Pearson Edexcel International GCSE

Mathematics A

Modular Unit 2

June 2023 Reconstructed Past Paper

DETAILED SOLUTIONS

Original question followed by a full worked solution

28 adaptive question sections 103 marks

Selected from Linear Higher Papers 1H and 2H

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L-to-M | CONVERTED MODULAR EDITION

Selected from Linear Higher papers; not an original Modular examination paper.

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About this reconstructed paper

Each question section appears in the same order as the Student book: the complete source demand is followed by its demand-local worked solution and final answer.

Ownership rule: Unit 2 owns a demand when its assessed or terminal statement is Unit 2, even if Unit 1 skills are prerequisites. For example, drawing boundary lines supports the Unit 2 region-of-inequalities demand. This book contains the demands owned by Unit 2; the selection contains 103 marks.

This is an Elite reconstructed teaching paper selected from official Linear Higher material; it is not an official Pearson Modular examination paper. Source assets are retained for private teaching use.

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Question 01

4MA1-1H Q1

ORIGINAL QUESTION

3 marks

1 Last season, the number of goals scored by Arjun, by Simon and by Kath for their football team were in the ratios $2:5:8$

Simon scored 12 more goals than Arjun.

Work out the number of goals scored by Kath.

.....

Worked Solution 01

Ratio difference

MODULAR UNIT 2

3 marks

Find one ratio part

$$5 - 2 = 3 \text{ parts} = 12 \Rightarrow 1 \text{ part} = 4.$$

Find Kath's goals

$$8 \times 4 = 32.$$

Final answer

$$32$$

Question 02
4MA1-1H Q2

ORIGINAL QUESTION
3 marks

2 The table gives information about the number of minutes that Abby spent walking each day in September.

Number of minutes (M)	Frequency
$0 < M \leqslant 30$	5
$30 < M \leqslant 60$	6
$60 < M \leqslant 90$	8
$90 < M \leqslant 120$	9
$120 < M \leqslant 150$	2

Work out an estimate for the total number of minutes that Abby spent walking in September.

..... minutes

Worked Solution 02

Estimated grouped total

MODULAR UNIT 2

3 marks

Use class midpoints

$$15, 45, 75, 105, 135.$$

Weight and add

$$15(5) + 45(6) + 75(8) + 105(9) + 135(2) = 2160.$$

Final answer

$$2160 \text{ minutes}$$

Question 03
4MA1-1H Q3

ORIGINAL QUESTION
4 marks

3 Nanette buys 60 notebooks for a total cost of 780 dirhams.

Nanette sells 70% of the notebooks for 22 dirhams each.
She sells the remaining notebooks for 19 dirhams each.

Work out Nanette's percentage profit.
Give your answer correct to 3 significant figures.

.....%

Worked Solution 03

Percentage profit

MODULAR UNIT 2

4 marks

Find the income

$$0.70(60)(22) = 924, \qquad 0.30(60)(19) = 342.$$

Compare with cost

$$\text{profit} = 924 + 342 - 780 = 486.$$

Convert to a percentage

$$\frac{486}{780} \times 100 = 62.307\ldots\%.$$

Final answer

$$62.3\%$$

Question 04
4MA1-1H Q4

ORIGINAL QUESTION
3 marks

4 The diagram shows a sketch of triangle **A** and triangle **B** on a coordinate grid.

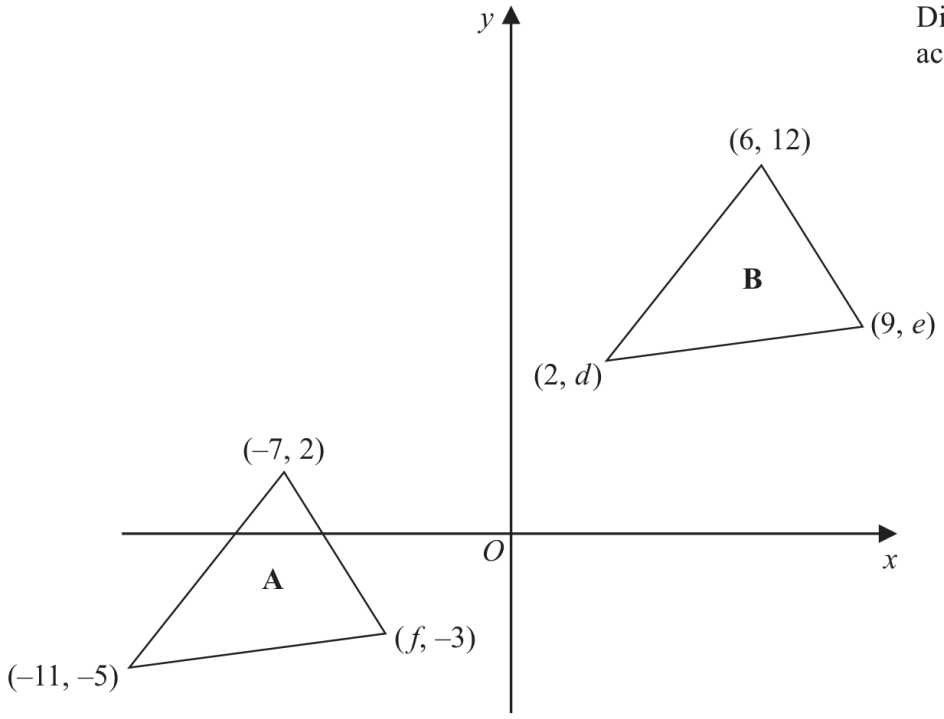


Diagram **NOT** accurately drawn

(a) Given that triangle **A** has been translated to give triangle **B**, work out the value of d, the value of e and the value of f

$d =$ .....

$e =$ .....

$f =$ .....

(3)

Worked Solution 04

Translation coordinates

MODULAR UNIT 2

3 marks

Read the translation

$$(6, 12) - (-7, 2) = (13, 10).$$

Apply it to the other vertices

$$d = -5 + 10 = 5, \quad e = -3 + 10 = 7, \quad f = 9 - 13 = -4.$$

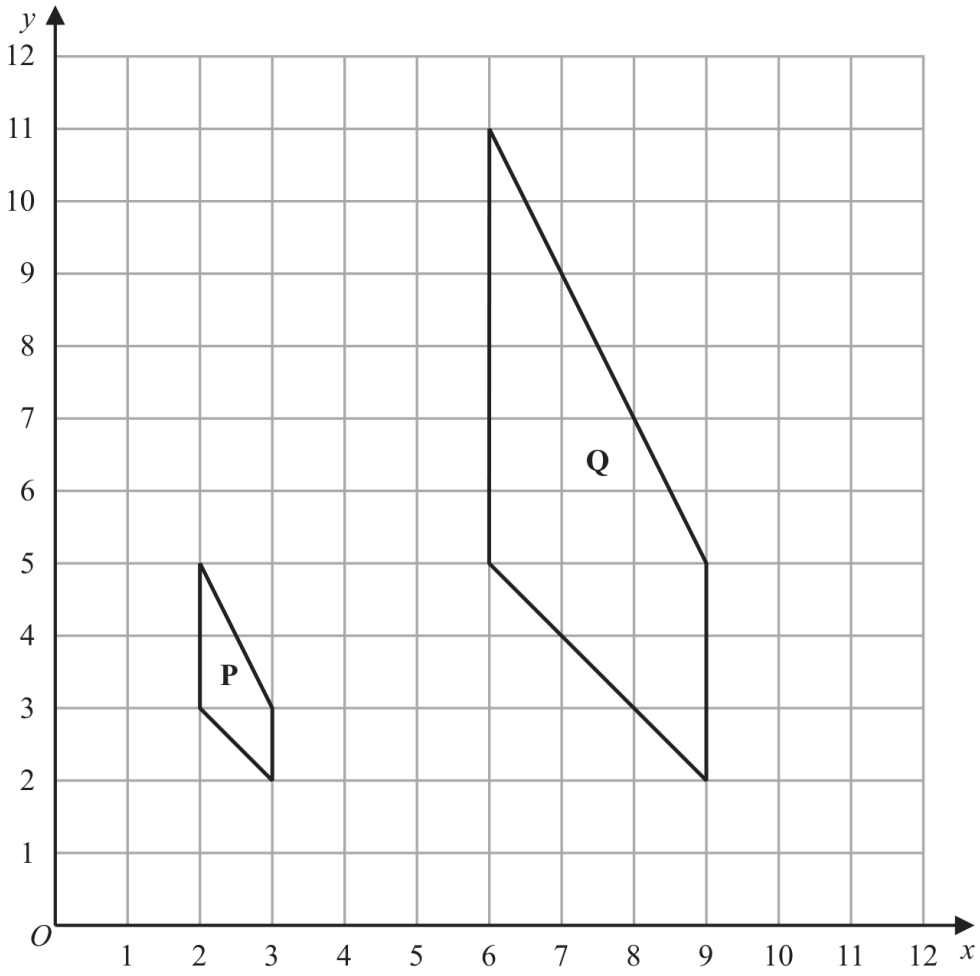
Final answer

$$d = 5, \quad e = 7, \quad f = -4$$

Question 05
4MA1-1H Q4

ORIGINAL QUESTION
5 marks

The diagram shows shape **P** and shape **Q** drawn on a grid.



(b) Describe fully the single transformation that maps shape **P** onto shape **Q**

.....

.....

(3)

(c) On the grid above, rotate shape **P** 90° clockwise about (3, 5)
Label your shape **R**

(2)

Worked Solution 05

Enlargement and rotation

MODULAR UNIT 2

5 marks

Describe P to Q

$$\text{Enlargement, scale factor } 3,\ \text{centre } (0,2).$$

Rotate P

$$(x,y) \mapsto \big(3+(y-5),\ 5-(x-3)\big).$$

Plot the image

$$R:\ (0,5),(1,6),(3,6),(1,5).$$

Final answer

$$\text{Enlargement } (k=3,\ C=(0,2)); \quad R:(0,5),(1,6),(3,6),(1,5)$$

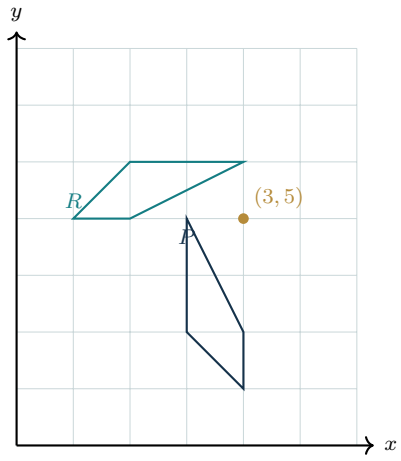
Completed diagram 05

Enlargement and rotation

MODULAR UNIT 2

5 marks

Completed solution diagram: Rotation image on the coordinate grid

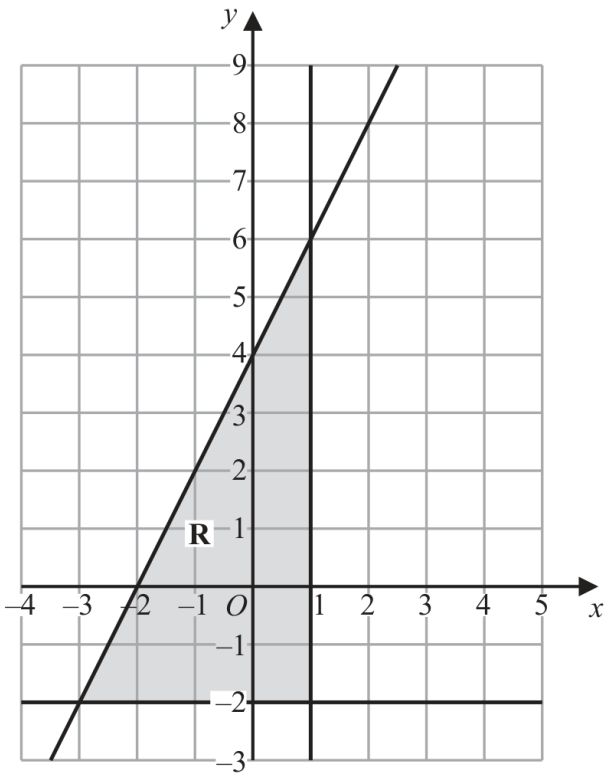


Question 06

4MA1-1H Q7

ORIGINAL QUESTION

4 marks



The region **R**, shown shaded in the diagram, is bounded by three straight lines.

Find the inequalities that define **R**

.....

.....

.....

Worked Solution 06

Region inequalities

MODULAR UNIT 2

4 marks

Read the vertical boundary

$$x \leq 1.$$

Read the horizontal boundary

$$y \geq -2.$$

Find the sloping line and shaded side

$$y = 2x + 4, \qquad y \leq 2x + 4.$$

Final answer

$$x \leq 1, \quad y \geq -2, \quad y \leq 2x + 4$$

Question 07
4MA1-1H Q8

ORIGINAL QUESTION
2 marks

8 (a) Write 300 as a product of its prime factors.
Show your working clearly.

.....

(2)

Worked Solution 07

Prime factorisation

MODULAR UNIT 2

2 marks

Divide into primes

$$300 = 3 \times 100 = 3 \times 2^2 \times 5^2.$$

Final answer

$$2^2 \times 3 \times 5^2$$

Question 08
4MA1-1H Q8

ORIGINAL QUESTION
2 marks

$A = 2 \times 2 \times 2 \times 3 \times 3 \times 5$

$B = 2 \times 2 \times 3 \times 3 \times 3 \times 5$

(b) Find the lowest common multiple (LCM) of $5A$ and $7B$
Show your working clearly.

.....

(2)

Worked Solution 08

LCM from prime factors

MODULAR UNIT 2

2 marks

Include the extra factors

$$5A = 2^3 \times 3^2 \times 5^2, \qquad 7B = 2^2 \times 3^3 \times 5 \times 7.$$

Take each maximum power

$$\text{LCM} = 2^3 \times 3^3 \times 5^2 \times 7 = 37800.$$

Final answer

$$37800$$

Question 09
4MA1-1H Q9

ORIGINAL QUESTION
3 marks

9 Solve the simultaneous equations

$$2x + 9y = 14.5$$
$$7x + 3y = 8$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

Worked Solution 09

Linear simultaneous equations

MODULAR UNIT 2

3 marks

Eliminate y

$$3(7x + 3y = 8) \Rightarrow 21x + 9y = 24.$$

Subtract

$$19x = 9.5 \Rightarrow x = 0.5.$$

Substitute

$$7(0.5) + 3y = 8 \Rightarrow y = 1.5.$$

Final answer

$$x = 0.5, \quad y = 1.5$$

Question 10

4MA1-1H Q10

ORIGINAL QUESTION

2 marks

10 Here are the test marks of 15 students.

7 10 14 15 16 17 18 19 20 20 23 25 30 39 40

Find the interquartile range of these marks.

.....

Worked Solution 10

Interquartile range

MODULAR UNIT 2

2 marks

Locate the quartiles

$$Q_1 = 15, \qquad Q_3 = 25.$$

Subtract

$$\text{IQR} = 25 - 15 = 10.$$

Final answer

$$10$$

Question 11
4MA1-1H Q11

ORIGINAL QUESTION
6 marks

11 The curve **C** has equation $y = 4x^3 + x^2 - 20x$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ .....

(2)

(b) Find the x coordinates of the points on **C** where the gradient is 4
Show clear algebraic working.

.....

(4)

Worked Solution 11

Differentiate and solve a gradient condition

MODULAR UNIT 2

6 marks

Differentiate

$$\frac{dy}{dx} = 12x^2 + 2x - 20.$$

Set the gradient to 4

$$12x^2 + 2x - 20 = 4 \Rightarrow 6x^2 + x - 12 = 0.$$

Factorise

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

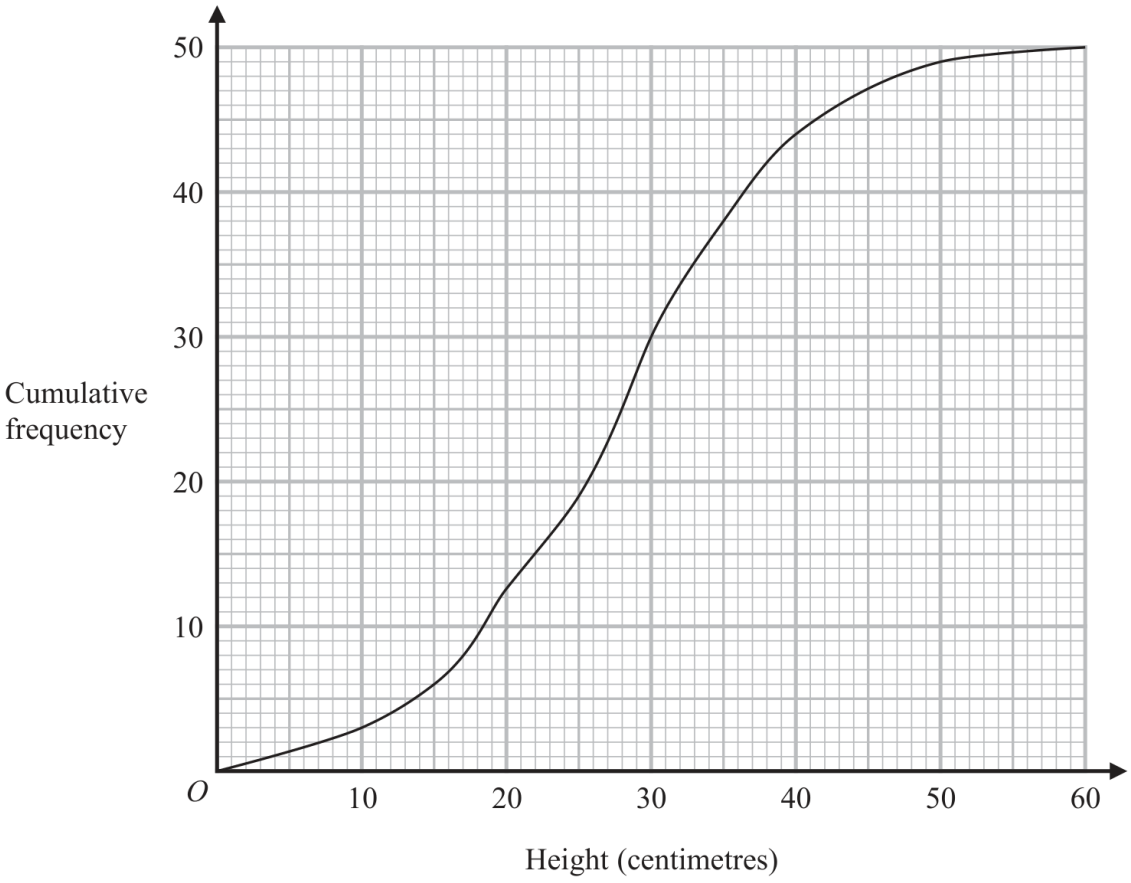
Final answer

$$x = \frac{4}{3} \text{ or } x = -\frac{3}{2}$$

Question 12
4MA1-1H Q12

ORIGINAL QUESTION
4 marks

12 The cumulative frequency graph shows information about the heights, in centimetres, of 50 plants in a flowerbed.



(a) Use the graph to find an estimate for the median height of these plants.

..... centimetres
(1)

(b) Use the graph to find the frequency for the class interval $30 < \text{Height} \leqslant 40$

.....
(1)

(c) Use the graph to find an estimate for the number of plants with a height greater than 35 centimetres.

.....
(2)

Worked Solution 12

Read a cumulative-frequency graph

MODULAR UNIT 2

4 marks

Median

$$\text{CF} = 25 \Rightarrow h \approx 28.$$

Class frequency

$$\text{CF}(40) - \text{CF}(30) \approx 44 - 30 = 14.$$

Above 35 cm

$$50 - \text{CF}(35) \approx 50 - 38 = 12.$$

Final answer

$$28 \text{ cm}; \quad 14; \quad 12$$

Question 13

4MA1-1H Q15

ORIGINAL QUESTION

3 marks

(b) Find 4% of 4.5×10^{157}

Give your answer in standard form.

.....

(3)

Worked Solution 13

Percentage of a standard-form number

MODULAR UNIT 2

3 marks

Change 4 percent to a multiplier

$$4\% = 0.04 = 4 \times 10^{-2}.$$

Multiply and normalize

$$(4 \times 10^{-2})(4.5 \times 10^{157}) = 18 \times 10^{155} = 1.8 \times 10^{156}.$$

Final answer

$$1.8 \times 10^{156}$$

Question 14
4MA1-1H Q17

ORIGINAL QUESTION
4 marks

17 The functions g and h are such that

$$g(x) = \frac{11}{2x - 5}$$

$$h(x) = x^2 + 4 \qquad x \geqslant 0$$

(a) What value of x must be excluded from any domain of g?

.....

(1)

(b) Solve $gh(x) = 1$

.....

(3)

Worked Solution 14

Domain exclusion and composite equation

MODULAR UNIT 2

4 marks

Exclude a zero denominator

$$2x - 5 \neq 0 \Rightarrow x \neq \frac{5}{2}.$$

Form the composite

$$g(h(x)) = \frac{11}{2(x^2 + 4) - 5} = 1.$$

Solve with the stated nonnegative domain

$$2x^2 + 3 = 11 \Rightarrow x^2 = 4, \quad x = 2.$$

Final answer

$$x \neq \frac{5}{2}; \qquad x = 2 \text{ for } g(h(x)) = 1$$

Question 15
4MA1-1H Q19

ORIGINAL QUESTION
5 marks

19

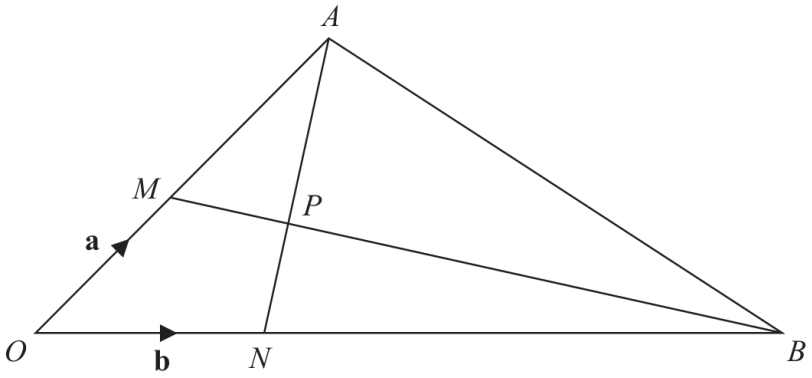


Diagram **NOT** accurately drawn

OMA, *ONB*, *MPB* and *NPA* are straight lines.

M is the midpoint of *OA*

$ON : NB = 1 : 5$

$\overrightarrow{OM} = \mathbf{a}$ $\overrightarrow{ON} = \mathbf{b}$

(a) Find in terms of **a** and **b** the vector $\overrightarrow{AN}$

.....

(1)

(b) Use a vector method to find the ratio $AP : PN$

$AP : PN =$ .....

(4)

Worked Solution 15

Intersection ratio by vectors

MODULAR UNIT 2

5 marks

Write the key vectors

$$\overrightarrow{OA} = 2\mathbf{a}, \quad \overrightarrow{OB} = 6\mathbf{b}, \quad \overrightarrow{AN} = \mathbf{b} - 2\mathbf{a}.$$

Describe P along AN

$$\overrightarrow{OP} = 2\mathbf{a} + \lambda(\mathbf{b} - 2\mathbf{a}) = (2 - 2\lambda)\mathbf{a} + \lambda\mathbf{b}.$$

Describe P along MB

$$\overrightarrow{OP} = \mathbf{a} + \mu(6\mathbf{b} - \mathbf{a}) = (1 - \mu)\mathbf{a} + 6\mu\mathbf{b}.$$

Equate coefficients

$$\lambda = 6\mu, \quad 2 - 2\lambda = 1 - \mu \Rightarrow \lambda = \frac{6}{11}.$$

Final answer

$$\overrightarrow{AN} = \mathbf{b} - 2\mathbf{a}; \qquad AP : PN = 6 : 5$$

Question 16
4MA1-1H Q20

ORIGINAL QUESTION
6 marks

20 The sum of the first 80 terms of an arithmetic series, S, is 470

The 75th term of S is 14.5

The sum of the first X terms of S is 171

Work out the value of X
Show your working clearly.

$X =$ .....

Worked Solution 16

Arithmetic-series reverse problem

MODULAR UNIT 2

6 marks

Use the two given facts

$$40(2a + 79d) = 470, \qquad a + 74d = 14.5.$$

Solve for the sequence

$$2a + 79d = 11.75, \quad 2a + 148d = 29 \Rightarrow d = 0.25,\ a = -4.$$

Use the partial sum

$$\frac{X}{2}\left[-8 + (X - 1)(0.25)\right] = 171.$$

Solve the quadratic

$$X^2 - 33X - 1368 = 0 = (X - 57)(X + 24).$$

Final answer

$$X = 57$$

Question 17
4MA1-1H Q21

ORIGINAL QUESTION
2 marks

21 A curve has equation $y = f(x)$

There is only one turning point on the curve.
The coordinates of this turning point are (6, 5)

Write down the coordinates of the turning point on the curve with equation

(a) $y = f(x - 4)$

(.....,.....)
(1)

(b) $y = f(3x)$

(.....,.....)
(1)

Worked Solution 17

Turning point under graph transformations

MODULAR UNIT 2

2 marks

Horizontal translation

$$y = f(x-4): \ (6,5) \mapsto (10,5).$$

Horizontal scale

$$y = f(3x): \ (6,5) \mapsto (2,5).$$

Final answer

$$(10,5); \quad (2,5)$$

Question 18
4MA1-1H Q23

ORIGINAL QUESTION
5 marks

23 A frustum is made by removing a small square-based pyramid from a similar large squared-based pyramid as shown in the diagram.

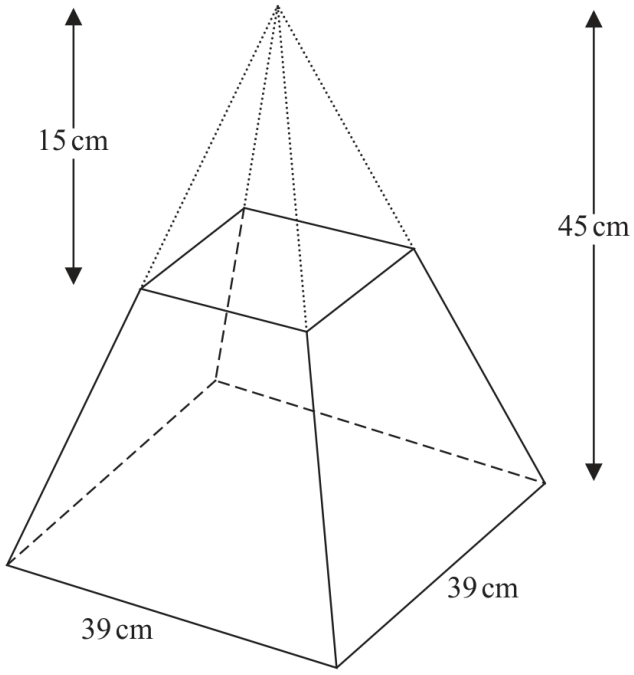


Diagram **NOT** accurately drawn

The height of the small pyramid is 15 cm.
The height of the large pyramid is 45 cm.
The square base of the large pyramid has side length 39 cm.

Work out the **total** surface area of the frustum.
Give your answer correct to the nearest whole number.

..... cm^2

Worked Solution 18

Frustum total surface area

MODULAR UNIT 2

5 marks

Use similarity

$$\frac{15}{45} = \frac{1}{3} \Rightarrow \text{small square side} = 13.$$

Find slant heights

$$L = \sqrt{45^2 + 19.5^2} = 49.043\ldots, \quad l = \frac{L}{3} = 16.348\ldots$$

Find the frustum face slant

$$L - l = 32.695\ldots$$

Add two squares and four trapezia

$$39^2 + 13^2 + 4\left[\frac{1}{2}(39 + 13)(32.695\ldots)\right] = 5090.3\ldots$$

Final answer

$$5090 \text{ cm}^2$$

Question 19
4MA1-2H Q5

ORIGINAL QUESTION
4 marks

5 Nancy has some coins with a total value of 85 pence.
She has only 2 pence coins and 5 pence coins.
The ratio

number of 2 pence coins : number of 5 pence coins = 1 : 3

Nancy has more 5 pence coins than 2 pence coins.

How many more?

.....

Worked Solution 19

Value-weighted coin ratio

MODULAR UNIT 2

4 marks

Write the value ratio

$1:3$ coins gives value ratio $2:15$.

Use the total

$$2n + 15n = 85 \Rightarrow 17n = 85 \Rightarrow n = 5.$$

Count and subtract

There are 5 two-pence coins and 15 five-pence coins, so $15 - 5 = 10$.

Final answer

$$10$$

Question 20
4MA1-2H Q6

ORIGINAL QUESTION
2 marks

6 (a) Write $76\,000\,000$ in standard form.

.....

(1)

(b) Write 5.4×10^{-4} as an ordinary number.

.....

(1)

Worked Solution 20

Standard form conversions

MODULAR UNIT 2

2 marks

Large ordinary number

$$76\,000\,000 = 7.6 \times 10^{7}.$$

Small ordinary number

$$5.4 \times 10^{-4} = 0.00054.$$

Final answer

$$7.6 \times 10^{7}, \quad 0.00054$$

Question 21
4MA1-2H Q7

ORIGINAL QUESTION
3 marks

7

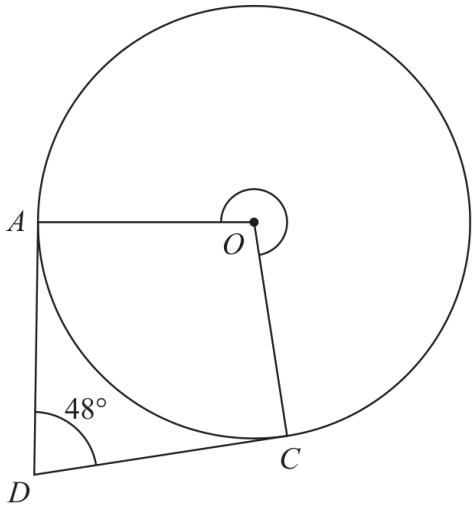


Diagram **NOT** accurately drawn

A and C are points on a circle, centre O
DA is the tangent to the circle at A and DC is the tangent to the circle at C

Angle $ADC = 48°$

Work out the size of reflex angle AOC

.....°

Worked Solution 21

Reflex angle between tangents

MODULAR UNIT 2

3 marks

Spot the right angles

$OA \perp AD$ and $OC \perp CD$, so the two tangent angles are 90°.

Find the reflex angle

$$\angle AOC_{\text{reflex}} = 90 + 48 + 90 = 228^\circ.$$

Final answer

228°

Question 22
4MA1-2H Q8

ORIGINAL QUESTION
3 marks

8 Charlotte buys a painting for $680
The value of the painting increases by 4% each year.

Work out the value of the painting at the end of 3 years.
Give your answer correct to the nearest $

$.....

Worked Solution 22

Compound appreciation

MODULAR UNIT 2

3 marks

Use the annual multiplier

$$V = 680(1.04)^3 = 764.90752.$$

Round as requested

$$V \approx \$765 \text{ to the nearest dollar.}$$

Final answer

$$\$765$$

Question 23

4MA1-2H Q10

ORIGINAL QUESTION

4 marks

10 Team **A** and Team **B** take part in a quiz league.

After 11 rounds, Team **A** has a mean score per round of 17
After 9 rounds, Team **B** has a mean score per round of 18

Both teams take part in a further round.
After this round, both teams have a mean score per round of 18.5

In the further round, Team **A** scored more points than Team **B**.

How many more?

.....

Worked Solution 23

Difference between two final-round scores

MODULAR UNIT 2

4 marks

Find the earlier totals

$$A: 11(17) = 187, \quad B: 9(18) = 162.$$

Find the final totals

$$A: 12(18.5) = 222, \quad B: 10(18.5) = 185.$$

Compare the last rounds

$$A \text{ scored } 222 - 187 = 35, \quad B \text{ scored } 185 - 162 = 23; \quad 35 - 23 = 12.$$

Final answer

$$12 points$$

Question 24
4MA1-2H Q11

ORIGINAL QUESTION
3 marks

11 Here is a 9-sided regular polygon $ABCDEFGHJ$, with centre O

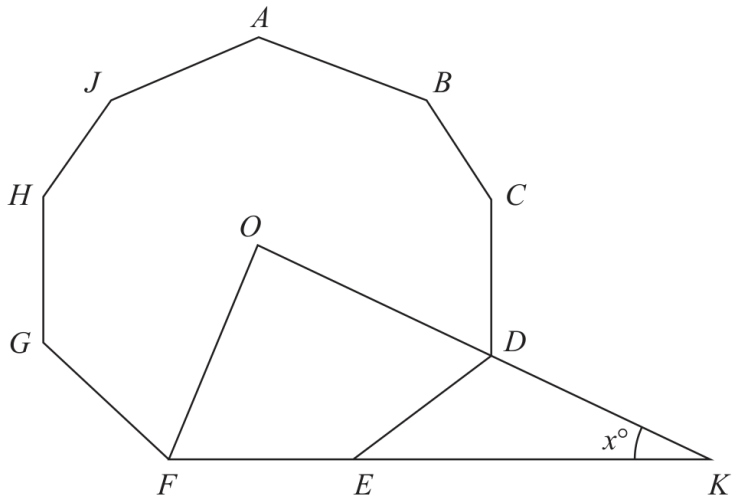


Diagram **NOT** accurately drawn

ODK and FEK are straight lines.

Work out the value of x

$x =$ .....

Worked Solution 24

Angles in a regular nonagon

MODULAR UNIT 2

3 marks

Use the regular polygon angle

$$\text{Exterior angle} = 360/9 = 40^\circ, \quad \text{interior angle} = 140^\circ.$$

Use the straight lines

$$\angle OFK = \angle FOK = 80^\circ \text{ (isosceles triangle), and } \angle EDK = 110^\circ.$$

Read the small triangle

$$x = 180 - 110 - 40 = 30^\circ.$$

Final answer

$$30^\circ$$

Question 25
4MA1-2H Q14

ORIGINAL QUESTION
4 marks

14

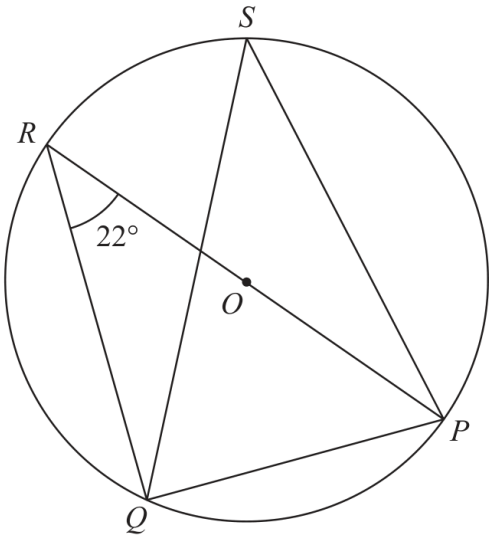


Diagram **NOT** accurately drawn

P, *Q*, *R* and *S* are points on a circle, centre *O*
ROP is a diameter of the circle.
Angle *PRQ* = 22°

(a) (i) Find the size of angle *RQP*

.....°

(1)

(ii) Give a reason for your answer.

.....

.....

(1)

(b) (i) Find the size of angle *PSQ*

.....°

(1)

(ii) Give a reason for your answer.

.....

.....

(1)

Worked Solution 25

Diameter and equal-segment circle angles

MODULAR UNIT 2

4 marks

Diameter angle

ROP is a diameter, so $\angle RQP = 90^\circ$ (angle in a semicircle).

Same chord

$\angle PRQ = 22^\circ$ and $\angle PSQ$ stand on chord PQ, so $\angle PSQ = 22^\circ$.

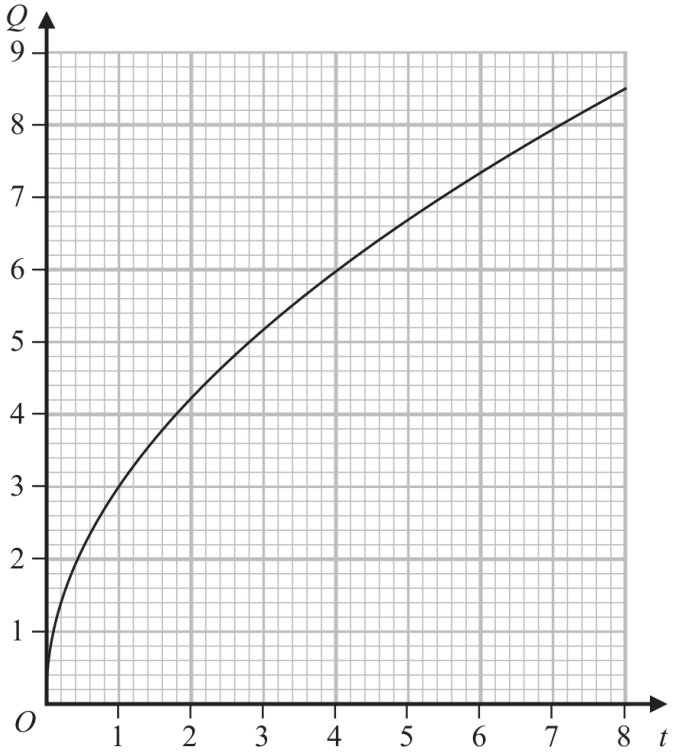
Final answer

$$\angle RQP = 90^\circ, \quad \angle PSQ = 22^\circ$$

Question 26
4MA1-2H Q16

ORIGINAL QUESTION
5 marks

16 Q is directly proportional to $\sqrt{t}$
The graph shows the relationship between Q and t for $0 < t < 8$



(a) Find a formula for Q in terms of t

.....

(3)

Q is increased by 20%

(b) Find the percentage increase in t

.....%

(2)

Worked Solution 26

Root proportionality and percentage change

MODULAR UNIT 2

5 marks

Read the graph

$$Q \propto \sqrt{t}, \quad Q = k\sqrt{t};\ \text{a point such as } (1,3) \text{ gives } k = 3.$$

Write the model

$$Q = 3\sqrt{t}.$$

Apply the 20% change

$$Q' = 1.2Q \Rightarrow 3\sqrt{t'} = 1.2(3\sqrt{t}) \Rightarrow t' = 1.2^2 t = 1.44t.$$

Convert to a percentage

$$(1.44 - 1) \times 100\% = 44\%.$$

Final answer

$$Q = 3\sqrt{t}; \quad 44\%$$

Question 27
4MA1-2H Q17

ORIGINAL QUESTION
4 marks

(b) Make e the subject of $w = \sqrt{\dfrac{e+g}{ef-d}}$

.....

(4)

Worked Solution 27

Make e the subject of a square-root formula

MODULAR UNIT 2

4 marks

Square

$$w^2 = \frac{e+g}{ef-d}.$$

Clear the denominator

$$w^2(ef-d) = e+g \Rightarrow w^2ef - w^2d = e+g.$$

Collect e

$$e(w^2f-1) = g + w^2d.$$

Divide

$$e = \frac{g+w^2d}{w^2f-1}.$$

Final answer

$$e = \frac{g+w^2d}{w^2f-1}$$

Question 28

4MA1-2H Q21

ORIGINAL QUESTION

5 marks

21 Solve the simultaneous equations

$$2x^2 + 3y^2 = 11$$
$$x = 3y - 1$$

Show clear algebraic working.

.....

Worked Solution 28

Linear-quadratic simultaneous equations

MODULAR UNIT 2

5 marks

Substitute

$$x = 3y - 1 \Rightarrow 2(3y-1)^2 + 3y^2 = 11.$$

Form the quadratic

$$21y^2 - 12y - 9 = 0 \Rightarrow 7y^2 - 4y - 3 = 0.$$

Solve

$$(7y+3)(y-1) = 0 \Rightarrow y = 1 \text{ or } y = -\frac{3}{7}.$$

Find x

$$y = 1 \Rightarrow x = 2; \quad y = -\frac{3}{7} \Rightarrow x = -\frac{16}{7}.$$

Final answer

$$(x, y) = (2, 1) \text{ or } \left(-\frac{16}{7}, -\frac{3}{7}\right)$$