Pearson Edexcel International GCSE

Mathematics A

Modular Unit 2

January 2022 Reconstructed Past Paper

DETAILED SOLUTIONS

Original question followed by a full worked solution

38 adaptive question sections 124 marks

Selected from Linear Higher Papers 1H and 2H

Dr Eslam Ahmed

Elite IGCSE Mathematics • eliteigcse.com

L-to-M | CONVERTED MODULAR EDITION

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

Assistant Lecturer, Faculty of Engineering, Cairo University

B.Sc. Electrical Engineering (2017), Distinction with Honours
M.Sc. Mathematics (2023)
PhD Candidate

eliteigcse.com • **WhatsApp +20 112 000 9622**

About this reconstructed paper

Each original source section is followed by the demand-local candidate solution and final answer in the same order as the Student book.

Ownership rule: Unit 2 owns a demand when its assessed or terminal statement is Unit 2, even if Unit 1 skills are prerequisites. This book contains the demands owned by Unit 2; the selection contains 124 marks.

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

Contents

No.	Source	Chapter	Focus	Marks	Page
1	4MA1-1H Q1 Q1(d)	Rearranging Formulas	Single squared/powered subject	2	4
2	4MA1-1H Q2	Ratio Problem Solving	Difference between two shares	3	6
3	4MA1-1H Q4	Percentages	Profit, loss or percentage margin from costs and revenue	5	8
4	4MA1-1H Q5 Q5(a)	Statistics Toolkit	Construct a data set from stated averages and range	3	10
5	4MA1-1H Q5 Q5(b)	Statistics Toolkit	Find a required score for a target mean	3	12
6	4MA1-1H Q6 Q6(a)	Solving Inequalities	One-sided linear inequality	2	14
7	4MA1-1H Q8	Powers, Roots & Standard Form	Multiply or divide standard-form numbers	2	16
8	4MA1-1H Q11	Compound Interest & Depreciation	Changing annual percentage rates	3	18
9	4MA1-1H Q12 Q12(a), Q12(b), Q12(c), Q12(d)	Cumulative Frequency Diagrams	Complete cumulative totals from a frequency table / Plot a cumulative-frequency curve from class frequencies / Estimate the median from a cumulative-frequency diagram / Estimate a percentage from a cumulative curve	6	20
10	4MA1-1H Q15	Direct & Inverse Proportion	Recover the input under inverse variation	3	26
11	4MA1-1H Q17	Area & Volume of Similar Shapes	Solve a volume difference or sum for similar solids	4	28
12	4MA1-1H Q19	Simultaneous Equations	Line with mixed quadratic relation	5	30
13	4MA1-1H Q22	Vectors	Find an intersection vector from two paths	5	32
14	4MA1-1H Q23	Transformations of Graphs	Horizontal translation	2	34
15	4MA1-1H Q24	Differentiation	Recover curve parameters from point and gradient data	6	36
16	4MA1-2H Q3 Q3(a)	Congruence, Similarity & Geometrical Proof	Find a corresponding length in similar triangles	2	38
17	4MA1-2H Q3 Q3(b)	Congruence, Similarity & Geometrical Proof	Solve a chained or algebraic similarity ratio	1	40
18	4MA1-2H Q5 Q5(a)	Bearings, Scale Drawing & Constructions	Plot a point from bearing and distance	3	42
19	4MA1-2H Q5 Q5(b)	Bearings, Scale Drawing & Constructions	Convert a map scale to 1:n	1	45
20	4MA1-2H Q7	Prime Factors, HCF & LCM	LCM of ordinary integers	3	47

No.	Source	Chapter	Focus	Marks	Page
21	4MA1-2H Q8 Q8(a)	Percentages	Calculate a percentage increase or decrease	2	49
22	4MA1-2H Q8 Q8(b)	Percentages	Reverse an increase or changed population/value	3	51
23	4MA1-2H Q9	Statistics Toolkit	Recover a missing value or frequency from a mean	4	53
24	4MA1-2H Q10	Simultaneous Equations	Decimal or fractional simultaneous coefficients	3	55
25	4MA1-2H Q11	Angles in Polygons & Parallel Lines	Find interior or exterior angle of a regular polygon	4	57
26	4MA1-2H Q12	Powers, Roots & Standard Form	Raise a standard-form quantity to a power	3	59
27	4MA1-2H Q13	Graphing Inequalities	Derive the sloping boundary equation from the graph	3	61
28	4MA1-2H Q15	Statistics Toolkit	Find quartiles and IQR from discrete data	3	63
29	4MA1-2H Q16	Circle Theorems	Complete a multi-theorem circle-angle chain	4	65
30	4MA1-2H Q18	Algebraic Proof	Fixed remainder modulo a divisor	3	67
31	4MA1-2H Q19	Circle Theorems	Use the internal intersecting-chords product	3	69
32	4MA1-2H Q21 Q21(a)	Graphs of Functions	Estimate roots from axis crossings	2	71
33	4MA1-2H Q21 Q21(b)	Graphs of Functions	Draw a line to solve a nonlinear equation	3	73
34	4MA1-2H Q22	Solving Inequalities	Contextual quadratic feasible range	5	76
35	4MA1-2H Q24	Differentiation	Instantaneous rest or direction reversal	5	78
36	4MA1-2H Q25 Q25(a)	Functions	Inverse of a restricted quadratic function	4	80
37	4MA1-2H Q25 Q25(b)	Functions	Domain and range swap under inversion	1	82
38	4MA1-2H Q26	Sequences	Nonlinear or integer-constrained series recovery	5	84

Original question 01

4MA1-1H Q1 Q1(d)

ORIGINAL QUESTION
2 marks

(d) Make t the subject of $c = t^3 - 8v$

.....

(2)

Worked solution 01

Chapter: Rearranging Formulas

MODULAR UNIT 2

2 marks

Q1(d) – Chapter: Rearranging Formulas

Family: Undo a single power or root in a formula • Variant: Single squared/powered subject

Method

c = t^3 − 8v gives t^3 = c + 8v.

Why: Add 8v to both sides.

Method

t = cube_root(c + 8v).

Why: Take the real cube root of both sides.

Final answer

t: $t = \sqrt[3]{(c + 8v)}$

Original question 02

4MA1-1H Q2

ORIGINAL QUESTION

3 marks

2 Danil, Gabriel and Hadley share some money in the ratios 3 : 5 : 9
The difference between the amount of money that Gabriel receives and the amount of money that Hadley receives is 196 euros.

Work out the amount of money that Danil receives.

..... euros

Worked solution 02

Chapter: Ratio Problem Solving

MODULAR UNIT 2
3 marks

Q2 – Chapter: Ratio Problem Solving

Family: Recover the ratio scale from a difference • Variant: Difference between two shares

Method
The difference in shares is $(9-5)=4$ parts, so one part is $196 \div 4 = 49$.
Why: Gabriel and Hadley correspond to 5 and 9 parts.

Method
Danil receives $3 \times 49 = 147$.
Why: Danil has three ratio parts.

Method
Therefore Danil receives 147 euros.
Why: Give the requested amount with units.

Final answer
Danil: 147 euros

Original question 03

4MA1-1H Q4

ORIGINAL QUESTION

5 marks

4 Sarah makes and sells mugs.

One day she makes 150 mugs.
Her total cost for making these mugs is £1140

Of these mugs

$\frac{2}{5}$ are small mugs

32% are medium mugs

and the rest are large mugs

Here is Sarah's price list for selling each mug.

MUGS	
Small	**£8.50**
Medium	**£11.20**
Large	**£14.20**

Sarah sells all 150 mugs.

Work out her percentage profit.
Give your answer correct to the nearest whole number.

.....%

Worked solution 03

Chapter: Percentages

MODULAR UNIT 2
5 marks

Q4 – Chapter: Percentages

Family: Measure or apply a single percentage change • Variant: Profit, loss or percentage margin from costs and revenue

Method
Small mugs = $(2/5)\times150 = 60$ and medium mugs = $0.32\times150 = 48$.
Why: Convert the fraction and percentage of 150 mugs.

Method
Large mugs = $150-60-48 = 42$.
Why: The remaining mugs are large.

Method
Income = $60\times8.50 + 48\times11.20 + 42\times14.20 = 1644$ pounds.
Why: Multiply each quantity by its selling price and add.

Method
Profit = $1644-1140 = 504$ pounds.
Why: Subtract total cost from total income.

Method
Percentage profit = $(504/1140)\times100 = 44.2105...\% \approx 44\%$.
Why: Use profit divided by cost and round to the nearest whole percent.

Final answer
percentage profit: 44%

Original question 04

4MA1-1H Q5 Q5(a)

ORIGINAL QUESTION

3 marks

5 Jenny has six cards.

Each card has a whole number written on it so that

the smallest number is 5
the largest number is 24
the median of the six numbers is 14
the mode of the six numbers is 8

Jenny arranges her cards so that the numbers are in order of size.



(a) For the remaining four cards, write on each dotted line a number that could be on the card.

(3)

Worked solution 04

Chapter: Statistics Toolkit

MODULAR UNIT 2

3 marks

Q5(a) – Chapter: Statistics Toolkit

Family: Calculate and reverse discrete averages • Variant: Construct a data set from stated averages and range

Method

A valid ordered set is 5, 8, 8, 20, 21, 24.

Why: It respects the smallest and largest cards.

Method

The middle pair is 8 and 20, whose mean is $(8+20)/2 = 14$.

Why: The median of six ordered values is the mean of the third and fourth.

Method

The mode is 8, because 8 occurs twice and the other listed values occur once.

Why: Check the stated mode.

Final answer

six cards: 5, 8, 8, 20, 21, 24

Original question 05

4MA1-1H Q5 Q5(b)

ORIGINAL QUESTION

3 marks

A basketball team plays 6 games.
After playing 5 games, the team has a mean score of 21 points per game.
After playing 6 games, the team has a mean score of 23 points per game.

(b) Work out the number of points the team scored in its 6th game.

.....

(3)

Worked solution 05

Chapter: Statistics Toolkit

MODULAR UNIT 2

3 marks

Q5(b) – Chapter: Statistics Toolkit

Family: Calculate and reverse discrete averages • Variant: Find a required score for a target mean

Method

After five games the total score is $5\times21 = 105$.

Why: Mean multiplied by number of games gives the total.

Method

After six games the total score is $6\times23 = 138$.

Why: Use the second mean.

Method

Sixth-game score $= 138-105 = 33$ points.

Why: Subtract the first five-game total.

Final answer

sixth-game score: 33 points

Original question 06

4MA1-1H Q6 Q6(a)

ORIGINAL QUESTION
2 marks

6 (a) Solve the inequality $5x - 7 \leqslant 2$

.....

(2)

Worked solution 06

Chapter: Solving Inequalities

MODULAR UNIT 2
2 marks

Q6(a) – Chapter: Solving Inequalities

Family: Solve linear inequalities • Variant: One-sided linear inequality

Method

$5x-7 \leq 2$ gives $5x \leq 9$.

Why: Add 7 to both sides.

Method

$x \leq 9/5 = 1.8$.

Why: Divide by the positive number 5.

Final answer

solution: $x \leq 1.8$

Original question 07
4MA1-1H Q8

ORIGINAL QUESTION
2 marks

8 $a = 4.2 \times 10^{-24}$ $b = 3 \times 10^{145}$

Work out the value of $a \times b$
Give your answer in standard form.

.....

Worked solution 07

Chapter: Powers, Roots & Standard Form

MODULAR UNIT 2
2 marks

Q8 – Chapter: Powers, Roots & Standard Form

Family: Calculate and model in standard form • Variant: Multiply or divide standard-form numbers

Method

$(4.2\times10^{-24})(3\times10^{145})=12.6\times10^{121}$.

Why: Multiply coefficients and add powers of ten.

Method

$12.6\times10^{121} = 1.26\times10^{122}$.

Why: Move the decimal one place and increase the exponent by one.

Final answer

standard form: 1.26×10^{122}

Original question 08

4MA1-1H Q11

ORIGINAL QUESTION

3 marks

11 Himari invests 200 000 yen for 3 years in a savings account paying compound interest.

The rate of interest is 1.8% for the first year and x% for each of the second year and the third year.

The value of the investment at the end of the third year is 209 754 yen.

Work out the value of x
Give your answer correct to one decimal place.

$x =$ .....

Worked solution 08

Chapter: Compound Interest & Depreciation

MODULAR UNIT 2
3 marks

Q11 – Chapter: Compound Interest & Depreciation

Family: Compare compound and mixed investment paths • Variant: Changing annual percentage rates

Method

After year 1 the value is $200000 \times 1.018 = 203600$ yen.

Why: Apply the first-year interest rate.

Method

The two-year multiplier is $209754/203600 = 1.015000...$, so $(1+x/100)^2 = 1.015000....$

Why: Compare the final value with the value after year 1.

Method

$1+x/100 = 1.015$, hence $x = 1.5\%$.

Why: Take the positive square root and convert the multiplier to a percentage.

Final answer

rate: $x=1.5\%$

Original question 09

4MA1-1H Q12 Q12(a), Q12(b), Q12(c), Q12(d)

ORIGINAL QUESTION

6 marks

12 The table gives information about the times, in minutes, taken by 80 customers to do their shopping in a supermarket.

Time taken (t minutes)	Frequency
$0 < t \leqslant 10$	7
$10 < t \leqslant 20$	26
$20 < t \leqslant 30$	24
$30 < t \leqslant 40$	14
$40 < t \leqslant 50$	7
$50 < t \leqslant 60$	2

(a) Complete the cumulative frequency table.

Time taken (t minutes)	Cumulative frequency
$0 < t \leqslant 10$	
$0 < t \leqslant 20$	
$0 < t \leqslant 30$	
$0 < t \leqslant 40$	
$0 < t \leqslant 50$	
$0 < t \leqslant 60$	

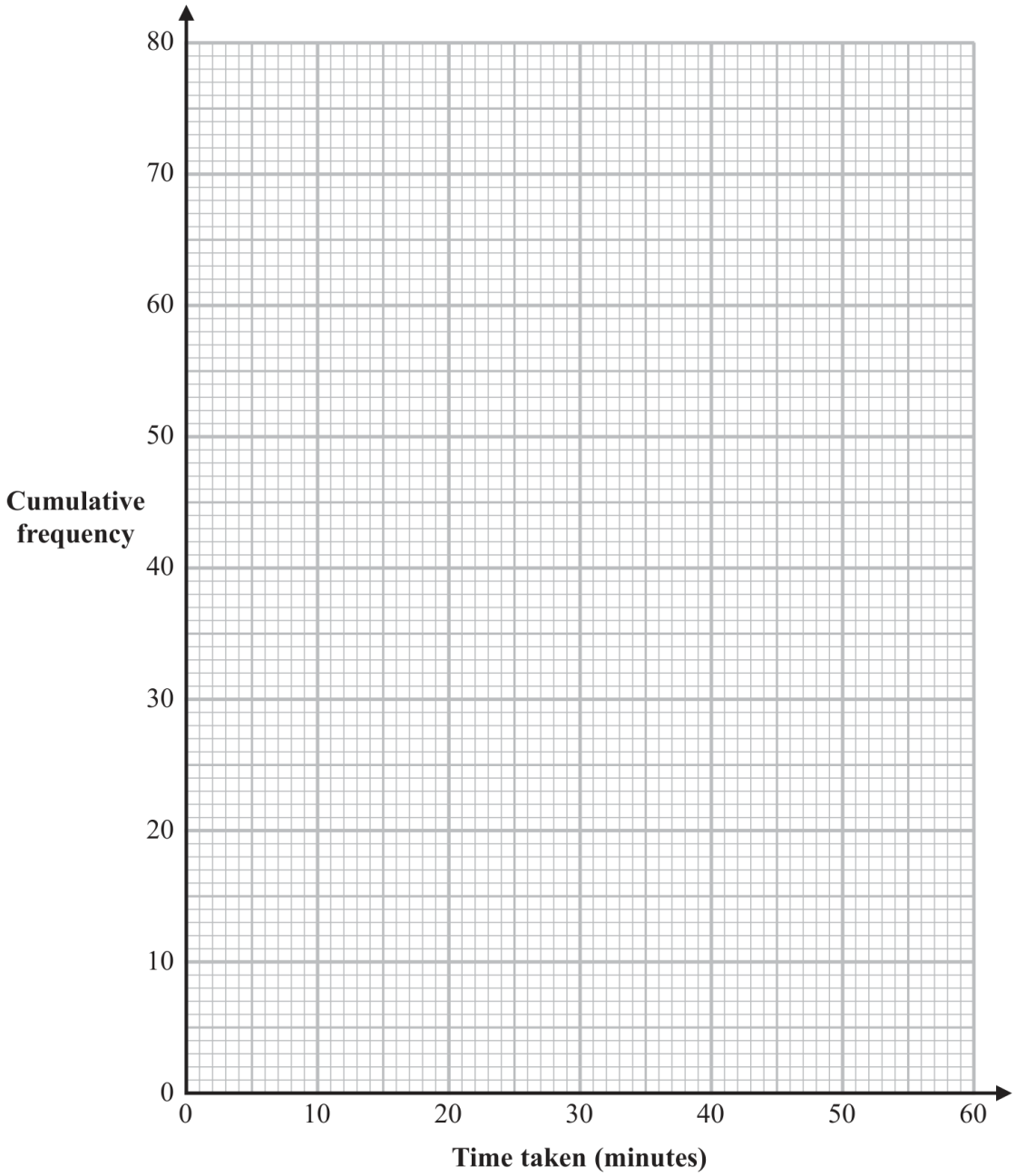
(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.

Original question 09 (continued)

4MA1-1H Q12 Q12(a), Q12(b), Q12(c), Q12(d)

ORIGINAL QUESTION
6 marks



(2)

Original question 09 (continued)

4MA1-1H Q12 Q12(a), Q12(b), Q12(c), Q12(d)

ORIGINAL QUESTION

6 marks

(c) Use your graph to find an estimate for the median time taken.

..... minutes

(1)

One of the 80 customers is chosen at random.

(d) Use your graph to find an estimate for the probability that the time taken by this customer was more than 42 minutes.

.....

(2)

Worked solution 09

Chapter: Cumulative Frequency Diagrams

MODULAR UNIT 2
6 marks

Q12(a) – Chapter: Cumulative Frequency Diagrams

Family: Construct cumulative-frequency diagrams • Variant: Complete cumulative totals from a frequency table

Method

The cumulative frequencies are 7, 33, 57, 71, 78, 80.
Why: Add the class frequencies successively.

Final answer

cumulative frequencies: 7, 33, 57, 71, 78, 80

Q12(b) – Chapter: Cumulative Frequency Diagrams

Family: Construct cumulative-frequency diagrams • Variant: Plot a cumulative-frequency curve from class frequencies

Method

Plot (10,7), (20,33), (30,57), (40,71), (50,78), (60,80).
Why: Cumulative frequency is plotted at the upper class boundaries.

Method

Join the points with straight or smooth connected segments.
Why: A cumulative-frequency graph joins the plotted points in order.

Final answer

graph: Correct cumulative-frequency curve through the six points

Q12(c) – Chapter: Cumulative Frequency Diagrams

Family: Estimate and compare location and spread from cumulative frequency • Variant: Estimate the median from a cumulative-frequency diagram

Method

Half of 80 is 40; reading the cumulative-frequency curve gives a median time in the range 21–24 minutes.
Why: Use CF=40 and follow the reviewed graph from part (b).

Final answer

median: 21–24 minutes

Q12(d) – Chapter: Cumulative Frequency Diagrams

Family: Read counts and thresholds from cumulative frequency • Variant: Estimate a percentage from a cumulative curve

Method

The graph gives about 72 customers with time at most 42 minutes.

Why: Read the cumulative frequency at 42 minutes.

Method

Customers taking more than 42 minutes $= 80-72 = 8$, so $\mathrm{P} = 8/80 = 1/10$.

Why: Subtract from the total and divide by 80.

Final answer

probability: $8/80 = 1/10$

Completed diagram 09

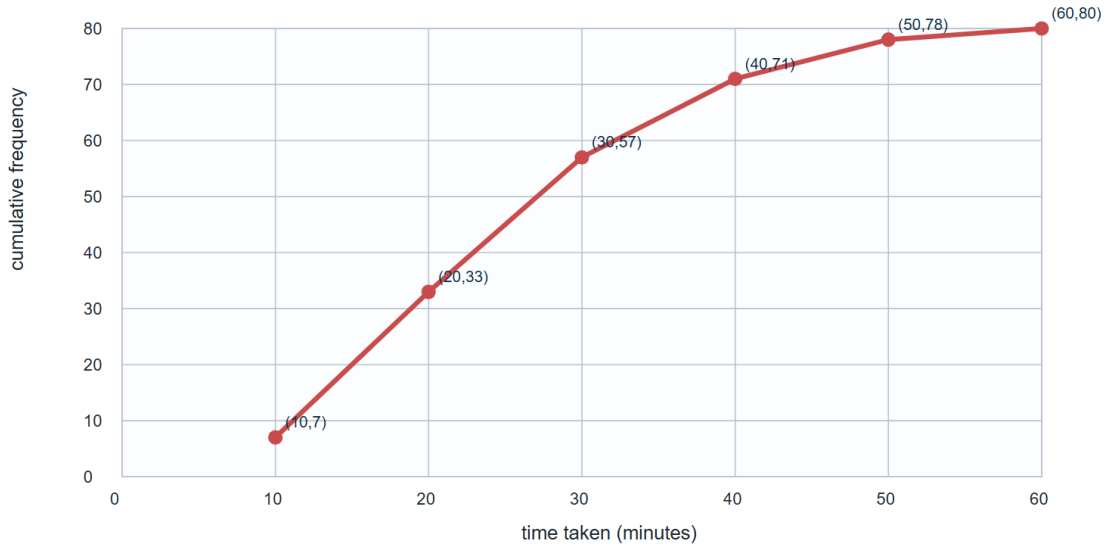
Chapter: Cumulative Frequency Diagrams

MODULAR UNIT 2

6 marks

Q12 • Completed cumulative-frequency graph

Points at upper class boundaries



Elite IGCSE Mathematics • Dr Eslam Ahmed • eliteigcse.com • WhatsApp +20 112 000 9622

Original question 10

4MA1-1H Q15

ORIGINAL QUESTION

3 marks

15 A is inversely proportional to C^2

$A = 40$ when $C = 1.5$

Calculate the value of C when $A = 1000$

$C =$ .....

Worked solution 10

Chapter: Direct & Inverse Proportion

MODULAR UNIT 2

3 marks

Q15 – Chapter: Direct & Inverse Proportion

Family: Build an inverse-variation model • Variant: Recover the input under inverse variation

Method

A=k/C^2 and 40=k/(1.5)^2, so k=90.

Why: Use inverse proportionality to find the constant.

Method

When A=1000, 1000=90/C^2, so C^2=0.09.

Why: Substitute the new value of A.

Method

C=0.3 (taking the positive value for this quantity).

Why: Take the positive square root.

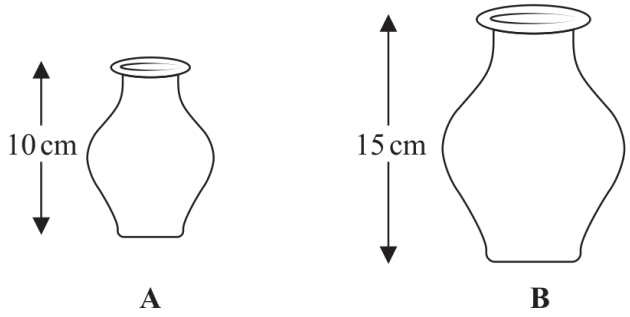
Final answer

C: 0.3

Original question 11
4MA1-1H Q17

ORIGINAL QUESTION
4 marks

17 **A** and **B** are two similar vases.



A **B**

Diagram **NOT** accurately drawn

Vase **A** has height 10 cm.
Vase **B** has height 15 cm.

The difference between the volume of vase **A** and the volume of vase **B** is 1197 cm^3

Calculate the volume of vase **A**

..... cm^3

Worked solution 11

Chapter: Area & Volume of Similar Shapes

MODULAR UNIT 2
4 marks

Q17 – Chapter: Area & Volume of Similar Shapes

Family: Use volume scale factors of similar solids • Variant: Solve a volume difference or sum for similar solids

Method
The linear scale factor from A to B is 15/10=1.5, so the volume scale factor is 1.5^3=27/8.
Why: Similar solids scale volumes by the cube of the linear factor.

Method
If V is the volume of A, (27/8)V−V=1197.
Why: Use the stated volume difference.

Method
(19/8)V=1197, so V=1197×8/19.
Why: Solve the linear equation in V.

Method
V=504 cm^3.
Why: Evaluate and state the volume of vase A.

Final answer
volume of A: 504 cm^3

Original question 12

4MA1-1H Q19

ORIGINAL QUESTION

5 marks

19 Solve the simultaneous equations

$$3x^2 + y^2 - xy = 5$$
$$y = 2x - 3$$

Show clear algebraic working.

.....

Worked solution 12

Chapter: Simultaneous Equations

MODULAR UNIT 2
5 marks

Q19 – Chapter: Simultaneous Equations

Family: Solve a linear-quadratic system • Variant: Line with mixed quadratic relation

Method
Substitute $y=2x-3$ into $3x^2+y^2-xy=5$ to obtain $5x^2-9x+4=0$.
Why: Use the given linear relation to form one quadratic.

Method
$(5x-4)(x-1)=0$, so $x=0.8$ or $x=1$.
Why: Factorise the quadratic.

Method
For $x=0.8$, $y=2(0.8)-3=-1.4$.
Why: Substitute the first x-value.

Method
For $x=1$, $y=2(1)-3=-1$.
Why: Substitute the second x-value.

Method
The solutions are $(0.8,-1.4)$ and $(1,-1)$.
Why: State both ordered pairs.

Final answer
solutions: $(0.8,-1.4)$ and $(1,-1)$

Original question 13
4MA1-1H Q22

ORIGINAL QUESTION
5 marks

22 The diagram shows triangle OAB

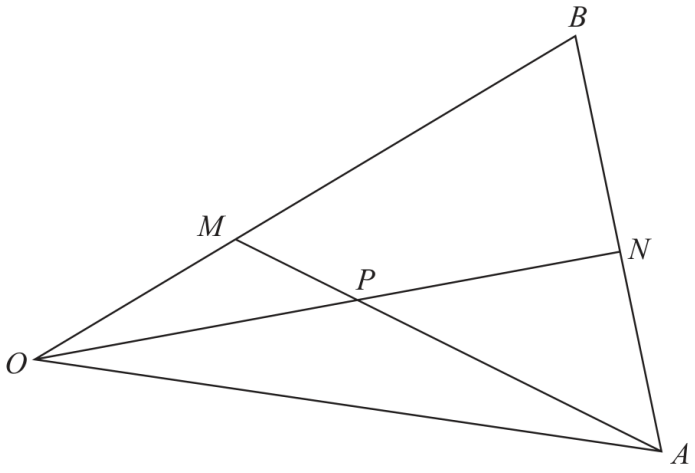


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = 8\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$

M is the point on OB such that $OM : MB = 1 : 2$
N is the midpoint of AB
P is the point of intersection of ON and AM

Using a vector method, find $\overrightarrow{OP}$ as a simplified expression in terms of **a** and **b**
Show your working clearly.

$\overrightarrow{OP} =$ .....

Worked solution 13

Chapter: Vectors

MODULAR UNIT 2
5 marks

Q22 – Chapter: Vectors

Family: Use vectors with ratios and intersections • Variant: Find an intersection vector from two paths

Method
OM=(1/3)OB=2b, so M has position vector 2b.
Why: Use OM:MB=1:2.

Method
N is the midpoint of AB, so ON=4a+3b.
Why: Average OA=8a and OB=6b.

Method
Let OP=λ(4a+3b) and also OP=8a+t(2b−8a).
Why: P lies on both ON and AM.

Method
Comparing coefficients gives 8−8t=4λ and 2t=3λ.
Why: Equate the a and b components.

Method
Solving gives λ=1/2, so OP=2a+3/2 b.
Why: Substitute λ into OP=λON.

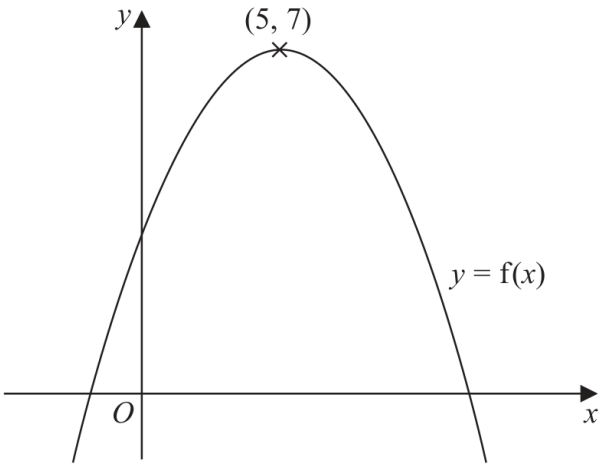
Final answer
OP: 2a + (3/2)b

Original question 14

4MA1-1H Q23

ORIGINAL QUESTION
2 marks

23 The diagram shows a sketch of the curve with equation $y = f(x)$



There is only one maximum point on the curve.
The coordinates of this maximum point are (5, 7)

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

(i) $y = f(x + 9)$

(..... , ...)

(ii) $y = f(x) + 3$

(..... , ...)

Worked solution 14

Chapter: Transformations of Graphs

MODULAR UNIT 2

2 marks

Q23 – Chapter: Transformations of Graphs

Family: Map a known graph feature • Variant: Horizontal translation

Method

For $y=f(x+9)$, the graph moves 9 units left, so $(5,7)$ becomes $(-4,7)$.

Why: An input translation $x+9$ shifts the graph left by 9.

Method

For $y=f(x)+3$, the graph moves 3 units up, so $(5,7)$ becomes $(5,10)$.

Why: An output translation $+3$ shifts all y-values up by 3.

Final answer

maximum for $y=f(x+9)$: $(-4,7)$

Final answer

maximum for $y=f(x)+3$: $(5,10)$

Original question 15

4MA1-1H Q24

ORIGINAL QUESTION

6 marks

24 The curve **C** has equation $y = ax^3 + bx^2 - 12x + 6$ where a and b are constants.

The point A with coordinates $(2, -6)$ lies on **C**
The gradient of the curve at A is 16

Find the y coordinate of the point on the curve whose x coordinate is 3
Show clear algebraic working.

$y =$ .....

Worked solution 15

Chapter: Differentiation

MODULAR UNIT 2
6 marks

Q24 – Chapter: Differentiation

Family: Find and classify stationary points • Variant: Recover curve parameters from point and gradient data

Method
At $(2,-6)$, $-6=8a+4b-24+6$, so $8a+4b=12$.
Why: Substitute the point into the cubic equation.

Method
$dy/dx=3ax^2+2bx-12$.
Why: Differentiate the curve.

Method
At $x=2$, $16=12a+4b-12$, so $12a+4b=28$.
Why: Use the given gradient at A.

Method
Solving $8a+4b=12$ and $12a+4b=28$ gives $a=4$ and $b=-5$.
Why: Solve the simultaneous linear equations.

Method
At x=3, y=4(3)^3−5(3)^2−12(3)+6.
Why: Substitute $x=3$ and the constants.

Method
$y=33$.
Why: Evaluate the expression.

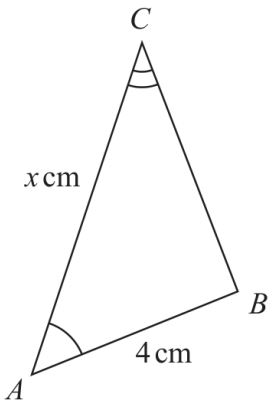
Final answer
y: 33

Original question 16

4MA1-2H Q3 Q3(a)

ORIGINAL QUESTION
2 marks

3



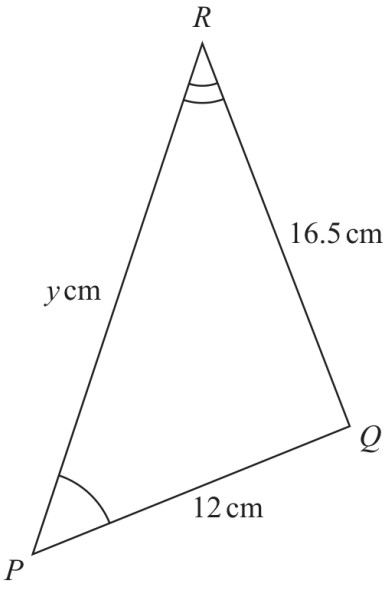


Diagram **NOT** accurately drawn

Triangle ABC is similar to triangle PQR

$AB = 4\,\text{cm}$ $PQ = 12\,\text{cm}$ $RQ = 16.5\,\text{cm}$ $AC = x\,\text{cm}$ $PR = y\,\text{cm}$

(a) Calculate the length of BC

..... cm

(2)

Worked solution 16

Chapter: Congruence, Similarity & Geometrical Proof

MODULAR UNIT 2
2 marks

Q3(a) – Chapter: Congruence, Similarity & Geometrical Proof

Family: Use length scale factor in similar figures • Variant: Find a corresponding length in similar triangles

Method

The scale factor from triangle ABC to PQR is PQ/AB=12/4=3.
Why: Corresponding lengths in similar triangles have a constant ratio.

Method

BC=16.5/3=5.5 cm.
Why: Divide the corresponding length by the scale factor.

Final answer

BC: 5.5 cm

Original question 17

4MA1-2H Q3 Q3(b)

ORIGINAL QUESTION

1 marks

(b) Write down an expression for y in terms of x

$y =$ .....

(1)

Worked solution 17

Chapter: Congruence, Similarity & Geometrical Proof

MODULAR UNIT 2

1 marks

Q3(b) – Chapter: Congruence, Similarity & Geometrical Proof

Family: Use length scale factor in similar figures • Variant: Solve a chained or algebraic similarity ratio

Method

The corresponding side PR is three times AC, so y=3x.

Why: Use the same similarity scale factor.

Final answer

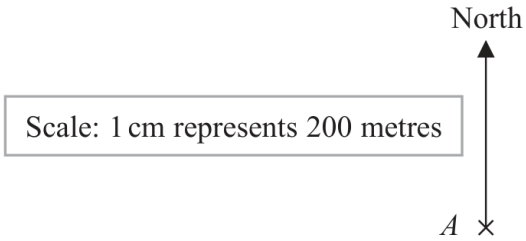
y: y=3x

Original question 18

4MA1-2H Q5 Q5(a)

ORIGINAL QUESTION
3 marks

5 The scale diagram shows the position on a map of a house, A



House C is on a bearing of 110° from A
The distance from A to C is 700 m

(a) Mark the position of C on the diagram with a cross (×)
Label your cross C

(3)

Worked solution 18

Chapter: Bearings, Scale Drawing & Constructions

MODULAR UNIT 2

3 marks

Q5(a) – Chapter: Bearings, Scale Drawing & Constructions

Family: Scale drawing and map location • Variant: Plot a point from bearing and distance

Method

700 m corresponds to 700/200=3.5 cm on the map.

Why: Use the scale 1 cm represents 200 m.

Method

From A, draw a ray on a bearing of 110° clockwise from north.

Why: Bearings are measured clockwise from north.

Method

Mark and label C at the end of this 3.5 cm ray.

Why: The distance and bearing locate C uniquely.

Final answer

map position: C at 3.5 cm on bearing 110° from A

Completed diagram 18

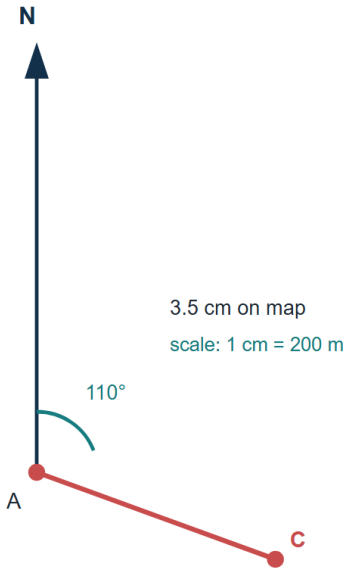
Chapter: Bearings, Scale Drawing & Constructions

MODULAR UNIT 2

3 marks

Q5 • Completed bearing map

C is 700 m from A on a bearing of 110°



Original question 19

4MA1-2H Q5 Q5(b)

ORIGINAL QUESTION

1 marks

(b) Write the scale of the map in the form $1 : n$

1 : .....

(1)

Worked solution 19

Chapter: Bearings, Scale Drawing & Constructions

MODULAR UNIT 2
1 marks

Q5(b) – Chapter: Bearings, Scale Drawing & Constructions

Family: Scale drawing and map location • Variant: Convert a map scale to 1:n

Method

1 cm represents 200 m, so 1 cm represents 20000 cm; the scale is 1:20000.
Why: Convert both units to centimetres.

Final answer

scale: 1:20000

Original question 20

4MA1-2H Q7

ORIGINAL QUESTION

3 marks

7 Find the lowest common multiple (LCM) of 28, 42 and 63
Show your working clearly.

.....

Worked solution 20

Chapter: Prime Factors, HCF & LCM

MODULAR UNIT 2
3 marks

Q7 – Chapter: Prime Factors, HCF & LCM

Family: Choose the common-prime envelope • Variant: LCM of ordinary integers

Method

28=2^2×7, 42=2×3×7 and 63=3^2×7.
Why: Prime-factorise each number.

Method

The LCM uses the greatest power of every prime: 2^2×3^2×7.
Why: Take each prime at its maximum exponent.

Method

LCM=252.
Why: Evaluate the product.

Final answer

LCM: 252

Original question 21

4MA1-2H Q8 Q8(a)

ORIGINAL QUESTION

2 marks

8 The table gives information about the average house price in England in 2018 and in 2019

Year	**2017**	**2018**	**2019**
Average house price (£)		228 314	231 776

(a) Work out the percentage increase in the average house price from 2018 to 2019
Give your answer correct to one decimal place.

..... %

(2)

Worked solution 21

Chapter: Percentages

MODULAR UNIT 2
2 marks

Q8(a) – Chapter: Percentages

Family: Measure or apply a single percentage change • Variant: Calculate a percentage increase or decrease

Method

Percentage increase $= (231776 - 228314)/228314 \times 100$.

Why: Use change divided by original value.

Method

$= 1.516...\% \approx 1.5\%$.

Why: Round to one decimal place.

Final answer

percentage increase: 1.5%

Original question 22

4MA1-2H Q8 Q8(b)

ORIGINAL QUESTION

3 marks

The average house price in 2019 was 7.7% greater than the average house price in 2017

(b) Work out the average house price in 2017
Give your answer correct to 3 significant figures.

£ .....

(3)

Worked solution 22

Chapter: Percentages

MODULAR UNIT 2
3 marks

Q8(b) – Chapter: Percentages

Family: Recover an original amount • Variant: Reverse an increase or changed population/value

Method

2019 price $=1.077\times$2017 price.

Why: A 7.7% increase has multiplier 1.077.

Method

2017 price=231776/1.077=215205.19... pounds.

Why: Reverse the percentage increase.

Method

To 3 significant figures, the 2017 price is £215000.

Why: Round as requested.

Final answer

2017 price: £215000

Original question 23
4MA1-2H Q9

ORIGINAL QUESTION
4 marks

9 The frequency table gives information about the number of points scored by a player.

Number of points	Frequency
0	13
1	17
2	8
3	x
4	11

The mean number of points scored is 2

Work out the value of x

$x =$ .....

Worked solution 23

Chapter: Statistics Toolkit

MODULAR UNIT 2

4 marks

Q9 – Chapter: Statistics Toolkit

Family: Calculate and reverse discrete averages • Variant: Recover a missing value or frequency from a mean

Method

The weighted total is $0\times13+1\times17+2\times8+3x+4\times11=77+3x$.

Why: Multiply each value by its frequency.

Method

The total frequency is $13+17+8+x+11=49+x$.

Why: Add all frequencies.

Method

$(77+3x)/(49+x)=2$, so $77+3x=98+2x$.

Why: Use the stated mean.

Method

$x=21$.

Why: Solve the linear equation.

Final answer

x: 21

Original question 24

4MA1-2H Q10

ORIGINAL QUESTION

3 marks

10 Solve the simultaneous equations

$$3x + 5y = 3.1$$
$$6x + 3y = 3.75$$

Show clear algebraic working.

$x =$ .....

$y =$ .....

Worked solution 24

Chapter: Simultaneous Equations

MODULAR UNIT 2
3 marks

Q10 – Chapter: Simultaneous Equations

Family: Eliminate between two linear equations • Variant: Decimal or fractional simultaneous coefficients

Method
Multiply the first equation by 2: $6x+10y=6.2$.
Why: Make the x-coefficients equal.

Method
Subtract $6x+3y=3.75$ to get $7y=2.45$, so $y=0.35$.
Why: Eliminate x and solve for y.

Method
Substitute $y=0.35$: $6x+1.05=3.75$, hence $x=0.45$.
Why: Use either original equation.

Final answer
x,y: $x=0.45$, $y=0.35$

Original question 25

4MA1-2H Q11

ORIGINAL QUESTION

4 marks

11 The diagram shows a regular 10-sided polygon, *ABCDEFGHIJ*

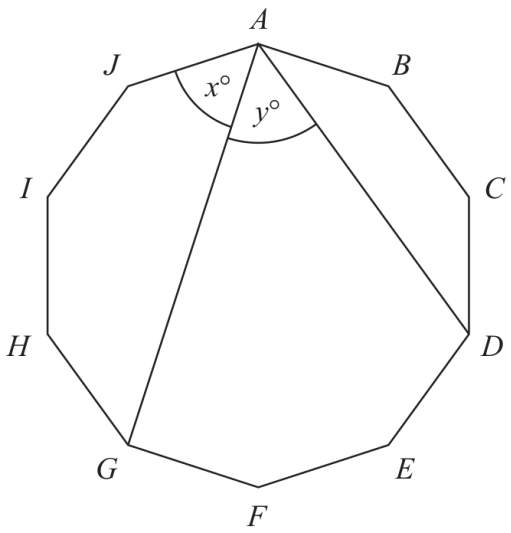


Diagram **NOT** accurately drawn

Show that $x = y$

Worked solution 25

Chapter: Angles in Polygons & Parallel Lines

MODULAR UNIT 2
4 marks

Q11 – Chapter: Angles in Polygons & Parallel Lines

Family: Use regular and general polygon angles • Variant: Find interior or exterior angle of a regular polygon

Method
The exterior angle of a regular decagon is $360/10=36°$, so each interior angle is $144°$.
Why: Use the polygon angle formula.

Method
In triangle formed at A, $x=144-90=54°$.
Why: Use the right/straight-angle relationship shown.

Method
The corresponding angle y is also $54°$ from the equal-angle/isosceles geometry.
Why: Use the symmetry of the regular decagon and the marked triangles.

Method
Thus $x=y=54°$.
Why: State the required result.

Final answer
angles: $x=y=54°$

Original question 26

4MA1-2H Q12

ORIGINAL QUESTION

3 marks

12 $a = 6 \times 10^{40}$

Work out the value of a^3
Give your answer in standard form.

.....

Worked solution 26

Chapter: Powers, Roots & Standard Form

MODULAR UNIT 2
3 marks

Q12 – Chapter: Powers, Roots & Standard Form

Family: Calculate and model in standard form • Variant: Raise a standard-form quantity to a power

Method

$(6\times10^{40})^3=6^3\times10^{120}=216\times10^{120}$.

Why: Cube the coefficient and multiply the exponent by 3.

Method

$216\times10^{120}=2.16\times10^{122}$.

Why: Normalize the coefficient to standard form.

Method

Therefore the value is 2.16×10^{122}.

Why: State the final answer.

Final answer

standard form: 2.16×10^{122}

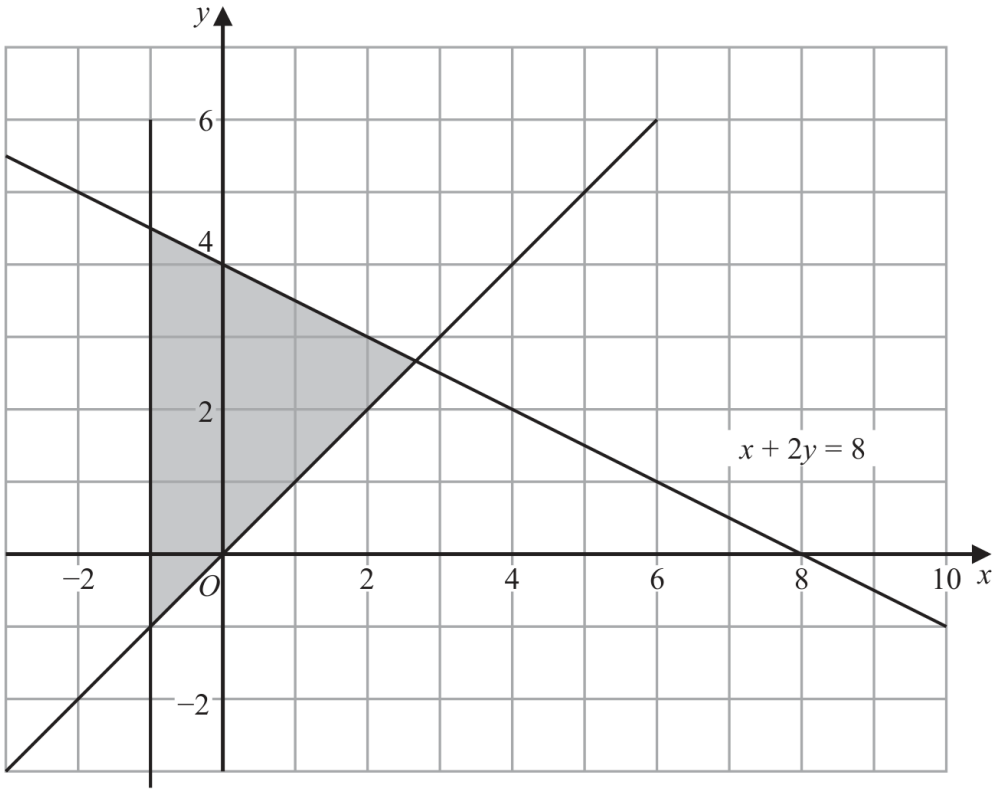
Original question 27

4MA1-2H Q13

ORIGINAL QUESTION

3 marks

13 The shaded region in the diagram is bounded by three lines.
The equation of one of the lines is given.



Write down three inequalities that define the shaded region.

.....

.....

.....

Worked solution 27

Chapter: Graphing Inequalities

MODULAR UNIT 2

3 marks

Q13 – Chapter: Graphing Inequalities

Family: Recover inequalities from a shaded region • Variant: Derive the sloping boundary equation from the graph

Method

The vertical boundary is $x=-1$ and the shaded side is $x\geq -1$.

Why: Test a point in the shaded region.

Method

The rising boundary is $y=x$ and the shaded side is $y\geq x$.

Why: Read the line and shaded side.

Method

The falling boundary is $x+2y=8$ and the shaded side is $x+2y\leq 8$.

Why: Use the labelled boundary equation and a test point.

Final answer

inequalities: $x\geq -1$, $y\geq x$, $x+2y\leq 8$

Original question 28

4MA1-2H Q15

ORIGINAL QUESTION

3 marks

15 Diyar recorded the distance, in kilometres, that he cycled each day for 11 days.
Here are his results.

8 10 12 13 5 23 21 7 5 16 14

Find the interquartile range of his results.

..... km

Worked solution 28

Chapter: Statistics Toolkit

MODULAR UNIT 2

3 marks

Q15 – Chapter: Statistics Toolkit

Family: Measure and compare spread • Variant: Find quartiles and IQR from discrete data

Method

Ordered data: 5,5,7,8,10,12,13,14,16,21,23.

Why: Sort the 11 distances.

Method

The lower and upper quartiles are 7 and 16.

Why: Use the quartile positions for 11 values.

Method

IQR=16−7=9 km.

Why: Subtract the quartiles.

Final answer

IQR: 9 km

Original question 29

4MA1-2H Q16

ORIGINAL QUESTION
4 marks

16 D, E, F and G are points on a circle, centre O

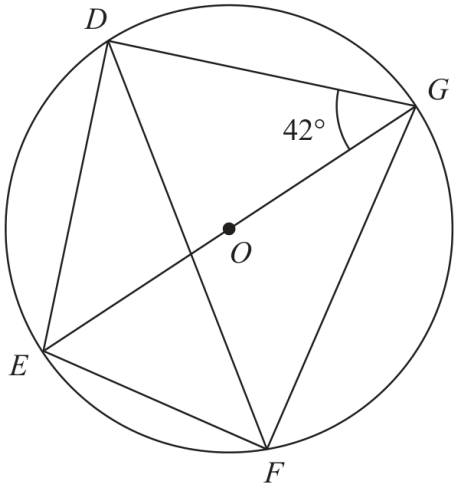


Diagram **NOT** accurately drawn

EOG is a diameter of the circle.

Angle $EGD = 42°$

Calculate the size of angle DFG
Give a reason for each stage of your working.

Angle DFG = ... °

Worked solution 29

Chapter: Circle Theorems

MODULAR UNIT 2

4 marks

Q16 – Chapter: Circle Theorems

Family: Write justified circle-angle chains • Variant: Complete a multi-theorem circle-angle chain

Method

EG is a diameter, so angle EFG=90°.

Why: An angle in a semicircle is a right angle.

Method

In triangle DEG, angle EDG=90° and angle EGD=42°, so angle DEG=48°.

Why: Angles in a triangle add to 180°.

Method

Angles DEG and DFG subtend the same chord DG, so angle DFG=48°.

Why: Angles in the same segment are equal.

Method

Therefore angle DFG is 48°.

Why: State the requested angle with reasons.

Final answer

angle DFG: 48°

Original question 30

4MA1-2H Q18

ORIGINAL QUESTION

3 marks

18 Prove that when the sum of the squares of any two consecutive odd numbers is divided by 8, the remainder is always 2
Show clear algebraic working.

Worked solution 30

Chapter: Algebraic Proof

MODULAR UNIT 2
3 marks

Q18 – Chapter: Algebraic Proof

Family: Prove divisibility or a remainder • Variant: Fixed remainder modulo a divisor

Method

Let the consecutive odd numbers be $2n-1$ and $2n+1$.
Why: Any two consecutive odd numbers have this form.

Method

Their square sum is $(2n-1)^2+(2n+1)^2=8n^2+2$.
Why: Expand and add.

Method

$8n^2$ is divisible by 8, so the remainder is always 2.
Why: Separate the multiple of 8 from the remainder.

Final answer

remainder: 2

Original question 31
4MA1-2H Q19

ORIGINAL QUESTION
3 marks

19

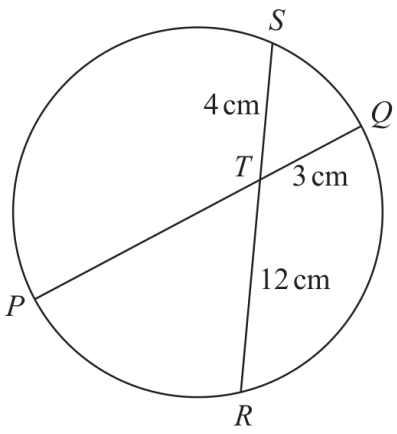


Diagram **NOT** accurately drawn

PTQ is a diameter of a circle.
RTS is a chord of the circle.

$TQ = 3$ cm $ST = 4$ cm $TR = 12$ cm

Calculate the radius of the circle.

..... cm

Worked solution 31

Chapter: Circle Theorems

MODULAR UNIT 2
3 marks

Q19 – Chapter: Circle Theorems

Family: Use intersecting chord and secant products • Variant: Use the internal intersecting-chords product

Method

By intersecting chords, $PT \times TQ = ST \times TR$, so $PT \times 3 = 4 \times 12$ and $PT = 16$ cm.

Why: Use the chord-intersection theorem.

Method

$PQ = PT + TQ = 16 + 3 = 19$ cm.

Why: P,T,Q are collinear and PQ is a diameter.

Method

Radius $= PQ/2 = 9.5$ cm.

Why: A radius is half a diameter.

Final answer

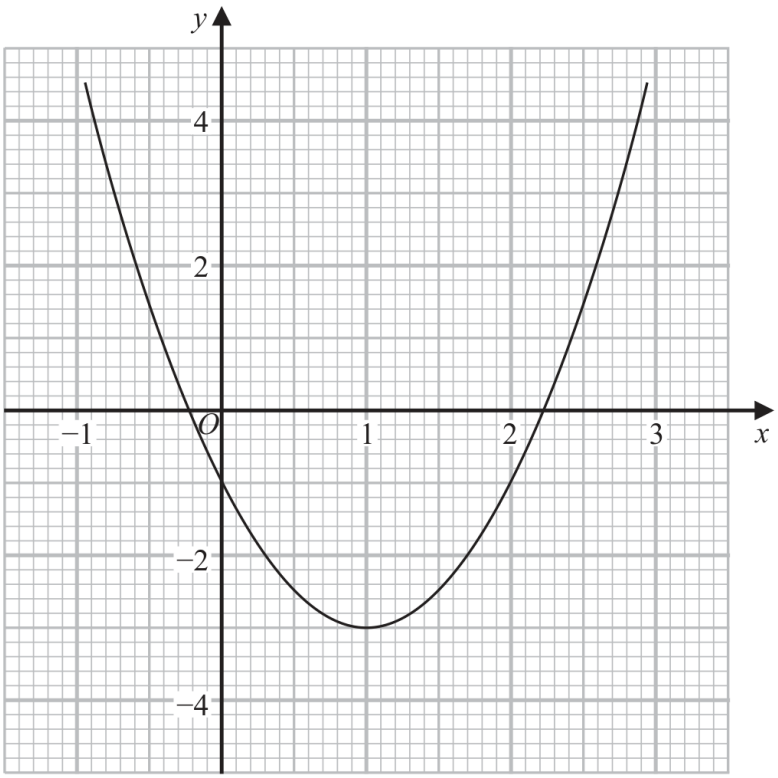
radius: 9.5 cm

Original question 32

4MA1-2H Q21 Q21(a)

ORIGINAL QUESTION
2 marks

21 Part of the graph of $y = 2x^2 - 4x - 1$ is shown on the grid.



(a) Use the graph to find estimates for the solutions of the equation $2x^2 - 4x - 1 = 0$
Give your solutions correct to one decimal place.

.....

(2)

Worked solution 32

Chapter: Graphs of Functions

MODULAR UNIT 2
2 marks

Q21(a) – Chapter: Graphs of Functions

Family: Solve using graph roots or intersections • Variant: Estimate roots from axis crossings

Method

The x-intercepts of $y=2x^2-4x-1$ are approximately $x=-0.2$ and $x=2.2$.

Why: Read where the curve crosses the x-axis.

Method

Both values are given to one decimal place.

Why: Round the graph readings as requested.

Final answer

roots: -0.2 and 2.2

Original question 33

4MA1-2H Q21 Q21(b)

ORIGINAL QUESTION

3 marks

(b) By drawing a suitable straight line on the grid, find estimates for the solutions of the equation $x^2 - x - 1 = 0$
Show your working clearly.
Give your solutions correct to one decimal place.

.....

(3)

Worked solution 33

Chapter: Graphs of Functions

MODULAR UNIT 2
3 marks

Q21(b) – Chapter: Graphs of Functions

Family: Solve using graph roots or intersections • Variant: Draw a line to solve a nonlinear equation

Method

For $y=x^2-x-1$, use $y=-2x+1$ as the straight line.

Why: Rearrange $x^2-x-1=0$ to $x^2-x=1$ and compare with the displayed quadratic.

Method

Draw $y=-2x+1$ through $(0,1)$ and $(-1,3)$.

Why: Use two points to draw the line on the supplied grid.

Method

The intersections give $x\approx-0.6$ and $x\approx1.6$.

Why: Read the two x-coordinates to one decimal place.

Final answer

roots: -0.6 and 1.6

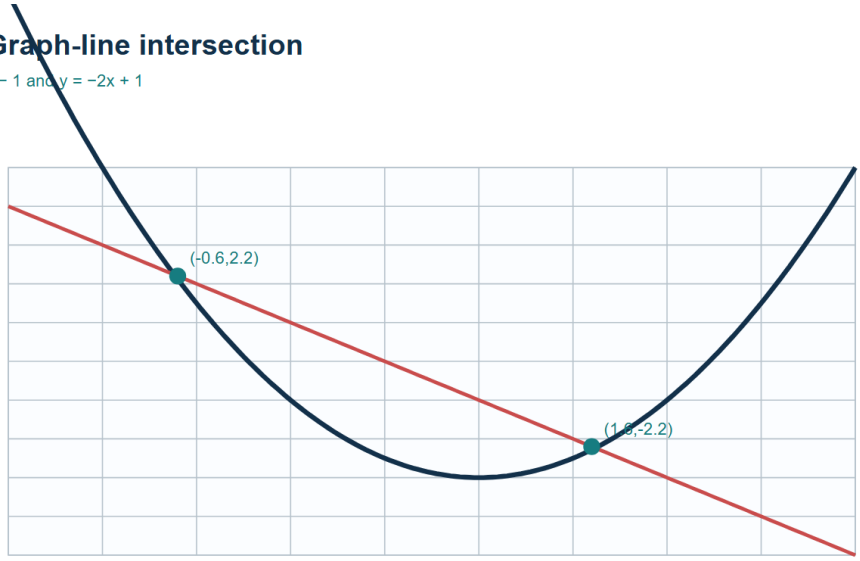
Completed diagram 33

Chapter: Graphs of Functions

MODULAR UNIT 2
3 marks

Q21 • Graph-line intersection

$y = 2x^2 - 4x - 1$ and $y = -2x + 1$



x-intersections: −0.6 and 1.6

Original question 34

4MA1-2H Q22

ORIGINAL QUESTION

5 marks

22 Here is a rectangle.



Diagram **NOT** accurately drawn

Given that the area of the rectangle is less than $75\,\text{cm}^2$

find the range of possible values of x

.....

Worked solution 34

Chapter: Solving Inequalities

MODULAR UNIT 2
5 marks

Q22 – Chapter: Solving Inequalities

Family: Solve quadratic inequalities • Variant: Contextual quadratic feasible range

Method
$(2x+3)(x-1)<75$ gives $2x^2+x-78<0$.
Why: Expand and move 75 to the left.

Method
The critical values solve $2x^2+x-78=0=(x-6)(2x+13)$, so $x=6$ or $x=-6.5$.
Why: Factorise the boundary equation.

Method
Because the rectangle side $x-1$ must be positive, $x>1$.
Why: Lengths are positive.

Method
The quadratic is negative between its roots, so $x<6$.
Why: Use the sign of the upward-opening quadratic.

Method
Therefore $1<x<6$.
Why: Combine the restrictions.

Final answer
range: $1<x<6$

Original question 35

4MA1-2H Q24

ORIGINAL QUESTION

5 marks

24 A particle P moves along a straight line that passes through the fixed point O

The displacement, x metres, of P from O at time t seconds, where $t \geqslant 0$, is given by

$$x = 4t^3 - 27t + 8$$

The direction of motion of P reverses when P is at the point A on the line.

The acceleration of P at the instant when P is at A is $a\ \text{m/s}^2$

Find the value of a

$a =$ .....

Worked solution 35

Chapter: Differentiation

MODULAR UNIT 2

5 marks

Q24 – Chapter: Differentiation

Family: Apply differentiation to linear kinematics • Variant: Instantaneous rest or direction reversal

Method

$v=dx/dt=12t^2-27$.

Why: Differentiate $x=4t^3-27t+8$.

Method

At a reversal $v=0$, so $12t^2-27=0$ and $t^2=9/4$.

Why: Set velocity equal to zero.

Method

Since $t\geq 0$, $t=3/2$.

Why: Choose the physical time.

Method

$a=dv/dt=24t$.

Why: Differentiate velocity.

Method

At $t=3/2$, $a=36\ m/s^2$.

Why: Evaluate the acceleration.

Final answer

acceleration: 36 m/s^2

Original question 36

4MA1-2H Q25 Q25(a)

ORIGINAL QUESTION

4 marks

25 The function g is defined as

$$g : x \mapsto 5 + 6x - x^2 \quad \text{with domain} \quad \{x : x \geqslant 3\}$$

(a) Express the inverse function g^{-1} in the form $g^{-1} : x \mapsto \ldots$

$g^{-1} : x \mapsto$ .....

(4)

Worked solution 36

Chapter: Functions

MODULAR UNIT 2
4 marks

Q25(a) – Chapter: Functions

Family: Construct an inverse function • Variant: Inverse of a restricted quadratic function

Method
$g(x)=5+6x-x^2=14-(x-3)^2$.
Why: Complete the square.

Method
For $x\geq 3$, $y=14-(x-3)^2$, so $(x-3)^2=14-y$.
Why: Use the restricted domain to choose the positive branch.

Method
$x-3=\sqrt{(14-y)}$.
Why: Take the positive square root.

Method
Therefore $g^{-1}(x)=3+\sqrt{(14-x)}$.
Why: Swap x and y to write the inverse function.

Final answer
inverse: $g^{-1}(x)=3+\sqrt{(14-x)}$

Original question 37

4MA1-2H Q25 Q25(b)

ORIGINAL QUESTION

1 marks

(b) State the domain of g^{-1}

.....

(1)

Worked solution 37

Chapter: Functions

MODULAR UNIT 2
1 marks

Q25(b) – Chapter: Functions

Family: Control domain and range • Variant: Domain and range swap under inversion

Method

The square root requires $14-x\geq 0$, so the domain of g^{-1} is $x\leq 14$.
Why: Use the radicand condition.

Final answer

domain: $x\leq 14$

Original question 38

4MA1-2H Q26

ORIGINAL QUESTION

5 marks

26 An arithmetic series has first term a and common difference d, where d is a prime number.

The sum of the first n terms of the series is S_n and

$S_m = 39$

$S_{2m} = 320$

Find the value of d and the value of m
Show clear algebraic working.

$d =$ .....

$m =$ .....

Worked solution 38

Chapter: Sequences

MODULAR UNIT 2
5 marks

Q26 – Chapter: Sequences

Family: Recover arithmetic-series parameters • Variant: Nonlinear or integer-constrained series recovery

Method

$S_m=m/2[2a+(m-1)d]=39$ and $S_{2m}=m[2a+(2m-1)d]=320$.

Why: Use the arithmetic-series sum formula twice.

Method

Subtracting the equations eliminates a and gives $dm^2=242$.

Why: Compare the two sum equations.

Method

$242=2\times11^2$; since d is prime, $d=2$ and $m^2=121$.

Why: Use the prime restriction on d.

Method

$m=11$ because m is positive.

Why: Take the positive square root.

Method

Thus $d=2$ and $m=11$.

Why: State both requested values.

Final answer

d,m: $d=2$, $m=11$