OCR
RECOGNISING ACHIEVEMENT

FREE-STANDING MATHEMATICS QUALIFICATION
INTERMEDIATE LEVEL

FOUNDATIONS OF ADVANCED MATHEMATICS 6989

Candidates answer on the Answer Sheet

OCR Supplied Materials:
- Answer Sheet (MS4)

Other Materials Required:
- Eraser
- Rough Paper
- Scientific calculator
- Soft pencil

Thursday 22 January 2009
Morning

Duration: 2 hours

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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number on the Answer Sheet in the spaces provided unless this has already been done for you.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- There are **forty** questions in this paper. Attempt as many questions as possible. For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.
- **Read very carefully the instructions on the Answer Sheet.**

INFORMATION FOR CANDIDATES

- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Paper is provided for rough work; this should not be handed in.
- This document consists of **20** pages. Any blank pages are indicated.

1 Three of the following statements are true and **one** is false. Which one is **false**?

A The highest common factor (HCF) of 56 and 98 is 14.

B 42 is a multiple of 6.

C The square of 25 is 5.

D 101 is a prime number.

2 Three of the following statements are true and **one** is false. Which one is **false**?

A $26\,447 = 26\,400$, correct to the nearest hundred.

B $\frac{2}{3} = 0.666$, correct to 3 decimal places.

C $\sqrt[3]{300} = 7$, correct to the nearest integer.

D $2^{20} = 1\,000\,000$, correct to 1 significant figure.

3 Three of the following statements are true and **one** is false. Which one is **false**?

A $\frac{4}{5}$ is the same as 80%.

B 0.625 is the same as $\frac{5}{8}$.

C $(-1)^{10} = -1$

D $7 - 3 \times 4 = -5$

4 Three of the following statements are true and **one** is false. Which one is **false**?

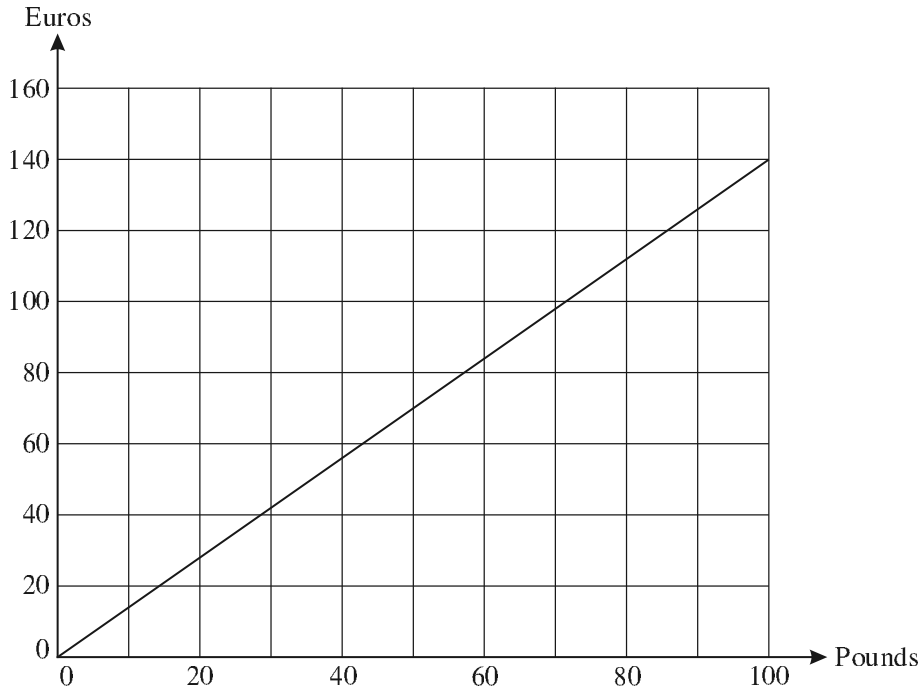
A 50 km is approximately 80 miles.

B 2 gallons is approximately 9 litres.

C 450 g is approximately 1 pound.

D $40\ \text{km h}^{-1}$ is approximately $11\ \text{m s}^{-1}$.

5 The diagram below shows the exchange rate between pounds (£) and euros (€) on a given da



Three of the following statements about the chart are true and **one** is false. Which one is **false**?

A €100 is just over £70.

B £55 is less than €80.

C The exchange rate is £1 = €1.40.

D Two £20 notes can be exchanged for three €20 notes.

6 Three of the following statements are reasonable and **one** is unreasonable. Which one is **unreasonable**?

A The mass of a sheet of A4 paper is 200 g.

B A car travels 25 km in half an hour.

C An apple tree has a height of 6 m.

D A mug contains 250 ml of coffee.

7 Nasinan is collecting data about where people spend their holiday. She asks 20 people and g responses.

UK	Spain	Greece	France	Greece
Spain	Italy	UK	Spain	UK
UK	Spain	Portugal	Greece	UK
Greece	France	Croatia	UK	Spain

In order to complete this question you may find it helpful to summarise the data using the tally chart below.

Holiday location	**Tally**	**Total**
UK		
France		
Greece		
Spain		
Other		

Three of the following statements about Nasinan's data are true and **one** is false. Which one is **false**?

A On a pie chart, the sector representing the UK will have an angle of 108°.

B One fifth of the people responded 'Spain'.

C Greece received twice as many responses as France.

D A bar chart with frequency axis starting at 2 (rather than 0) will create a misleading impression.

8 You are given $a = 6$, $b = 5$ and $c = -4$.

Three of the following statements are true and **one** is false. Which one is **false**?

A $ab^2 = 150$

B $\dfrac{a+c}{b} = 0.4$

C $a - b \times c = 4$

D $4a - (2b - c) = 10$

9 Three of the following statements are true and **one** is false. Which one is **false**?

A When £280 is divided in the ratio 5 : 3 the larger share is £70 more than the smaller share.

B Hasan sells a bicycle, at a 10% discount, for £162. The cost before the discount was £180.

C 25% of 50 is more than 42% of 30.

D Robbie works for 3 hours and earns £18. At the same rate of pay he will earn £42 when he works for 7 hours.

10 In Jack's business the salaries of 5 employees are as follows.

£15 000 £15 000 £20 000 £25 000 £45 000

Three of the following statements are true and **one** is false. Which one is **false**?

A The mean is £24 000.

B The median is £20 000.

C The mean increases if the highest salary is increased and the others remain unchanged.

D The median increases if the highest salary is increased and the others remain unchanged.

11 Three of the following statements are true and **one** is false. Which one is **false**?

A $2a^{-1} = \frac{2}{a}$

B $3a^4 \times 2a^3 = 6a^{12}$

C $\frac{15a^6}{3a^2} = 5a^4$

D $(4a^3)^2 = 16a^6$

12 Three of the following statements are true and **one** is false. Which one is **false**?

A The solution of $\frac{2}{x+1} = 4$ is $x = -\frac{1}{2}$.

B The equation $3x = 2x$ has no solution.

C The solution of $7x - 4 = 2x + 9$ is $x = 2.6$.

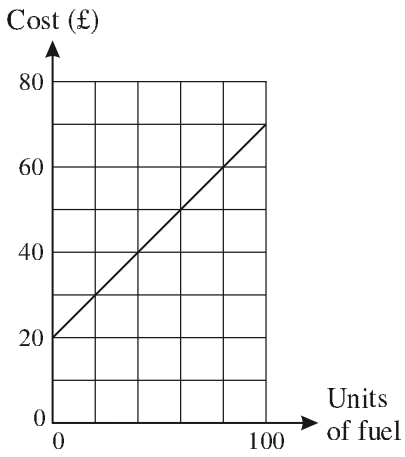
D $x^2 = 36$ has exactly two roots.

13 A company sells fuel using two tariffs.

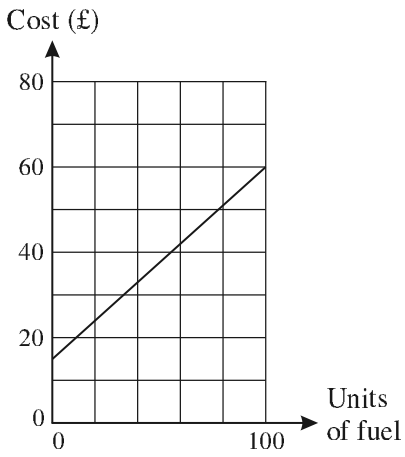
- With tariff A there is a fixed charge of £20 and fuel costs 50 pence per unit.
- With tariff B there is a fixed charge of £15 and fuel costs 60 pence per unit.

Using this information Rachel draws these two graphs to show the cost of up to 100 units of fuel with each tariff.

Tariff A



Tariff B



Which **one** of the following statements is **true**?

A Both graphs are correctly drawn.

B Only the graph for tariff A is correctly drawn.

C Only the graph for tariff B is correctly drawn.

D Neither graph is correctly drawn.

14 A fence post is 120 cm long and has a square cross-section of side 5 cm. Each measurement is to the nearest centimetre.

Three of the following statements are true and **one** is false. Which one is **false**?

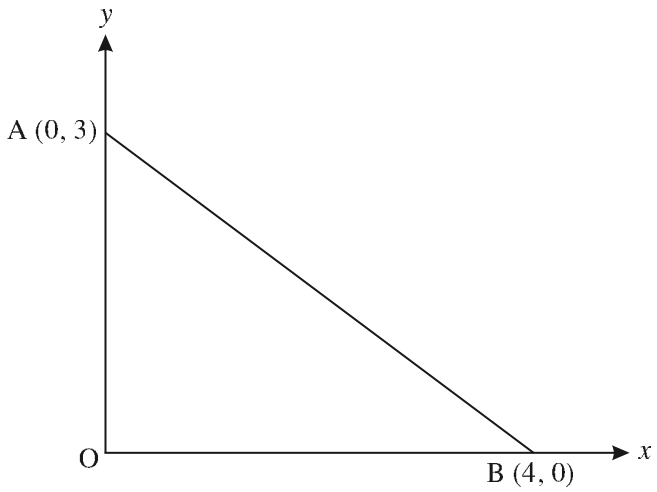
A The length of the fence post is less than 120.5 cm.

B The perimeter of the cross-section must be 20 cm, correct to the nearest cm.

C The area of the cross-section cannot exceed 30.25 cm^2.

D The minimum possible volume of the post is 2419.875 cm^3.

15



Three of the following statements about the diagram are true and **one** is false. Which one is **false**?

A The gradient of the line AB is $\frac{3}{4}$.

B The line AB passes through the point (1, 2.25).

C The perimeter of triangle OAB is 12 units.

D The equation of the line AB can be written $3x + 4y = 12$.

16 Which **one** of the following expressions has the **greatest** value?

A $2\frac{3}{4} + 3\frac{7}{8}$

B $7\frac{5}{8} - 1\frac{1}{4}$

C $\left(2\frac{1}{2}\right)^2$

D $3\frac{1}{4} \div \frac{1}{2}$

17 Three of the following statements are true and **one** is false. Which one is **false**?

A $0.008 = 8 \times 10^{-3}$

B $5 \times 10^6 + 4 \times 10^4 = 5.04 \times 10^6$

C $(6 \times 10^{11}) \times (5 \times 10^{15}) = 3 \times 10^{29}$

D $(1.8 \times 10^4) \div (1.2 \times 10^{-2}) = 1.5 \times 10^6$

18 When the expressions **A**, **B**, **C** and **D** are factorised, three of them are found to have a factor in common.

Which **one** does **not** have this common factor?

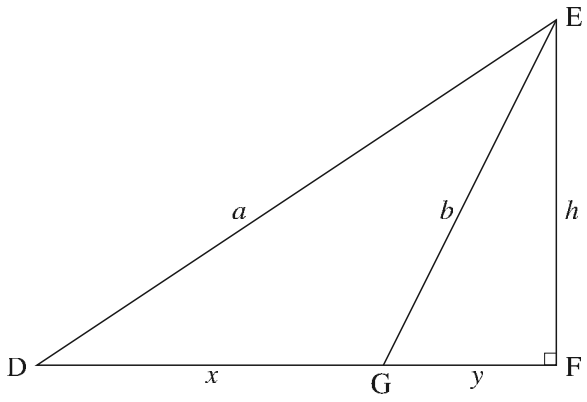
A $x^2 - x - 2$

B $x^2 + x - 6$

C $2x^2 - 3x - 2$

D $x^2 - 2x - 8$

19 Look at this diagram.



Three of the following statements are true and **one** is false. Which one is **false**?

A $\tan \text{EDF} = \dfrac{h}{x+y}$

B $\cos \text{EGF} = \dfrac{y}{b}$

C area of triangle DGE $= \frac{1}{2}hx$

D $\dfrac{\sin \text{EDG}}{b} = \dfrac{\sin \text{DEG}}{a}$

20 Three of the following statements are true and **one** is false. Which one is **false**?

A The solution of $\dfrac{x}{2} < 4$ is $x < 8$.

B The solution of $\dfrac{x}{3} + 2 > 5$ is $x > 13$.

C The solution of $11 > 2x - 3$ is $x < 7$.

D The solution of $-4x < -20$ is $x > 5$.

21 Which **one** of the following is the **correct** solution of the equation $3x^2 = 7x + 1$?

A $\dfrac{-7 \pm \sqrt{61}}{6}$ **B** $\dfrac{-7 \pm \sqrt{37}}{6}$ **C** $\dfrac{7 \pm \sqrt{61}}{6}$ **D** $\dfrac{7 \pm \sqrt{37}}{6}$

22 For $0^\circ < \theta < 90^\circ$, three of the following statements are true and **one** is false. Which one is **fa**

A $0 < \sin\theta < 1$

B $\tan\theta > 0$

C $\sin\theta + \cos\theta = 1$

D $\cos\theta = \sin(90^\circ - \theta)$

23 Three vectors are given by $\mathbf{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$.

Which **one** of the following is the **correct** value of $\mathbf{a} - 2\mathbf{b} + 3\mathbf{c}$?

A $\begin{pmatrix} 10 \\ -9 \end{pmatrix}$ **B** $\begin{pmatrix} 2 \\ -9 \end{pmatrix}$ **C** $\begin{pmatrix} 10 \\ -4 \end{pmatrix}$ **D** $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$

24 The admission charges at a swimming pool are £3 for infants, £4 for children and £5 for adults. There are x infants, y children and z adults making up a party of 50.

Three of the following statements are true and **one** is false. Which one is **false**?

A $x + y + z = 50$

B The total cost of admission is £$(3x + 4y + 5z)$.

C Whatever the values of x, y and z the mean cost of admission is £4 per person.

D The total cost of admission does not exceed £250.

25 Two ordinary dice are thrown and their scores are noted. One of the dice is red and the other

Three of the following statements are true and **one** is false. Which one is **false**?

A The probability that the score on the red die is not a 4 is $\frac{5}{6}$.

B The probability that both dice show the same score is $\frac{1}{6}$.

C The probability of a total score of 11 is $\frac{1}{18}$.

D In 10 000 throws of the dice you would expect the score on the red die to be greater than the score on the blue die in around 5000 throws.

26 Three of the following statements are true and **one** is false. Which one is **false**?

A $12x + 4(x - y) = 4(4x - y)$

B $3x(x - 3) = 3x^2 - 9x$

C $5x^2y + 10y^2 = 5y(x^2 + 2y)$

D $x^2 - 2 = (x + 1)(x - 1)$

27 You are given the vectors $\mathbf{a} = 7\mathbf{i} - 4\mathbf{j}$, $\mathbf{b} = -\mathbf{i} + 8\mathbf{j}$ and $\mathbf{c} = 4\mathbf{i} + 7\mathbf{j}$.

Three of the following statements are true and **one** is false. Which one is **false**?

A The vectors **a**, **b** and **c** have the same magnitude.

B The angle between vectors **b** and **i** is approximately 82.9°.

C The vectors **a** and **c** are perpendicular.

D $2\mathbf{a} + \mathbf{b} = 13\mathbf{i}$

28 Which **one** of the following is the **correct** solution of this pair of simultaneous equations?

$$5x + 2y = 1$$
$$14x - 8y = 13$$

A $x = \frac{1}{2},\ y = -\frac{3}{4}$

B $x = -\frac{1}{2},\ y = \frac{7}{4}$

C $x = -2,\ y = \frac{11}{2}$

D $x = 2,\ y = \frac{9}{2}$

29 An ordinary pack contains 52 cards. A card is taken at random from the pack and then a second card is taken at random from the pack.

Three of the following statements are true and **one** is false. Which one is **false**?

A If the first card is replaced before the second card is taken then the probability that both cards are hearts is $\frac{1}{16}$.

B If the first card is **not** replaced before the second card is taken then the probability that both cards are hearts is $\frac{1}{17}$.

C If the first card is replaced before the second card is taken then the probability that **neither** card is a heart is $\frac{15}{16}$.

D If the first card is **not** replaced before the second card is taken then the probability that **neither** card is a heart is $\frac{19}{34}$.

30 Three of the following statements are true and **one** is false. Which one is **false**?

A $y = a + bx$ may be rearranged to give $x = \dfrac{y - a}{b}$.

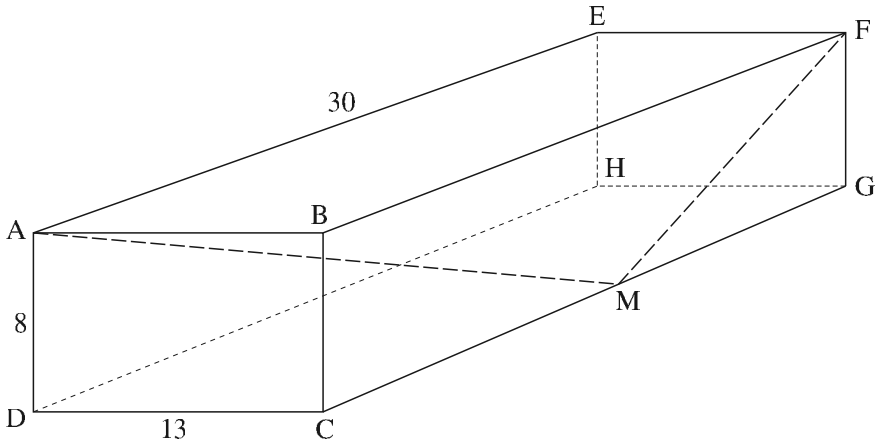
B $\dfrac{a}{b} = \dfrac{c}{d}$ may be rearranged to give $d = \dfrac{bc}{a}$.

C $s = \frac{1}{2}(u + v)t$ may be rearranged to give $t = \dfrac{2s}{u + v}$.

D $V = \frac{4}{3}\pi r^3$ may be rearranged to give $r = \dfrac{3}{4\pi}\sqrt[3]{V}$.

31 The diagram shows a cuboid ABCDEFGH. M is the midpoint of CG.

AE = 30 cm, AD = 8 cm and DC = 13 cm.



Alex is trying to calculate angle AMF and shows the following steps.

Step (i)	FM = 17
Step (ii)	AM = $\sqrt{458}$
Step (iii)	AF = $\sqrt{1069}$
Step (iv)	Angle AMF = 116°, correct to the nearest degree.

How many of Alex's steps are **correct**?

A 1 **B** 2 **C** 3 **D** 4

32 A cube is enlarged so that the length of each edge is increased by 10%.

Three of the following statements are true and **one** is false. Which one is **false**?

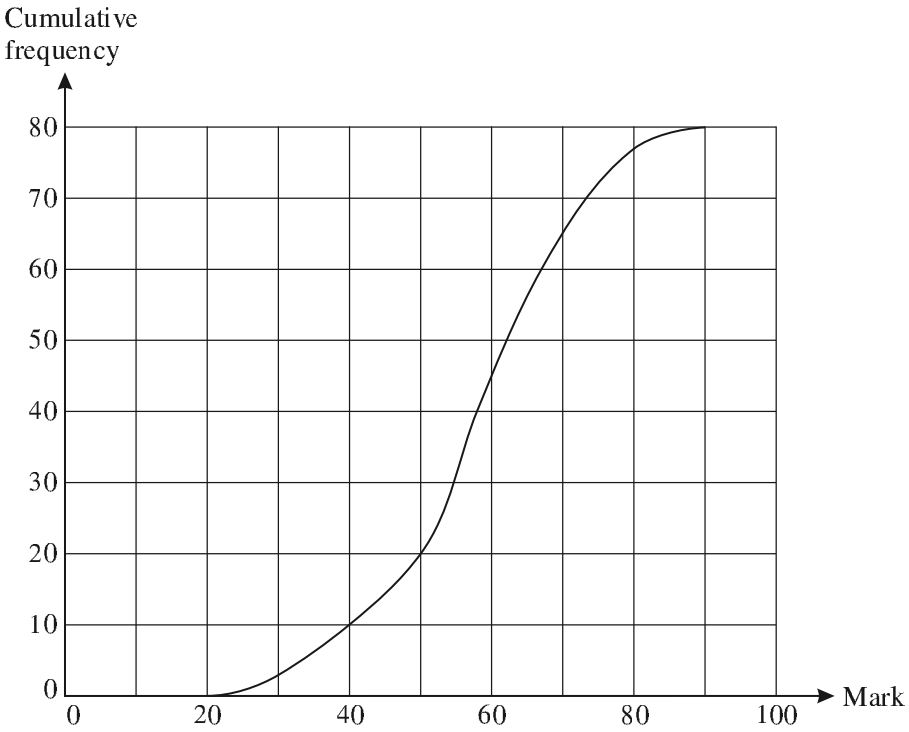
A The diagonal of a face is increased by 10%.

B The surface area is increased by 21%.

C The volume is increased by 33.1%.

D The perimeter of a face is increased by 40%.

33 This cumulative frequency diagram summarises the marks awarded to students in a test.



Three of the following statements are true and **one** is false. Which one is **false**?

A The median mark is approximately 58.

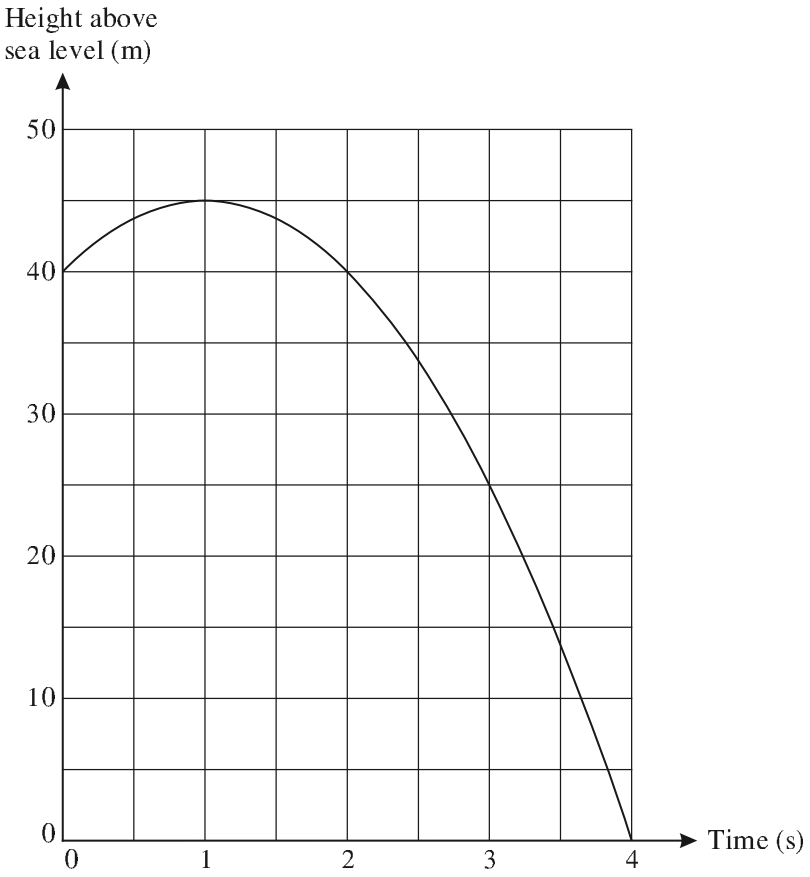
B The interquartile range is approximately 17 marks.

C Approximately 20 students get 50 marks or more.

D Each student's mark, m, is such that $20 \leqslant m \leqslant 90$.

34 A small stone is thrown vertically upwards from the edge of a cliff top and falls into the se
The cliff top is 40 m above the sea.

The graph shows the height of the ball against time.



Three of the following statements are true and **one** is false. Which one is **false**?

A The stone hits the sea after 4 seconds.

B The greatest height of the stone is 45 m above the cliff top.

C The stone falls 15 m in the third second.

D The speed after 0.5 seconds is the same as the speed after 1.5 seconds.

35 Gareth makes a model of his house using a scale of 4 cm : 1 m.

Three of the following statements are true and **one** is false. Which one is **false**?

A The scale can be written 1 : 25.

B His front door is 2 m high so it will be 8 cm high in the model.

C His bedroom window is twice as wide as it is high. The ratio of the width to the height in the model is 2 : 1.

D His garage door has an area of 4.5 m^2 so it will have an area of 18 cm^2 in the model.

36 Three of the following statements are true and **one** is false. Which one is **false**?

A $\frac{3x}{10} - \frac{x}{4} = \frac{x}{20}$

B $\frac{x}{2} + \frac{x}{3} = \frac{5x}{6}$

C $\frac{4x + 8}{4} = x + 2$

D $x + \frac{x + 1}{2} = \frac{2x + 1}{2}$

37 The cost, £C, of hiring a coach is shared equally between T tourists. Each tourist pays P pence for afternoon tea. No other expenses are involved.

Which **one** of the following expressions is the **correct** total cost, in pounds, for each tourist?

A $\frac{C}{T} + \frac{P}{100}$

B $CT + \frac{P}{100}$

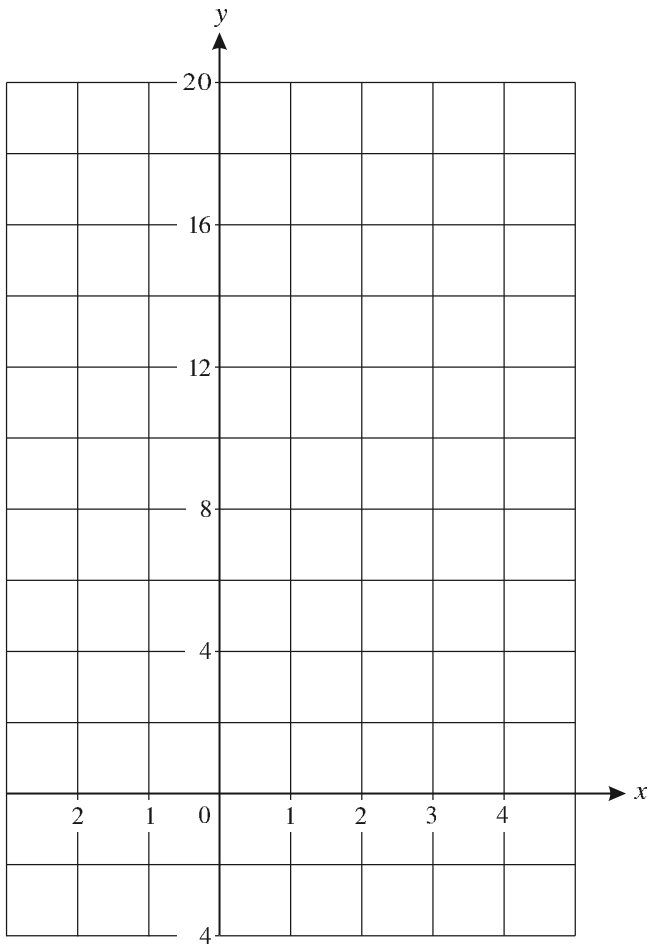
C $\frac{C}{T} + 100P$

D $CT + 100P$

38 The table below shows points on the graph of $y = 2x^2 - 5x + 1$.

x	−2	−1	0	1	2	3	4
y	19	8	1	−2	−1	4	13

In order to answer this question you should draw the graph on the grid below.



Three of the following statements are true and **one** is false. Which one is **false**?

A The minimum value of y occurs when $1 < x < 2$.

B The gradient of the curve at $x = 3$ is between 5 and 9.

C The roots of the equation $2x^2 - 5x + 1 = 0$ are integers.

D The equation $2x^2 - 5x + 1 = 12$ has one positive root and one negative root.

39 Laura has been given the first five terms of a quadratic sequence. She finds the first differe
the second differences as shown below.

Sequence	4		15		30		49	72	...	...
First difference		11		15		19	23	...	...	
Second difference			4		4		4	...	...	

Three of the following statements are true and **one** is false. Which one is **false**?

A The next number in the first difference row is 27.

B The seventh term in the sequence is 130.

C The nth term in the sequence is given by $4n^2 + n - 1$.

D The nth term in the first difference row is given by $4n + 7$.

40 A solid cylinder has length 10 cm and radius 3 cm. Its density is 6 g cm^{-3}.

Three of the following statements are true and **one** is false. Which one is **false**?

A The curved surface area of the cylinder is $18\pi\text{ cm}^2$.

B The total surface area of the cylinder is $78\pi\text{ cm}^2$.

C The volume of the cylinder is $90\pi\text{ cm}^3$.

D The mass of the cylinder is 540π g.

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