ELITE MATHEMATICS

Modular Unit 1

Linear to Modular | Regional papers

Worked solutions

23 question entries | 80 marks

Linear questions reorganised for Modular practice. Not an original Pearson Modular examination.

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Student edition | June 2026 | Elite Mathematics

Question 1

3 marks

June 2026 | 4MA1/1HR | Mixed-number multiplication

1 Show that $2\frac{4}{5} \times 3\frac{3}{7} = 9\frac{3}{5}$

(Total for Question 1 is 3 marks)

Question 1 | Worked solution

3 marks

June 2026 | 4MA1/1HR | Mixed-number multiplication

Solution

3 marks

STEP 1

$$2\frac{4}{5} = \frac{14}{5}, \qquad 3\frac{3}{7} = \frac{24}{7}.$$

Convert each mixed number into an improper fraction.

STEP 2

$$\frac{14}{5} \times \frac{24}{7} = \frac{2 \times 24}{5} = \frac{48}{5} = 9\frac{3}{5}.$$

Cancel the common factor 7, multiply, then convert back to a mixed number.

Final answer
$2\frac{4}{5} \times 3\frac{3}{7} = 9\frac{3}{5}$

Question 3

2 marks

June 2026 | 4MA1/1HR | Elementary index laws

3 (a) Simplify $e^7 \times e^3$

.....

(1)

(b) Simplify $g^5 \div g^2$

.....

(1)

(Total for Question 3 is 2 marks)

Question 3 | Worked solution

2 marks

June 2026 | 4MA1/1HR | Elementary index laws

Part (a)

1 marks

STEP 1

$$e^7 \times e^3 = e^{7+3} = e^{10}.$$

For equal bases, add the indices when multiplying.

Final answer
e^{10}

Part (b)

1 marks

STEP 1

$$g^5 \div g^2 = g^{5-2} = g^3 \quad (g \neq 0).$$

For equal bases, subtract the indices when dividing.

Final answer
g^3

Question 4

2 marks

June 2026 | 4MA1/1HR | Bounds of rounded measurements

4 The weight of a giraffe is 1178 kg, correct to the nearest kg

(i) Write down the lower bound of the weight of the giraffe.

..... kg

(1)

(ii) Write down the upper bound of the weight of the giraffe.

..... kg

(1)

(Total for Question 4 is 2 marks)

Question 4 | Worked solution

2 marks

June 2026 | 4MA1/1HR | Bounds of rounded measurements

Part (i)

1 marks

STEP 1

$$1178 - 0.5 = 1177.5 \text{ kg}.$$

Rounding to the nearest kilogram allows half a kilogram below the stated value.

Final answer
1177.5 kg

Part (ii)

1 marks

STEP 1

$$1178 + 0.5 = 1178.5 \text{ kg}.$$

The rounding interval is $1177.5 \leq w < 1178.5$; the upper endpoint is the upper bound, not an included weight.

Final answer
1178.5 kg

Question 5

4 marks

June 2026 | 4MA1/1HR | Probability totals and frequency

5 A bag contains only blue counters, green counters, red counters and yellow counters.

Danny takes a counter at random from the bag.

The table gives information about the probabilities that he takes a blue counter or a green counter or a red counter or a yellow counter.

Colour	blue	green	red	yellow
Probability	0.45	0.31	$5x$	x

There are 400 counters in the bag.

Work out the number of red counters in the bag.

.....

(Total for Question 5 is 4 marks)

Question 5 | Worked solution

4 marks

June 2026 | 4MA1/1HR | Probability totals and frequency

Solution

4 marks

STEP 1

$$0.45 + 0.31 + 5x + x = 1.$$

The four colours are mutually exclusive and exhaust all counters, so their probabilities sum to 1.

STEP 2

$$6x = 1 - 0.76 = 0.24, \qquad x = 0.04.$$

Collect the unknown probabilities and solve the linear equation.

STEP 3

$$P(\text{red}) = 5(0.04) = 0.20, \qquad N_{\text{red}} = 400(0.20) = 80.$$

Multiply the red proportion by the total number of counters.

Final answer
80 red counters

Question 8

2 marks

June 2026 | 4MA1/1HR | Quadratic factorisation

8 Factorise $x^2 - 12x + 32$

.....

(Total for Question 8 is 2 marks)

Question 8 | Worked solution

2 marks

June 2026 | 4MA1/1HR | Quadratic factorisation

Solution

2 marks

STEP 1

$$(-4)(-8) = 32, \qquad -4 + (-8) = -12.$$

Choose two numbers with product 32 and sum -12.

STEP 2

$$x^2 - 12x + 32 = (x - 4)(x - 8).$$

The chosen numbers give the two constant terms in the factors.

Final answer
$(x - 4)(x - 8)$

Question 13

3 marks

June 2026 | 4MA1/1HR | Straight-line gradient and intercept

13 The straight line **L** has equation $4y - 10x - 5 = 0$

(a) Find the gradient of **L**

.....

(2)

(b) Find the coordinates of the point where **L** crosses the y-axis.

(..... , ...)

(1)

(Total for Question 13 is 3 marks)

Question 13 | Worked solution

3 marks

June 2026 | 4MA1/1HR | Straight-line gradient and intercept

Part (a)

2 marks

STEP 1

$$4y - 10x - 5 = 0 \quad \Longrightarrow \quad 4y = 10x + 5 \quad \Longrightarrow \quad y = \frac{5}{2}x + \frac{5}{4}.$$

Rearrange into the form y=mx+c.

STEP 2

The gradient is $\frac{5}{2}$. The coefficient of x is the gradient.

Final answer

$\frac{5}{2}$

Part (b)

1 marks

STEP 1

$$x = 0 \quad \Longrightarrow \quad 4y - 5 = 0 \quad \Longrightarrow \quad y = \frac{5}{4}.$$

Every point on the y-axis has x-coordinate zero.

Final answer

$\left(0, \frac{5}{4}\right)$

Question 16

6 marks

June 2026 | 4MA1/1HR | Algebraic fractions and expansion

16 (a) Express $\frac{5}{8} - \frac{x+2}{4x}$ as a single fraction in its simplest form.

.....

(3)

(b) Expand and simplify $3x(2x - 1)(x + 4)$

.....

(3)

(Total for Question 16 is 6 marks)

Question 16 | Worked solution

6 marks

June 2026 | 4MA1/1HR | Algebraic fractions and expansion

Part (a)

3 marks

STEP 1

$$\frac{5}{8} - \frac{x+2}{4x} = \frac{5x}{8x} - \frac{2(x+2)}{8x}, \qquad x \neq 0.$$

Use 8x as a common denominator.

STEP 2

$$\frac{5x - 2(x+2)}{8x} = \frac{5x - 2x - 4}{8x} = \frac{3x-4}{8x}.$$

Subtract the entire numerator of the second fraction and collect like terms.

Final answer

$\frac{3x-4}{8x}$

Part (b)

3 marks

STEP 1

$$(2x-1)(x+4) = 2x^2 + 8x - x - 4 = 2x^2 + 7x - 4.$$

Multiply each term in the first bracket by each term in the second.

STEP 2

$$3x(2x^2 + 7x - 4) = 6x^3 + 21x^2 - 12x.$$

Multiply every term by 3x.

Final answer

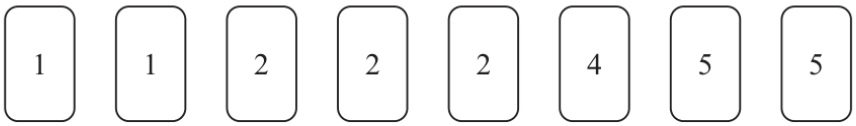
$6x^3 + 21x^2 - 12x$

Question 18

3 marks

June 2026 | 4MA1/1HR | Probability without replacement

18 Here are 8 cards.
There is a number on each card.



Gordon puts the 8 cards in a bag.
He takes at random a card from the bag and does not replace it.
Gordon then takes at random a second card from the bag.

Calculate the probability that the number on the second card is 3 more than the number on the first card.

.....

(Total for Question 18 is 3 marks)

Question 18 | Worked solution

3 marks

June 2026 | 4MA1/1HR | Probability without replacement

Solution

3 marks

STEP 1

The only possible ordered number pairs are $(1, 4)$ and $(2, 5)$. The second number must be exactly 3 more than the first, not merely differ by 3.

STEP 2

$$P(1 \text{ then } 4) = \frac{2}{8} \times \frac{1}{7}, \qquad P(2 \text{ then } 5) = \frac{3}{8} \times \frac{2}{7}.$$

There are 7 cards remaining for the second draw; there are two 1s, three 2s, one 4 and two 5s.

STEP 3

$$P = \frac{2}{56} + \frac{6}{56} = \frac{8}{56} = \frac{1}{7}.$$

The two ordered events are mutually exclusive, so add their probabilities.

Final answer

$\frac{1}{7}$

Question 21

5 marks

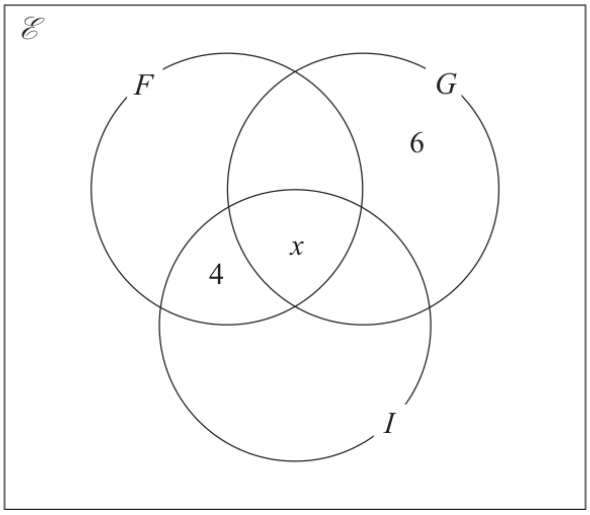
June 2026 | 4MA1/1HR | Three-set Venn diagram

21 60 students were asked if they study French (F), German (G) or Italian (I)

Of these students

32 students study French
24 students study German
27 students study Italian
16 students study French and German
15 students study German and Italian

The incomplete Venn diagram gives some more information about the languages the 60 students study.



(a) Work out the value of x

$x =$ .....

(3)

(b) Work out how many of the 60 students study none of French or German or Italian.

.....

(2)

(Total for Question 21 is 5 marks)

Question 21 | Worked solution

5 marks

June 2026 | 4MA1/1HR | Three-set Venn diagram

Part (a)

3 marks

STEP 1

The French-and-German-only region is $16 - x$, and the German-and-Italian-only region is $15 - x$. The totals 16 and 15 each include the triple intersection x.

STEP 2

$$6 + (16 - x) + (15 - x) + x = 24.$$

The four disjoint regions in the German set must total 24.

STEP 3

$$37 - x = 24 \quad \Longrightarrow \quad x = 13.$$

Solve for the common triple-intersection count.

Final answer
$x = 13$

Part (b)

2 marks

STEP 1

$$FG \text{ only} = 16 - 13 = 3, \qquad GI \text{ only} = 15 - 13 = 2.$$

Use the triple-intersection value from part (a).

STEP 2

$$F \text{ only} = 32 - (3 + 4 + 13) = 12, \qquad I \text{ only} = 27 - (4 + 2 + 13) = 8.$$

The French-and-Italian-only count is the given 4.

STEP 3

$$n(F \cup G \cup I) = 12 + 6 + 8 + 3 + 4 + 2 + 13 = 48.$$

Sum all seven mutually exclusive interior regions.

STEP 4

$$n(\text{none}) = 60 - 48 = 12.$$

Subtract the union from the total number of students.

Final answer
12 students.

Question 22

4 marks

June 2026 | 4MA1/1HR | Triangle area using the sine rule

22 The diagram shows triangle ABC

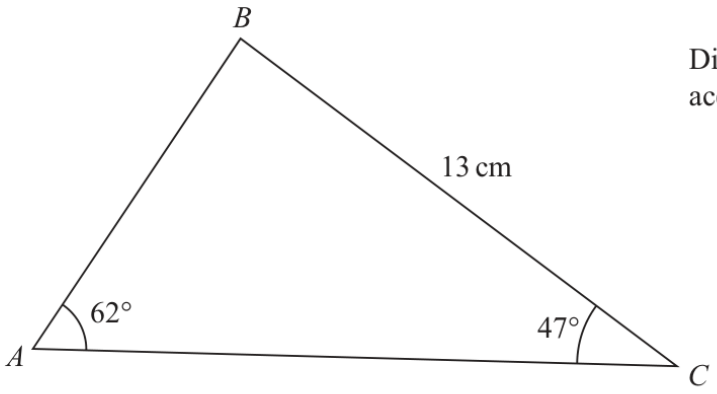


Diagram **NOT** accurately drawn

Calculate the area of the triangle.
Give your answer correct to 3 significant figures.

..... cm^2

(Total for Question 22 is 4 marks)

Question 22 | Worked solution

4 marks

June 2026 | 4MA1/1HR | Triangle area using the sine rule

Solution

4 marks

STEP 1

$$\angle ABC = 180^\circ - 62^\circ - 47^\circ = 71^\circ.$$

The three triangle angles sum to 180 degrees.

STEP 2

$$\frac{AB}{\sin 47^\circ} = \frac{13}{\sin 62^\circ} \quad \Longrightarrow \quad AB = \frac{13 \sin 47^\circ}{\sin 62^\circ} = 10.7680208859\ldots \text{ cm}.$$

Match each side to its opposite angle in the sine rule.

STEP 3

$$\text{Area} = \frac{1}{2}(13)\left(\frac{13 \sin 47^\circ}{\sin 62^\circ}\right) \sin 71^\circ = 66.1788645053\ldots \text{ cm}^2.$$

Use half the product of two sides times the sine of their included angle; retain unrounded values.

STEP 4

$$\text{Area} = 66.2 \text{ cm}^2 \quad (3 \text{ significant figures}).$$

Round only the final area.

Final answer
66.2 cm^2

Question 26

3 marks

June 2026 | 4MA1/1HR | Exponential equation using common bases

26

$$\frac{27^x \times 3^{n+6}}{9^{4-n}} = \frac{6^x}{2^x}$$

Express x in terms of n
Show your working clearly and simplify your expression.

$x =$ .....

(Total for Question 26 is 3 marks)

Question 26 | Worked solution

3 marks

June 2026 | 4MA1/1HR | Exponential equation using common bases

Solution

3 marks

STEP 1

$$27 = 3^3, \qquad 9 = 3^2, \qquad \frac{6^x}{2^x} = \left(\frac{6}{2}\right)^x = 3^x.$$

Write both sides in a common base.

STEP 2

$$\frac{27^x \times 3^{n+6}}{9^{4-n}} = 3^{3x+n+6-2(4-n)} = 3^{3x+3n-2}.$$

Multiply powers by adding indices and divide powers by subtracting indices.

STEP 3

$$3^{3x+3n-2} = 3^x \quad \Longrightarrow \quad 3x + 3n - 2 = x.$$

The base-3 exponential is one-to-one, so equal powers have equal indices.

STEP 4

$$2x = 2 - 3n \quad \Longrightarrow \quad x = 1 - \frac{3n}{2}.$$

Collect the x terms and divide by 2.

Final answer

$x = 1 - \frac{3n}{2}$

Question 1

3 marks

June 2026 | 4MA1/2HR | Pythagoras

1 The diagram shows a right-angled triangle.

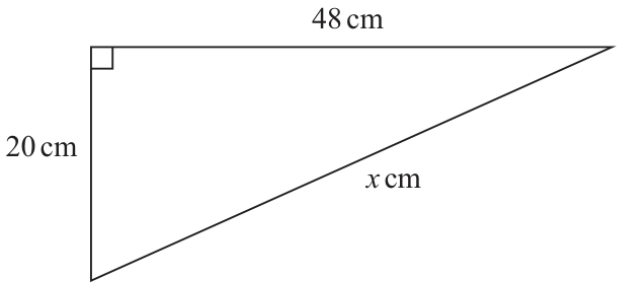


Diagram **NOT** accurately drawn

Work out the value of x

$x =$ .....

(Total for Question 1 is 3 marks)

Question 1 | Worked solution

3 marks

June 2026 | 4MA1/2HR | Pythagoras

Solution

3 marks

STEP 1

$$x^2 = 20^2 + 48^2 = 400 + 2304 = 2704.$$

Use Pythagoras because the 20 cm and 48 cm sides meet at the right angle.

STEP 2

$$x = \sqrt{2704} = 52.$$

Take the positive square root because x is a length.

Final answer

$x = 52$, so the hypotenuse is 52 cm.

Question 3

1 marks

June 2026 | 4MA1/2HR | Sets

3 $\mathscr{E}$ = {integers from 1 to 12}
A = {factors of 12}

List the members of the set A'

.....

(Total for Question 3 is 1 mark)

Question 3 | Worked solution

1 marks

June 2026 | 4MA1/2HR | Sets

Solution

1 marks

STEP 1

$A = \{1, 2, 3, 4, 6, 12\}$. Remove these factors from the integers 1 to 12. The complement contains precisely the universal-set elements not in A.

Final answer

$A' = \{5, 7, 8, 9, 10, 11\}$.

Question 4 | parts a, c, d

6 marks

June 2026 | 4MA1/2HR | Linear equations, substitution and algebraic indices

4 (a) Solve $3(x + 2) = 1 - 5x$
Show clear algebraic working.

$x =$ .....

(3)

(c) Simplify m^0

.....

(1)

(d) Simplify $(4r^2t)^3$

.....

(2)

Question 4 | parts a, c, d | Worked solution

6 marks

June 2026 | 4MA1/2HR | Linear equations, substitution and algebraic indices

Part (a)

3 marks

STEP 1

$$3x + 6 = 1 - 5x.$$

Expand the bracket.

STEP 2

$$8x = -5 \quad \Rightarrow \quad x = -\frac{5}{8}.$$

Add 5x and subtract 6 on both sides, then divide by 8.

Final answer
$x = -\frac{5}{8}$.

Part (c)

1 marks

STEP 1

$m^0 = 1$ for $m \neq 0$. Any nonzero base to the zero power equals 1.

Final answer
1.

Part (d)

2 marks

STEP 1

$$(4r^2t)^3 = 4^3(r^2)^3t^3 = 64r^6t^3.$$

Cube each factor and multiply the exponents in the power of a power.

Final answer
$64r^6t^3$.

Question 9

3 marks

June 2026 | 4MA1/2HR | Compound units: speed

9 Change a speed of 198 kilometres per hour to a speed in metres per second.
Show your working clearly.

..... m/s

(Total for Question 9 is 3 marks)

Question 9 | Worked solution

3 marks

June 2026 | 4MA1/2HR | Compound units: speed

Solution

3 marks

STEP 1

198 km = 198000 m and 1 hour = 3600 s. Convert both the distance and the time in the rate.

STEP 2

$$198 \text{ km/h} = \frac{198000}{3600} = 55 \text{ m/s}.$$

Metres per second means metres divided by seconds.

Final answer
55 m/s.

Question 10

3 marks

June 2026 | 4MA1/2HR | Density and cylinder volume

10 The diagram shows a solid cylinder.

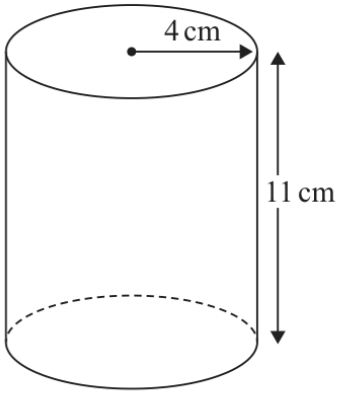


Diagram **NOT** accurately drawn

The cylinder has radius 4 cm and height 11 cm
The cylinder is made from wood with a density of 0.6 g/cm^3

Work out the mass of the cylinder.
Give your answer correct to 3 significant figures.

..... g

(Total for Question 10 is 3 marks)

Question 10 | Worked solution

3 marks

June 2026 | 4MA1/2HR | Density and cylinder volume

Solution

3 marks

STEP 1

$$V = \pi r^2 h = \pi(4)^2(11) = 176\pi \text{ cm}^3.$$

Use the cylinder volume formula.

STEP 2

$$m = \rho V = 0.6(176\pi) = 105.6\pi = 331.7521842\ldots \text{ g}.$$

Mass equals density times volume; keep full precision until the end.

STEP 3

$$m = 332 \text{ g} \quad (3 \text{ significant figures}).$$

Round the final mass as requested.

Final answer
332 g (3 significant figures).

Question 11

5 marks

June 2026 | 4MA1/2HR | Right-triangle trigonometry and area

11 The diagram shows a square $ABCD$ and a right-angled triangle EFG

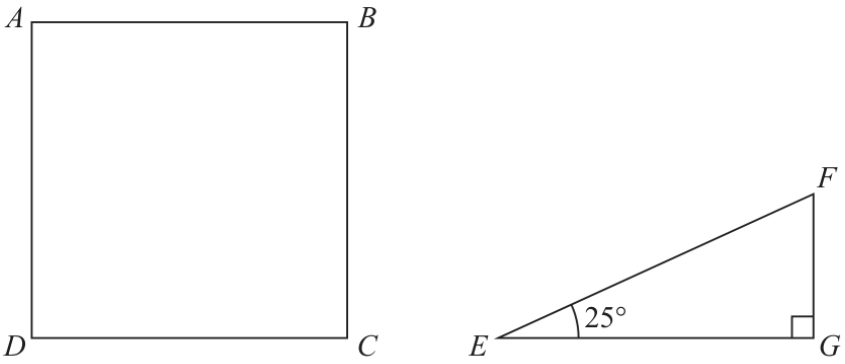


Diagram **NOT** accurately drawn

The area of square $ABCD$ is $36\,\text{cm}^2$
$DC = EG$

Work out the area of triangle EFG
Give your answer correct to one decimal place.
Show your working clearly.

..... cm^2

(Total for Question 11 is 5 marks)

Question 11 | Worked solution

5 marks

June 2026 | 4MA1/2HR | Right-triangle trigonometry and area

Solution

5 marks

STEP 1

$$DC = \sqrt{36} = 6 \text{ cm}, \qquad EG = 6 \text{ cm}.$$

All sides of the square have length equal to the square root of its area, and DC=EG.

STEP 2

$$\tan 25^\circ = \frac{FG}{EG} \quad \Rightarrow \quad FG = 6 \tan 25^\circ = 2.7978459\ldots \text{ cm}.$$

Relative to angle E, FG is opposite and EG is adjacent.

STEP 3

$$\text{Area} = \frac{1}{2}(EG)(FG) = \frac{1}{2}(6)(6 \tan 25^\circ) = 8.3935378\ldots \text{ cm}^2.$$

The base EG and height FG are perpendicular.

Final answer
8.4 cm^2 (1 decimal place).

Question 13

4 marks

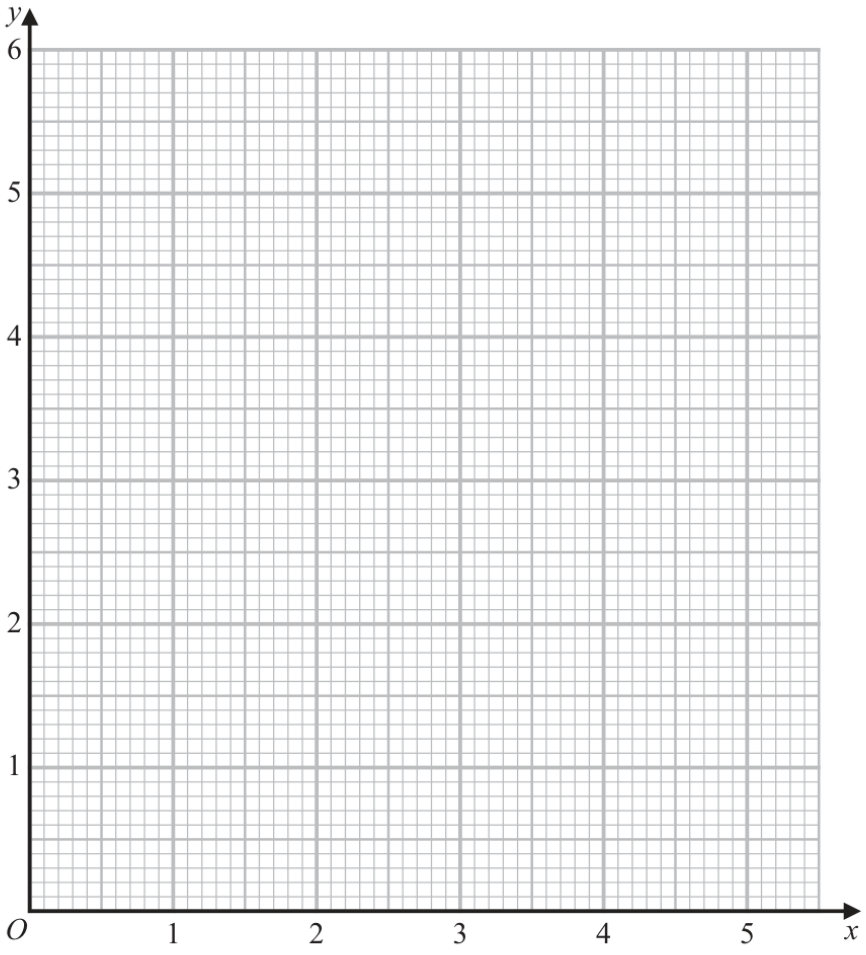
June 2026 | 4MA1/2HR | Function graph construction

13 (a) Complete the table of values for $y = x + \frac{1}{x}$

x	0.25	0.5	1	2	3	4	5
y	4.25			2.5	3.33		

(2)

(b) On the grid, draw the graph of $y = x + \frac{1}{x}$ for $0.25 \leqslant x \leqslant 5$



(2)

(Total for Question 13 is 4 marks)

Question 13 | Worked solution

4 marks

June 2026 | 4MA1/2HR | Function graph construction

Part (a)

2 marks

STEP 1

Use $y = x + 1/x$:

$$y(0.5) = 0.5 + 2 = 2.5, \quad y(1) = 1 + 1 = 2, \quad y(4) = 4 + 0.25 = 4.25, \quad y(5) = 5 + 0.2 = 5.2.$$

Substitute each required x-value into the formula.

Final answer

Table entries, in order: $2.5, 2, 4.25, 5.2$.

Part (b)

2 marks

STEP 1

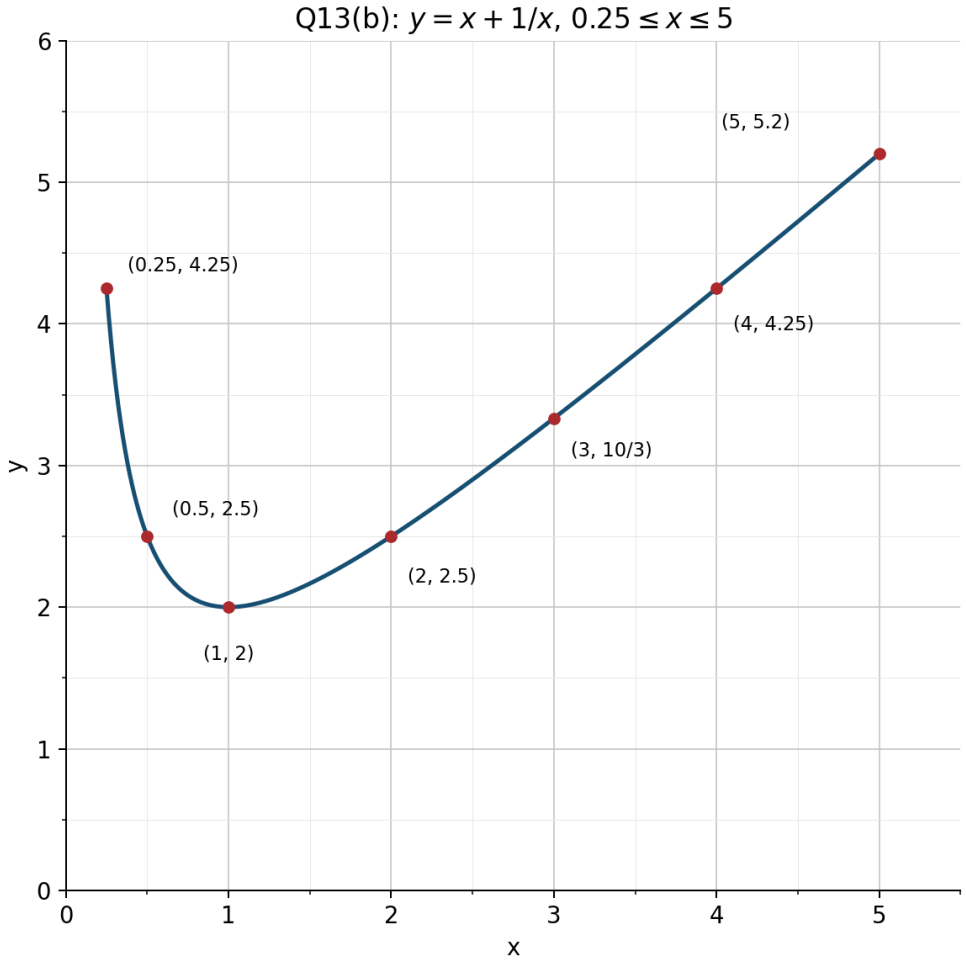
Plot

$$(0.25, 4.25),\ (0.5, 2.5),\ (1, 2),\ (2, 2.5),\ (3, 10/3),\ (4, 4.25),\ (5, 5.2).$$

Use x horizontally and y vertically on the supplied grid; $10/3$ is approximately 3.33.

STEP 2

Join the points with one smooth curve for $0.25 \leq x \leq 5$, descending to its minimum $(1, 2)$ and then ascending. The graph is curved, not a set of straight segments, and includes both endpoints.



Final answer

The smooth curve $y = x + 1/x$ through the stated coordinates on $[0.25, 5]$.

Question 14

8 marks

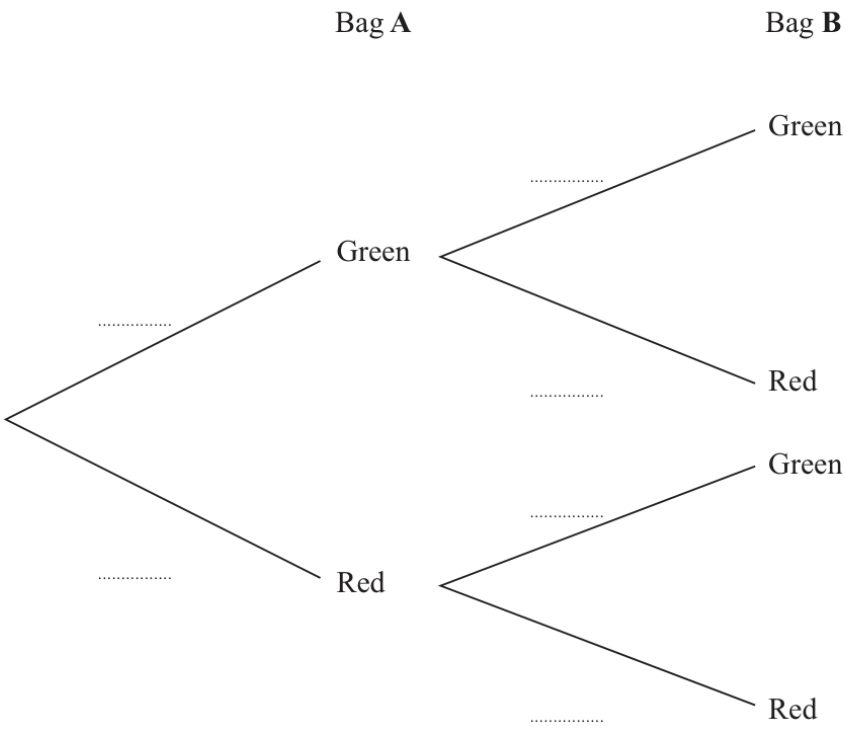
June 2026 | 4MA1/2HR | Independent probability and tree diagrams

14 Pras has 2 bags of counters, bag **A** and bag **B**

In bag **A**, there are 4 green counters and 3 red counters.
In bag **B**, there are 5 green counters and 1 red counter.

Pras is going to take at random a counter from bag **A** and a counter from bag **B**

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Pras will take two green counters.

.....

(2)

Pras also has a third bag of counters, bag **C**
In bag **C**, there are only green counters and red counters.
All the original counters are back in bag **A** and bag **B**

Pras is going to take at random a counter from bag **A**, a counter from bag **B** and a counter from bag **C**

The probability that Pras will take three red counters is $\frac{3}{70}$

(c) Work out the probability that Pras will take 1 green counter and 2 red counters.

.....

(4)

(Total for Question 14 is 8 marks)

Question 14 | Worked solution

8 marks

June 2026 | 4MA1/2HR | Independent probability and tree diagrams

Part (a)

2 marks

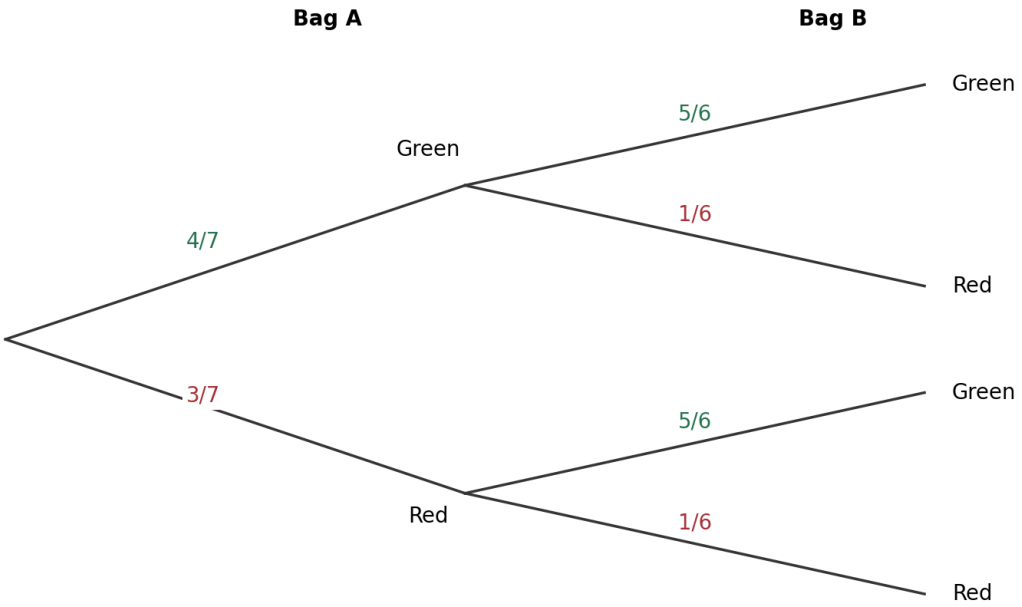
STEP 1

From the start, label the Bag A branches $P(G_A) = 4/7$ and $P(R_A) = 3/7$. Bag A has 7 counters in total.

STEP 2

From each Bag A outcome, label the Bag B green branch $5/6$ and red branch $1/6$. Bag B has 6 counters and is unaffected by the result from bag A.

Q14(a): Completed probability tree



Final answer

Branch labels from top to bottom: $4/7, 3/7$ for A; $5/6, 1/6$ for B after either A result.

Part (b)

2 marks

STEP 1

$$P(G_A G_B) = \frac{4}{7} \times \frac{5}{6} = \frac{20}{42} = \frac{10}{21}.$$

Both events must occur, so multiply along the green-green path.

Final answer

$\frac{10}{21}$.

Part (c)

4 marks

STEP 1

Let $r = P(R_C)$. Then

$$\frac{3}{7} \times \frac{1}{6} \times r = \frac{3}{70} \quad \Rightarrow \quad r = \frac{3}{5}, \qquad P(G_C) = \frac{2}{5}.$$

Use the given probability of three reds to find the bag C probabilities.

STEP 2

Exactly one green means the disjoint outcomes $G_A R_B R_C$, $R_A G_B R_C$, or $R_A R_B G_C$. The single green counter can come from A, B or C.

STEP 3

$$P = \frac{4}{7}\frac{1}{6}\frac{3}{5} + \frac{3}{7}\frac{5}{6}\frac{3}{5} + \frac{3}{7}\frac{1}{6}\frac{2}{5} = \frac{2}{35} + \frac{3}{14} + \frac{1}{35} = \frac{3}{10}.$$

Multiply within each outcome and add the three mutually exclusive probabilities.

Final answer

$\frac{3}{10}$.

Question 16

2 marks

June 2026 | 4MA1/2HR | Algebraic indices

16 $\left(\frac{1}{\sqrt{a}}\right)^6 = a^n$

Work out the value of n

$n =$ .....

(Total for Question 16 is 2 marks)

Question 16 | Worked solution

2 marks

June 2026 | 4MA1/2HR | Algebraic indices

Solution

2 marks

STEP 1

$$\frac{1}{\sqrt{a}} = a^{-1/2}, \qquad \left(a^{-1/2}\right)^6 = a^{-3}.$$

A reciprocal changes the sign of the exponent and an outer power multiplies exponents.

Final answer

$n = -3$.

Question 17

2 marks

June 2026 | 4MA1/2HR | Recurring decimal to fraction

17 Use algebra to show that $0.\dot{8}1\dot{4} = \frac{22}{27}$

(Total for Question 17 is 2 marks)

Question 17 | Worked solution

2 marks

June 2026 | 4MA1/2HR | Recurring decimal to fraction

Solution

2 marks

STEP 1

Let $z = 0.\overline{814} = 0.814814814\ldots$. Then $1000z = 814.814814\ldots$. Multiplication by 1000 aligns the repeating three-digit tails.

STEP 2

$$1000z - z = 814 \quad \Rightarrow \quad 999z = 814 \quad \Rightarrow \quad z = \frac{814}{999} = \frac{22}{27}.$$

Subtract to cancel the recurring tails, then cancel the common factor 37.

Final answer
$0.\overline{814} = \frac{22}{27}$.

Question 19

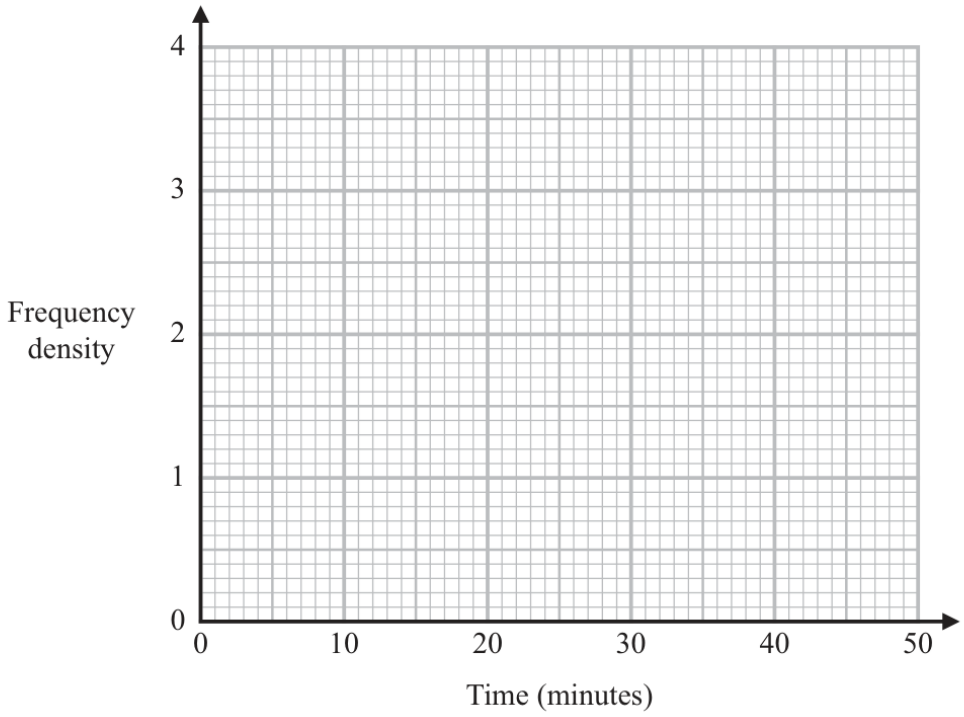
3 marks

June 2026 | 4MA1/2HR | Histograms

19 The table gives information about the times, in minutes, some people spent waiting to go on a rollercoaster.

Time (t minutes)	Frequency
$0 < t \leqslant 20$	14
$20 < t \leqslant 25$	12
$25 < t \leqslant 35$	32
$35 < t \leqslant 50$	30

On the grid, draw a histogram for this information.



(Total for Question 19 is 3 marks)

Question 19 | Worked solution

3 marks

June 2026 | 4MA1/2HR | Histograms

Solution

3 marks

STEP 1

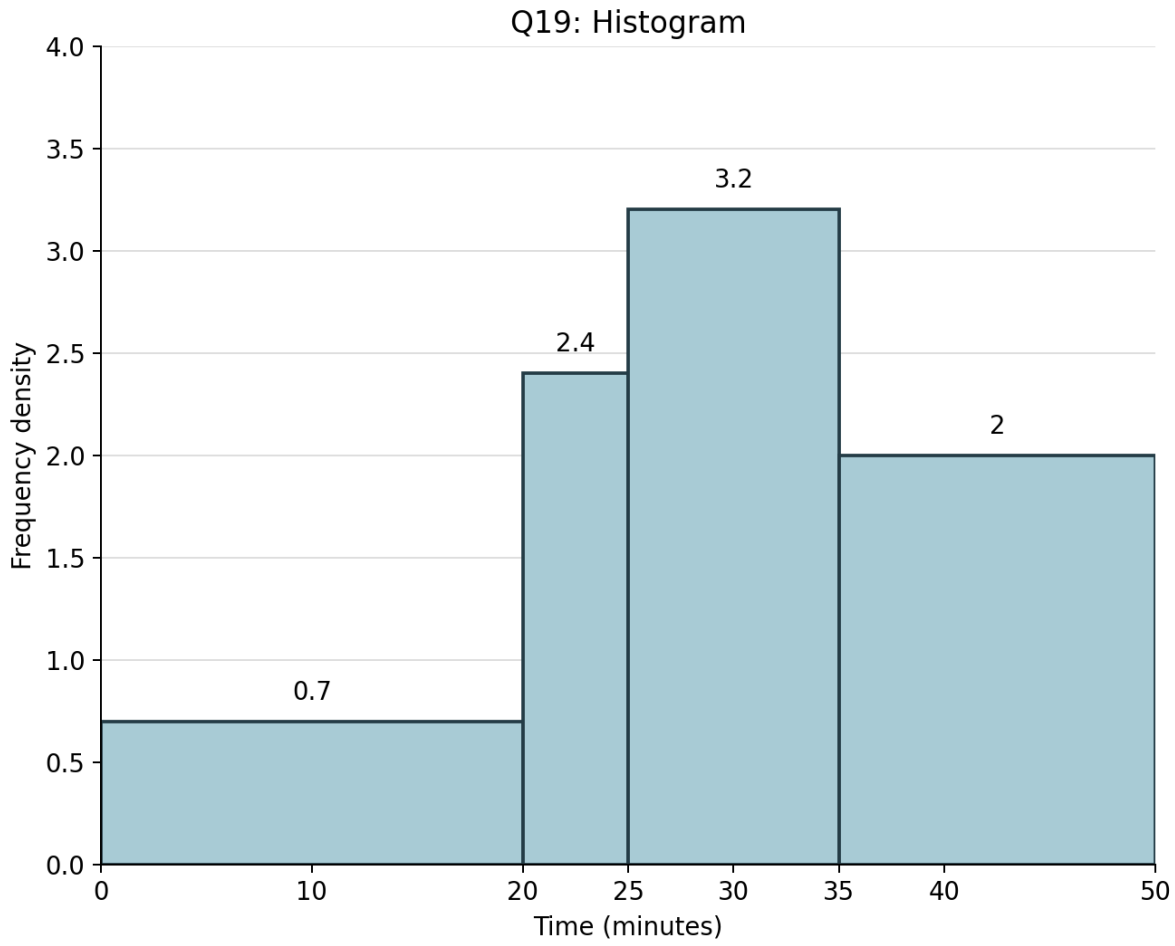
Use frequency density = frequency/class width:

$$14/20 = 0.7, \quad 12/5 = 2.4, \quad 32/10 = 3.2, \quad 30/15 = 2.$$

Histogram areas, rather than heights alone, represent frequencies.

STEP 2

Draw four adjoining rectangles on the supplied time and frequency-density axes: $[0, 20]$ at height 0.7, $[20, 25]$ at height 2.4, $[25, 35]$ at height 3.2, and $[35, 50]$ at height 2. Each rectangle starts at density 0 and has the stated class boundaries as its vertical edges; leave no gaps between classes.



Final answer

Bar intervals/heights: $[0, 20] : 0.7$; $[20, 25] : 2.4$; $[25, 35] : 3.2$; $[35, 50] : 2$.

Question 21

3 marks

June 2026 | 4MA1/2HR | Bounds

21 $p = \dfrac{d-e}{f}$

$d = 6.6$ correct to 1 decimal place
$e = 2.8$ correct to 1 decimal place
$f = 0.47$ correct to 2 decimal places

Calculate the lower bound for the value of p
Give your answer correct to 3 significant figures.
Show your working clearly.

.....

(Total for Question 21 is 3 marks)

Question 21 | Worked solution

3 marks

June 2026 | 4MA1/2HR | Bounds

Solution

3 marks

STEP 1

$$6.55 \leq d < 6.65, \quad 2.75 \leq e < 2.85, \quad 0.465 \leq f < 0.475.$$

Use half of each rounding unit to obtain the bounds.

STEP 2

$$p_{\text{lower}} = \frac{6.55 - 2.85}{0.475} = \frac{3.70}{0.475} = 7.789473684\ldots.$$

Minimize the positive numerator by using the lower bound of d and upper bound of e; maximize the positive denominator.

STEP 3

$$p_{\text{lower}} = 7.79 \quad (3 \text{ significant figures}).$$

Round the boundary value to the requested accuracy.

Final answer
Lower bound = 7.79 (3 significant figures).