times 2$ ↓ ↓ $\times 2$

$2s - 2vt = -at^2$

Tip: $-at^2 \equiv -t^2a$

$\div(-t^2)$ ↓ ↓ $\div(-t^2)$

$\dfrac{2s-2vt}{-t^2} = a$

✓ M1 (1 correct rearrangement step)

$a = \dfrac{2vt-2s}{t^2}$ ✓ A1

(2)

Alternative forms:

$a = \dfrac{2(s-vt)}{-t^2}$ ✓ A1 $\quad a = \dfrac{2s-2vt}{-t^2}$ ✓ A1 $\quad a = \dfrac{2(vt-s)}{t^2}$ ✓ A1

**(Total marks for Question 7 is 6 marks)**



2H24

**8** Joanne wants to invest £3800 into a high interest savings account.
These are the two banks she is considering.

| **Zupa Bank** | **Sterling Bank** |
|---|---|
| **Compound Interest Rates:** | **Simple Interest Rates:** |
| 6% for the **first** 6 months<br>3.2% thereafter | 3.8% per annum |

Work out the **difference** in interest Joanne would earn between the two banks after 4 years.

**Compound Multipliers**

$1 + \frac{6}{100} = 1.06$ $\quad 1 + \frac{3.2}{100} = 1.032$

**Simple Multiplier**

$3.8 \div 100 = 0.038$

**Zupa Bank**

$3800 \times 1.06^{0.5} \times 1.032^{3.5} = £4368.33$ ✓ M1

Interest earned = 4368.33 - 3800
= £568.33

**Sterling Bank**

$3800 \times 0.038 = £144.40$ ✓ M1

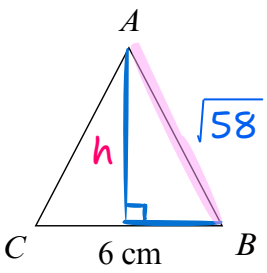
Interest earned = 4 x 144.40
= £577.60

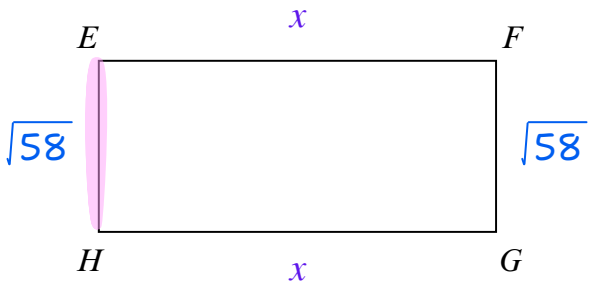
**Difference in interest** = 577.60 - 568.33 ✓ M1
= £9.27

£ 9.27 ✓ A1

**(Total marks for Question 8 is 4 marks)**

**9** $ABC$ is an isosceles triangle.
$EFGH$ is a rectangle.




Triangle $ABC$ has an area of 21cm²

$AB = EH$

$EFGH$ has a perimeter of 41.4 cm

Work out the area of $EFGH$.

Give your answer correct to 1 decimal place.

Area = $\frac{b \times h}{2}$

$21 = \frac{6 \times h}{2}$ ✓ P1

×2 ↓ ↓ ×2

$42 = 6 \times h$

÷6 ↓ ↓ ÷6

$h = 7$

EFGH Perimeter = 41.4

$2x + 2\sqrt{58} = 41.4$ ✓ P1

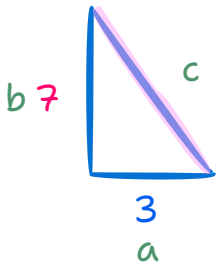
$-2\sqrt{85}$ ↓ ↓ $-2\sqrt{85}$

$2x = 41.4 - 2\sqrt{58}$

÷2 ↓ ↓ ÷2

$x = \frac{41.4 - 2\sqrt{58}}{2}$

$x = 13.08422689$




$a^2 + b^2 = c^2$

$3^2 + 7^2 = c^2$ ✓ M1

$\sqrt{3^2 + 7^2} = c$

$\sqrt{58} = c$

Area = b × h

Area = $\sqrt{58} \times 13.0842...$

$= 99.6465032$

99.6 ✓ A1 ..... cm²

**(Total marks for Question 9 is 4 marks)**

**10** There are 21 teams in a youth football league.
During a season, each team will play each other twice.
If 4 of the matches were cancelled, work out the total games that were played.

21 x 20 = 420 matches ✓ M1

420 - 4 = 416

416 ✓ A1

.....

**(Total marks for Question 10 is 2 marks)**

---

**11** Josh is competing in a 20 mile race.
He must run the first half and then cycle the remaining half.

After 24 minutes, Josh looks at his fitness watch and reads he has ran 1.8 miles.

He continues this pace until he reaches the half way point.

Work out exactly how long the first half of the race takes Josh to complete.
Give your answer in, hours, minutes and seconds.

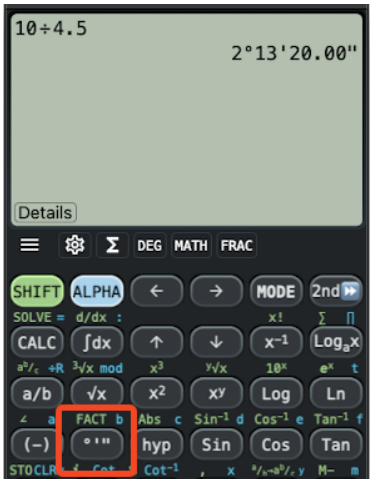
20 miles ÷ 2 = 10 miles to run

24 minutes ÷ 60 = 0.4 hours

$S = \frac{D}{T} = \frac{1.8}{0.4} = 4.5$ mph ✓ M1

$T = \frac{D}{S} = \frac{10}{4.5} = 2.\dot{2}$ hours ✓ M1

pressing [° ′ ″] button will convert your answer into hours, minutes & seconds!




✓ A1

2 hrs, 13 mins & 20 secs

.....

**(Total marks for Question 11 is 3 marks)**

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**12** The frequency table gives information about the number of goals scored by a player.

| Number of goals (y) | Frequency (f) | fy |
|---|---|---|
| 0 | 13 | 0 |
| 1 | 17 | 17 |
| 2 | 6 | 12 |
| 3 | $x$ | $3x$ |
| 4 | 13 | 52 |
| $\Sigma$ | $x + 49$ | $3x + 81$ |

✓ M1

The mean number of goals scored is 2.

Work out the value of $x$

✓ P1

$$\text{mean} = \frac{\Sigma fy}{\Sigma f} = \frac{3x + 81}{x + 49} \qquad \text{mean} = 2$$

✓ P1

$$\therefore \quad \frac{3x + 81}{x + 49} = 2$$

$\times (x+49)$ ↓ ↓ $\times (x+49)$

$$3x + 81 = 2(x + 49)$$

$$3x + 81 = 2x + 98$$

$-x$ ↓ ↓ $-x$

$$x + 81 = 98$$

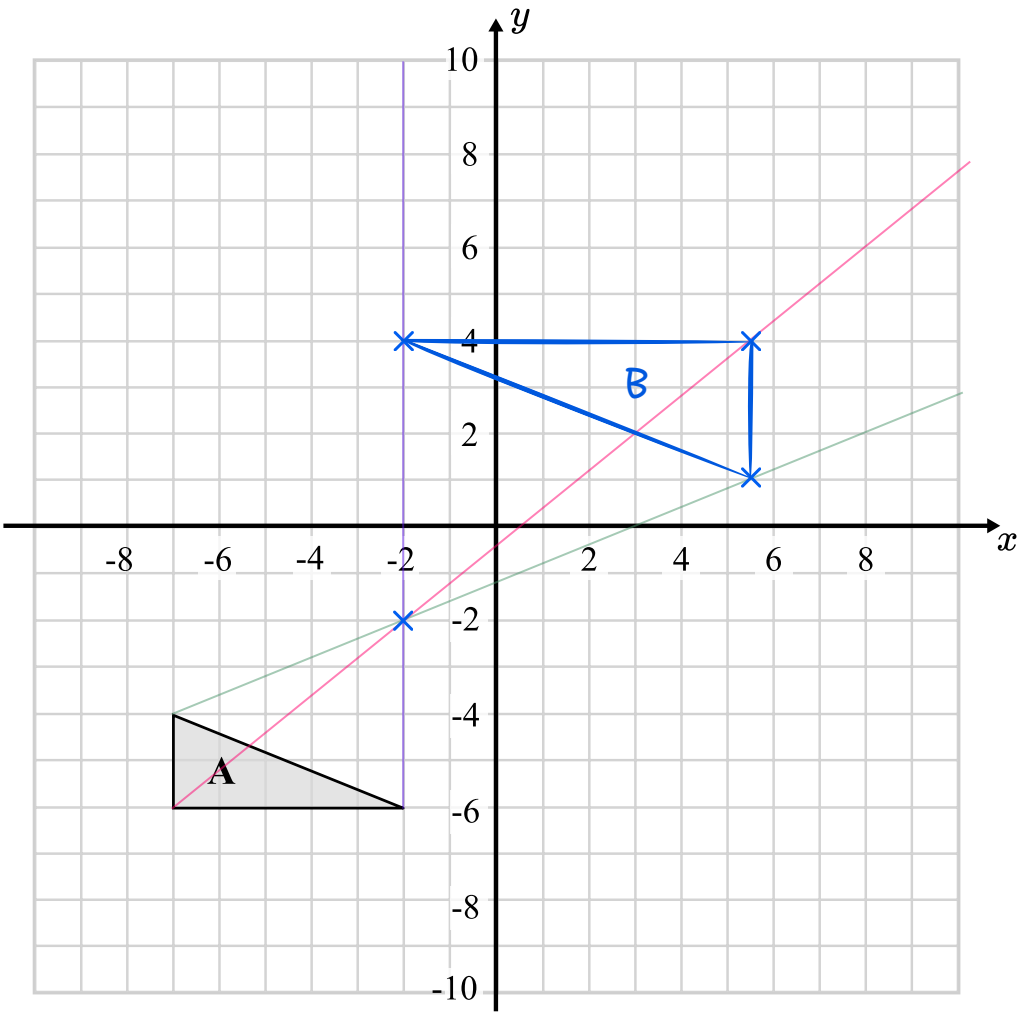
$-81$ ↓ ↓ $-81$

$$x = 17$$

$x =$ 17 ✓ A1

**(Total marks for Question 12 is 4 marks)**

**13**



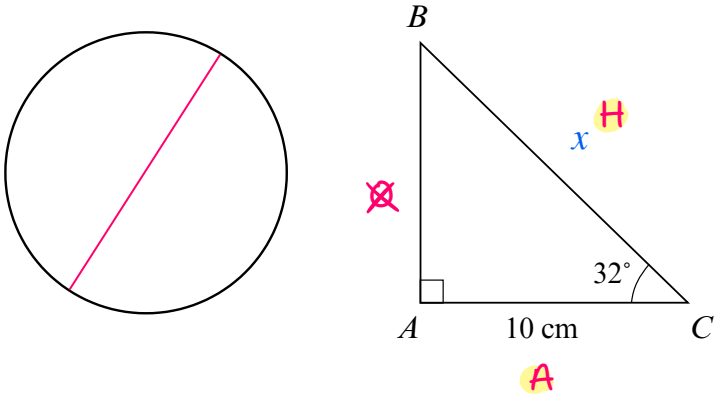

Enlarge shape **A** by scale factor $-1\frac{1}{2}$ with centre of enlargement (-2, -2).

Label your image **B**.

✓ A1 (At least 1 point correct)
✓ A2 (All 3 points correct)

**(Total marks for Question 13 is 2 marks)**

**14** Here is a circle and right angled triangle $ABC$.




The circumference of the circle is $12\pi$ cm

Work out if the triangle will fit inside the circle.

You must show full workings and justify your answer.

We need to find out if the length of BC ($x$) is smaller than the diameter.

$C = \pi \times d$

$12\pi = \pi \times d$

$12 = d$ ✓ A1

SOH CAH TOA

$\cos\theta = \frac{A}{H}$

$\cos(32) = \frac{10}{x}$ ✓ M1

$x = \frac{10}{\cos(32)}$

$x = 11.791784...$

$x = 11.8$ cm ✓ A1

∴ The triangle will fit since, 11.8 cm ≤ 12 cm ✓ C1

**(Total marks for Question 14 is 4 marks)**

**15** (a) Complete the table of values for $y = 1 - 3x - x^2$

y= 1 - 3(0) - (0)²

| $x$ | -4 | -3 | -2 | -1 | 0 | 1 |
|---|---|---|---|---|---|---|
| $y$ | -3 | 1 | 3 | 3 | 1 | -3 |

y= 1 - 3(-4) - (-4)²  y= 1 - 3(-2) - (-2)²  y= 1 - 3(-1) - (-1)²

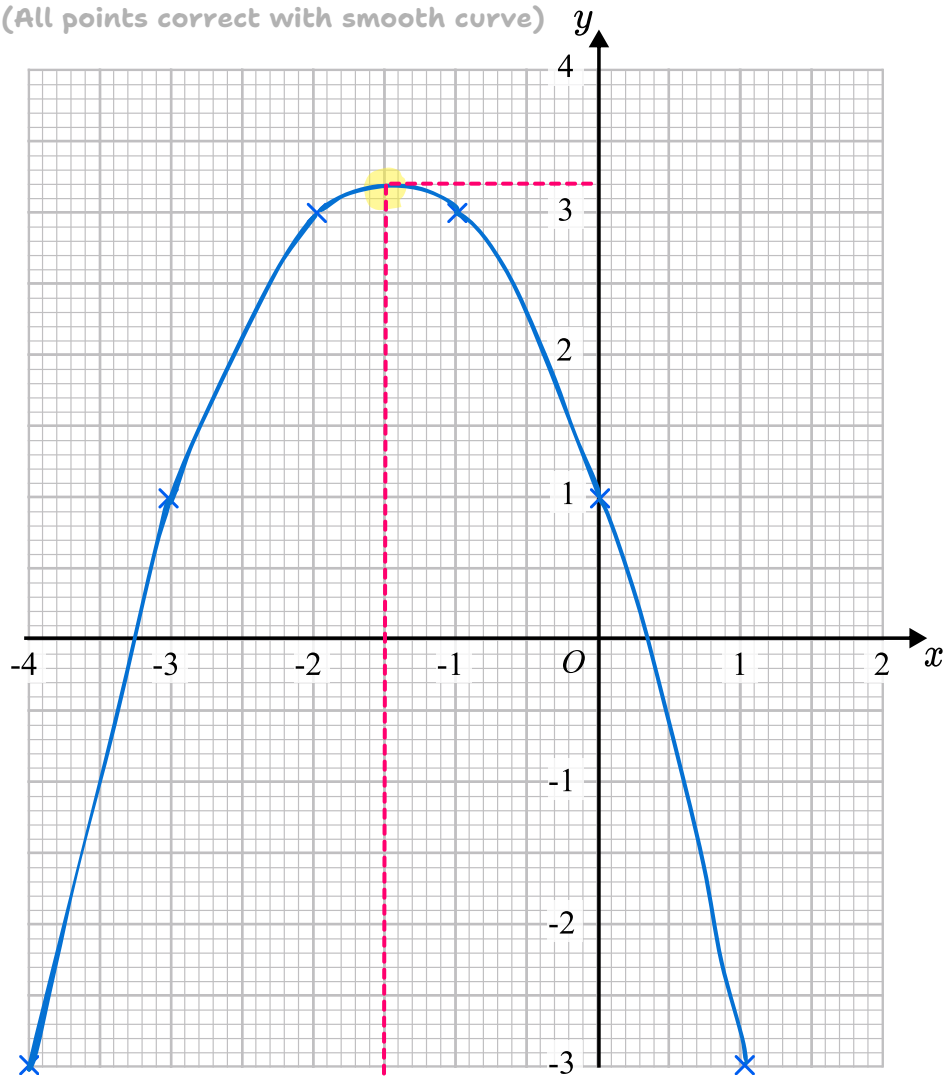
(1)

✓ A1 (All 4 values correct)

(b) On the grid, draw the graph of $y = 1 - 3x - x^2$ for $x$ values from -4 to 1

✓ A1 (At least 3 correct points)
✓ A2 (All points correct with smooth curve)

(2)




(c) Using your graph, write down the coordinates of the turning point.

✓ A1 Accept range:
x: -1.2 to -1.8
y: 3 to 3.5

(-1.5 , 3.2)

(1)

**(Total marks for Question 15 is 4 marks)**

Note: There are alternative methods!

**16** Shawley has a bag of 18 sweets.

Inside the bag there are, gummy bears, fried eggs and coke bottles.

There are 8 gummy bears in the bag.

The ratio

number of gummy bears : number of coke bottles = 4 : 3

⚠ Because they eat the first sweet, this is conditional probability

Shawley takes a sweet at random from a bag and eats it.
Then, he takes another sweet at random from the bag and eats it.

Work out the probability that the two sweets Shawley eats are different.

G : CB

x2 ↓ 4 : 3 ↓ x2

8 : 6

✓ A1

Fried eggs = 18 - 8 - 6 = 4

$P(G) = \frac{8}{18}$ $P(CB) = \frac{6}{18}$ $P(FE) = \frac{4}{18}$

$P(Same) = P(G,G) + P(CB,CB) + P(FE,FE)$ ✓ P1

$P(G,G) = \frac{8}{18} \times \frac{7}{17} = \frac{56}{306}$

$P(CB,CB) = \frac{6}{18} \times \frac{5}{17} = \frac{30}{306}$

$P(FE,FE) = \frac{4}{18} \times \frac{3}{17} = \frac{12}{306}$

$\therefore P(Same) = \frac{56}{306} + \frac{30}{306} + \frac{12}{306} = \frac{98}{306}$ ✓ M1

$\therefore P(Different) = 1 - P(Same)$

$= 1 - \frac{98}{306}$ ✓ M1

$= \frac{208}{306}$

✓ A1

$\frac{208}{306} = \frac{104}{153}$

**(Total marks for Question 16 is 5 marks)**

**17** Here are the first five terms of a quadratic sequence.

Quadratic nth term: $an^2 + bn + c$

10, 5, -4, -17, -34

-5, -9, -13, -17

-4, -4, -4

Find an expression, in terms of $n$, for the $n$th term of this sequence.

$2a$ = 2nd difference

$3a + b$ = 1st difference

$a + b + c$ = 1st term

$2a = -4$

$a = -2$ (÷2)

$3a + b = -5$

$3(-2) + b = -5$

$-6 + b = -5$ (+6)

$b = 1$ (+6)

$a + b + c = 10$

$-2 + 1 + c = 10$

$-1 + c = 10$ (+1)

$c = 11$ (+1)

$\therefore an^2 + bn + c = -2n^2 + n + 11$

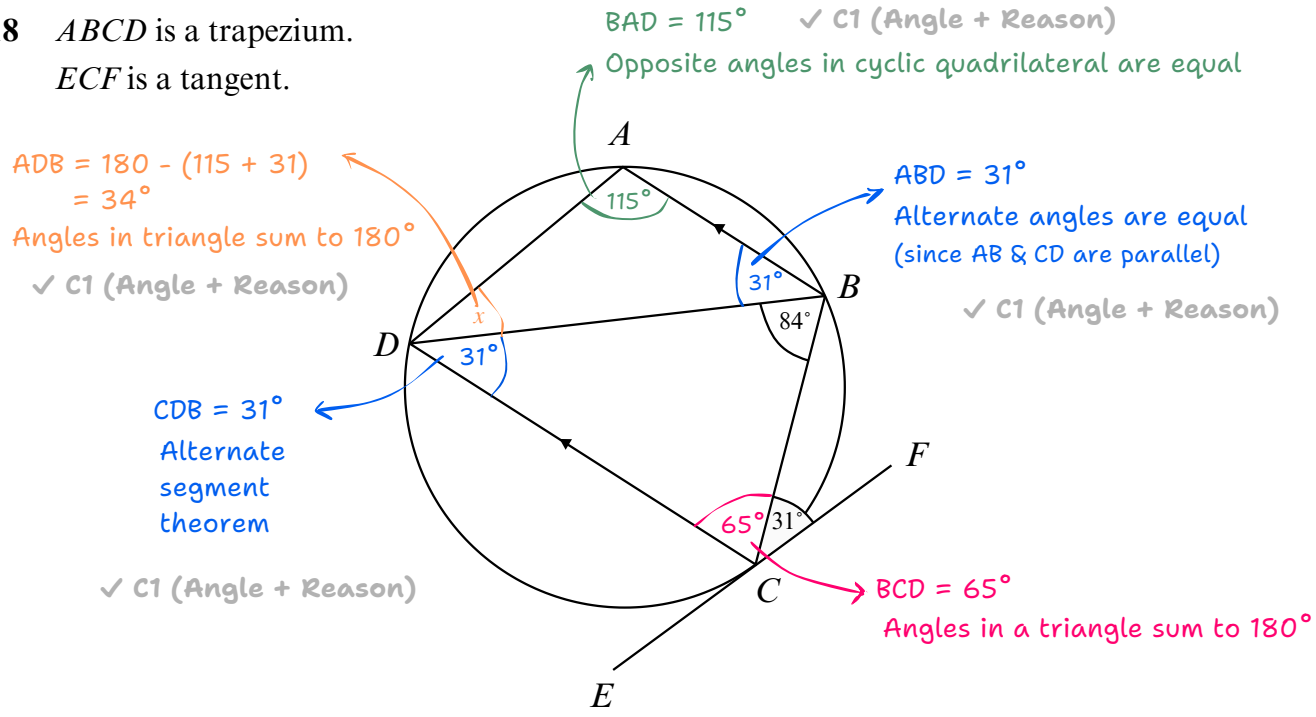
✓ M1 (correct method to find a, b or c)

✓ M2 (correct method to find two (a,b or c))

$-2n^2 + n + 11$ ✓ A1

**(Total marks for Question 17 is 3 marks)**

**18** $ABCD$ is a trapezium.
$ECF$ is a tangent.




Work out the size of angle $ADB$.
You must give reasons for each stage of your workings.

$ADB =$ 34 °

**(Total marks for Question 18 is 4 marks)**

**19** Solve $\frac{2}{x+1} - \frac{10}{x+4} > -1$ , where $x > 0$

$\times(x+4)$ $\times(x+1)$

$$\frac{2}{x+1} - \frac{10}{x+4} > -1$$ ✓ M1

$\times(x+4)$ $\times(x+1)$

$$\frac{2(x+4) - 10(x+1)}{(x+1)(x+4)} > -1$$

$$2x + 8 - 10x - 10 > -1\,(x+1)(x+4)$$ ✓ M1

$$-8x - 2 > -1\,(x^2 + 4x + x + 4)$$

$$-8x - 2 > -x^2 - 5x - 4$$

$+x^2$ $+x^2$

$$x^2 - 8x - 2 > -5x - 4$$

$+5x$ $+5x$

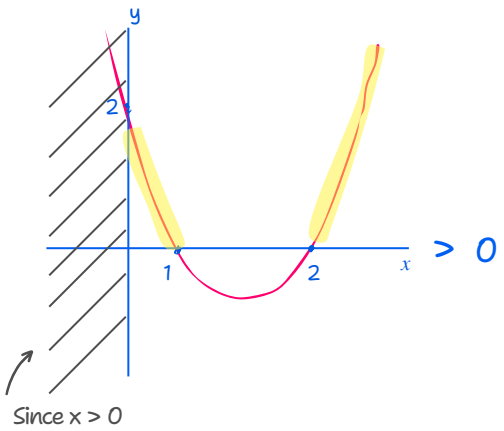
$$x^2 - 3x - 2 > -4$$

$+4$ $+4$

$$x^2 - 3x + 2 > 0$$

$$(x-2)(x-1) > 0$$ ✓ M1

$x - 2 = 0$ $\quad x = 2$ $\qquad$ $x - 1 = 0$ $\quad x = 1$ ✓ A1 (both values)




✓ A1 (both values)

$0 < x < 1$ , $x > 2$

**(Total marks for Question 19 is 5 marks)**

**20** (a) Starting with $x_0 = 1$, use the iteration formula $x_{n+1} = \sqrt[3]{4x_n^2 + 8}$ to find the values of $x_1$, $x_2$ and $x_3$

$x_1 = 2.289428485$

$x_2 = 3.071113247$

$x_3 = 3.575944199$

Accept any correct rounding

$x_1 =$ 2.2894 ✓ A1

$x_2 =$ 3.0711 ✓ A1

$x_3 =$ 3.5759 ✓ A1

**(3)**

The values of $x_1$, $x_2$ and $x_3$ are solutions of an equation in the form $x^3 + ax^2 + b$ where $a$ and $b$ are integers.

(b) Find the value of $a$ and $b$.

$x^3 + ax^2 + b = 0$

$x = \sqrt[3]{4x^2 + 8}$

$x^3 = 4x^2 + 8$

$x^3 - 4x^2 - 8 = 0$

✓ A1 (both values)

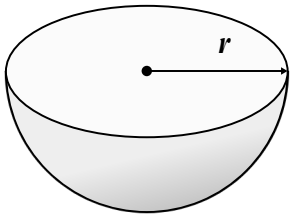
$a =$ -4

$b =$ -8

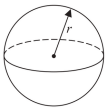
**(1)**

**(Total marks for Question 20 is 4 marks)**

**21** Shown is a hemisphere.




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

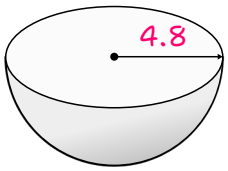



$r$ = 4.8 cm correct to 2 signifiant figures.

The hemisphere has a mass of 8kg correct to the nearest kilogram.

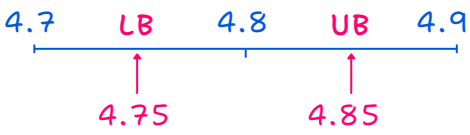
Work out the hemisphere's **maximum** density, in grams per cubic centimetre.
Give your answer correct to 3 significant figures

✓ M1 (finding bounds)

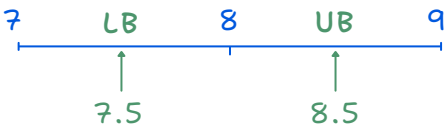



8kg = 8000g

Radius:




Mass:




$V_{min} = \dfrac{\frac{4}{3} \times \pi \times (4.75)^3}{2}$ ✓ M1

$= 224.4602501\ cm^3$

$D = \dfrac{M}{V}$ $\quad D_{max} = \dfrac{M_{max}}{V_{min}} = \dfrac{8500}{224.46...}$ ✓ M1

$= 37.86862037$

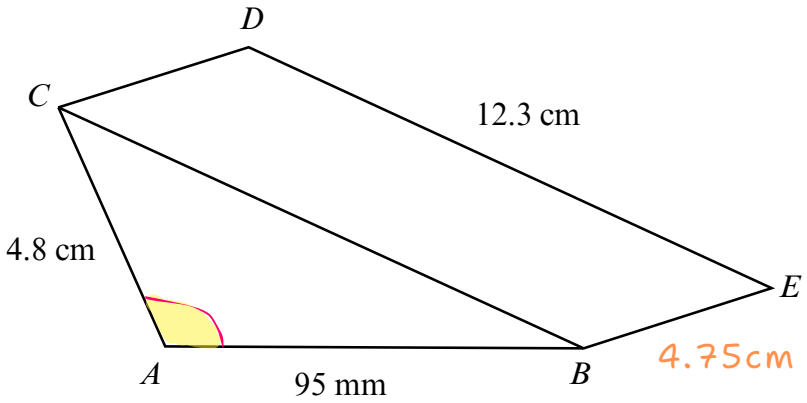
37.9 ✓ A1 ..... g/cm³

**(Total marks for Question 21 is 4 marks)**



2H24

**22** The cross-section of this prism is a scalene triangle.

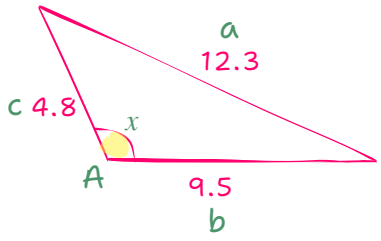



$AB = 95$ mm
$AC = 4.8$ cm
$DE = 12.3$ cm

$AB : BE = 2 : 1$

AB : BE
2 : 1 (×4.75, ×4.75)
9.5 : 4.75
✓ A1

Work out the volume of prism $ABCDE$.
Give your answer correct to 1 decimal place.

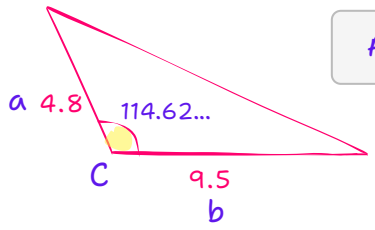



$\cos A = \frac{b^2+c^2-a^2}{2bc}$

$\cos(x) = \frac{9.5^2+4.8^2-12.3^2}{2\times(9.5)\times(4.8)}$

$x = \cos^{-1}(-\frac{5}{12})$ ✓ M1

$x = 114.6243184$




Area = ½absinC

Area = ½ x (4.8) x (9.5) x sin(114.62...)
= 20.72655302 ✓ M1

Volume = cross-section area x length

Volume = (20.726...) x 4.75
= 98.45112683 ✓ M1

98.5 ✓ A1 ..... $cm^3$

**(Total marks for Question 22 is 5 marks)**

**TOTAL FOR PAPER IS 80 MARKS**