OCR
RECOGNISING ACHIEVEMENT

FREE-STANDING MATHEMATICS QUALIFICATION
Intermediate Level

Foundations of Advanced Mathematics 6989/01

THURSDAY 25 JANUARY 2007

Morning
Time: 2 hours

Additional materials:
- Answer paper (MS4)
- Rough paper

To be brought by candidate:
- Eraser
- Scientific calculator
- Soft pencil

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

- Write your name, centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.
- 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.

[Turn over

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

A 5.72 km = 572 m

B 2.5 kg + 150 g = 2.65 kg

C $900\,\text{mm}^2 = 9\,\text{cm}^2$

D 1800 seconds = half an hour

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

A The square of 100 is 10 000.

B The cube root of 125 is 5.

C The highest common factor (HCF) of 70 and 105 is 7.

D The lowest common multiple (LCM) of 15 and 20 is 60.

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

A $-6 - 8 = -14$

B $\frac{3}{8}$ is the same as 37.5%.

C $\frac{1}{4}$ of $\frac{1}{4}$ is $\frac{1}{2}$.

D $\dfrac{120}{24 + 18} = 2\frac{6}{7}$

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

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

B $(3c)^3 = 27c^3$

C $(c^4)^2 = c^8$

D $\dfrac{6c^{12}}{2c^3} = 3c^4$

5 The number of GCSEs passed by each of twelve students is given below.

9 7 4 8 10 7 9 9 4 6 9 5

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

A The mean is 7.25.

B The mode is 9.

C The median is 8.

D The range is 6.

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

A $\frac{2}{7} = 0.29$, correct to 2 decimal places.

B $2^9 = 500$, correct to 1 significant figure.

C $3^{-2} = 0.1$, correct to 1 decimal place.

D 28 457 = 29 000, correct to the nearest thousand.

7 You are given $a = 9, b = -1$ and $c = 2$.

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

A $\dfrac{a}{c-b} = 3$

B $a - b \times c = 20$

C $(c-a)^2 = 49$

D $a^2 + b^2 + c^2 = 86$

8 The result of an election is as follows.

Candidate	Votes
Amber Avery	25 578
Priyanka Patel	17 249
James Jolly	6 673
Claire Cavanagh	2 523
Matthew Murray	1 682
Total	53 705

A pie chart is used to show how the votes were cast.

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

A The angle of the sector representing James Jolly is 45°, correct to the nearest degree.

B The angle of the largest sector is 171°, correct to the nearest degree.

C The sector representing Priyanka Patel covers less than one third of the pie chart.

D The ratio of the angle of the sector representing Claire Cavanagh to the angle of the sector representing Matthew Murray is 2 : 3.

9 A straight line has a gradient of -3 and an intercept of 2 on the y-axis.

Which **one** of the following is a **correct** equation of the line?

A $y - 3x + 2 = 0$

B $x + 2y - 3 = 0$

C $y + 3x - 2 = 0$

D $x + 3y + 2 = 0$

10 Three of the following statements are reasonable but **one** is unreasonable. Which one is **unreasonable**?

A The mass of a baby at birth is usually less than 1 kg.

B An express train reaches a maximum speed of about 150 km h ^{1}.

C The height of a car is about 1.4 m.

D The length of an adult bed is about 190 cm.

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

A The solution of $\frac{2x}{5} = 3$ is $x = 7.5$.

B The solution of $4x - 3 = 21$ is $x = 6$.

C The solution of $\frac{4}{x} = 5$ is $x = \frac{5}{4}$.

D The solution of $5(x + 7) + x = 33$ is $x = -\frac{1}{3}$.

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

A An amount of money is divided in the ratio 3 : 1. The smaller part is 25% of the total amount.

B A dress originally priced at £49.50 is reduced by 20%. The new price is £39.60.

C Increasing a price by 30% is the same as multiplying the price by 1.3.

D Decreasing a price by 30% is the same as dividing the price by 1.3.

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

A $93\,000\,000 = 9.3 \times 10^7$

B $1 \times 10^{-4} - 3 \times 10^{-5} = 7 \times 10^{-5}$

C $(5 \times 10^{16}) \times (4 \times 10^{13}) = 2 \times 10^{32}$

D $(6.3 \times 10^{12}) \div (2.1 \times 10^6) = 3 \times 10^6$

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

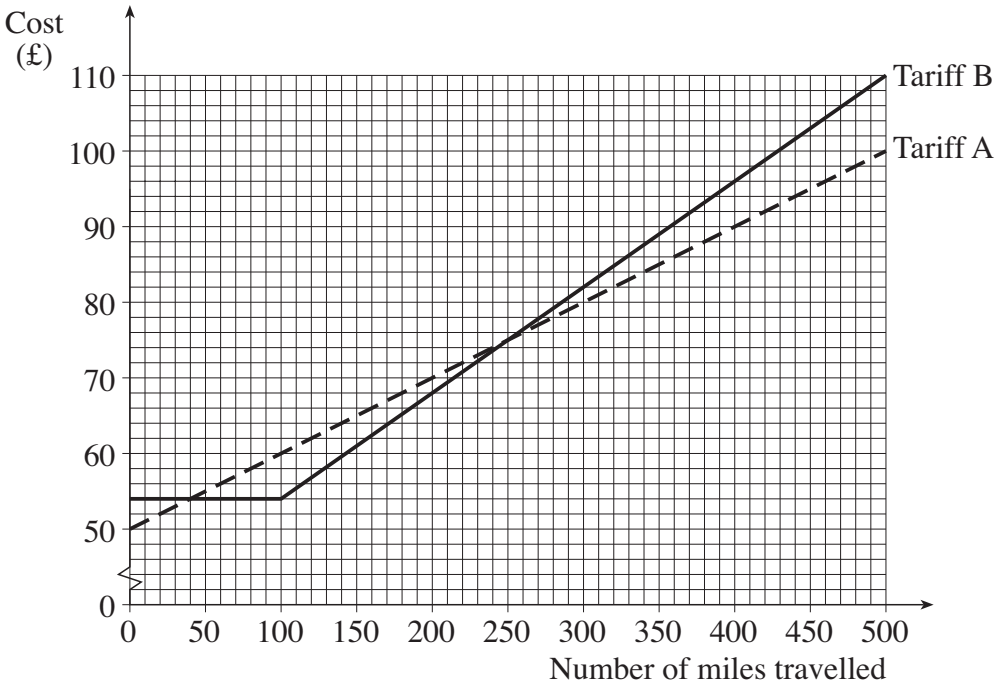
A $4(x-2)+3(x+7)=7x+13$

B $(x-8)^2=x^2-16x-64$

C $(3x+1)(x-4)=3x^2-11x-4$

D $2x(x-3)-x=2x^2-7x$

15 The graph below shows two different tariffs for the hire of a van.



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

A With Tariff A, the cost is £$\left[50+(0.1\times\text{number of miles})\right]$.

B A person travelling any distance under 250 miles will pay less with Tariff B.

C A person travelling 500 miles will pay £10 more with Tariff B than with Tariff A.

D For each mile travelled in excess of 100 miles the cost with Tariff B increases by 14 pence.

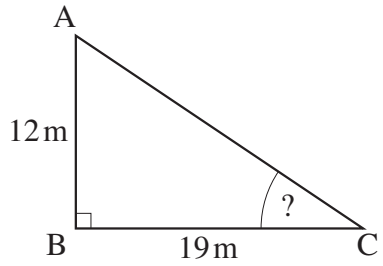
16 Three vectors are given by $\mathbf{a} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$.

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

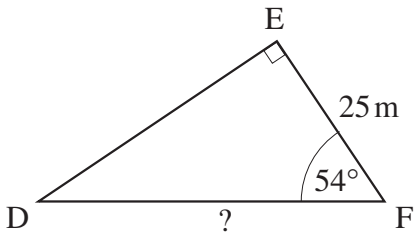
A $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ **B** $\begin{pmatrix} 5 \\ 7 \end{pmatrix}$ **C** $\begin{pmatrix} 5 \\ 5 \end{pmatrix}$ **D** $\begin{pmatrix} 13 \\ 3 \end{pmatrix}$

17 Anna and Emily are both solving trigonometry problems.

Anna's problem



Emily's problem



Anna claims that angle ACB is 32°, correct to the nearest degree.

Emily claims that length DF is 43 m, correct to the nearest metre.

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

A Anna and Emily are both correct.

B Anna is correct and Emily is incorrect.

C Anna is incorrect and Emily is correct.

D Anna and Emily are both incorrect.

18 A point P has coordinates $(4, 1)$.

Which **one** of the following points is nearest to P?

A $(4, 9)$ **B** $(-3, 5)$ **C** $(3, -7)$ **D** $(-1, -5)$

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

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

A $x^2 - 7x + 10$

B $x^2 + x - 2$

C $x^2 + 6x + 8$

D $x^2 - 6x - 16$

20 Two fair six-sided dice are rolled and their scores noted.

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

A The probability that the sum of the scores is 7 is $\frac{1}{6}$.

B The probability that the sum of the scores is less than 11 is $\frac{11}{12}$.

C The probability that the scores on the dice are 6 and 1 is $\frac{1}{18}$.

D The probability that multiplying the scores together gives an even number is $\frac{1}{2}$.

21 The length of an aeroplane flight is 5200 kilometres, correct to the nearest 100 kilometres. The duration of the flight is 6 hours and 20 minutes, correct to the nearest 10 minutes.

Which **one** of the following is the **greatest** possible average speed of the aeroplane, correct to the nearest 10 km h ^{1}?

A 820 km h ^{1} **B** 830 km h ^{1} **C** 840 km h ^{1} **D** 850 km h ^{1}

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

A The solution of $2x + 3 < 7$ is $x < 2$.

B The solution of $x - 5 < 6x$ is $x < 1$.

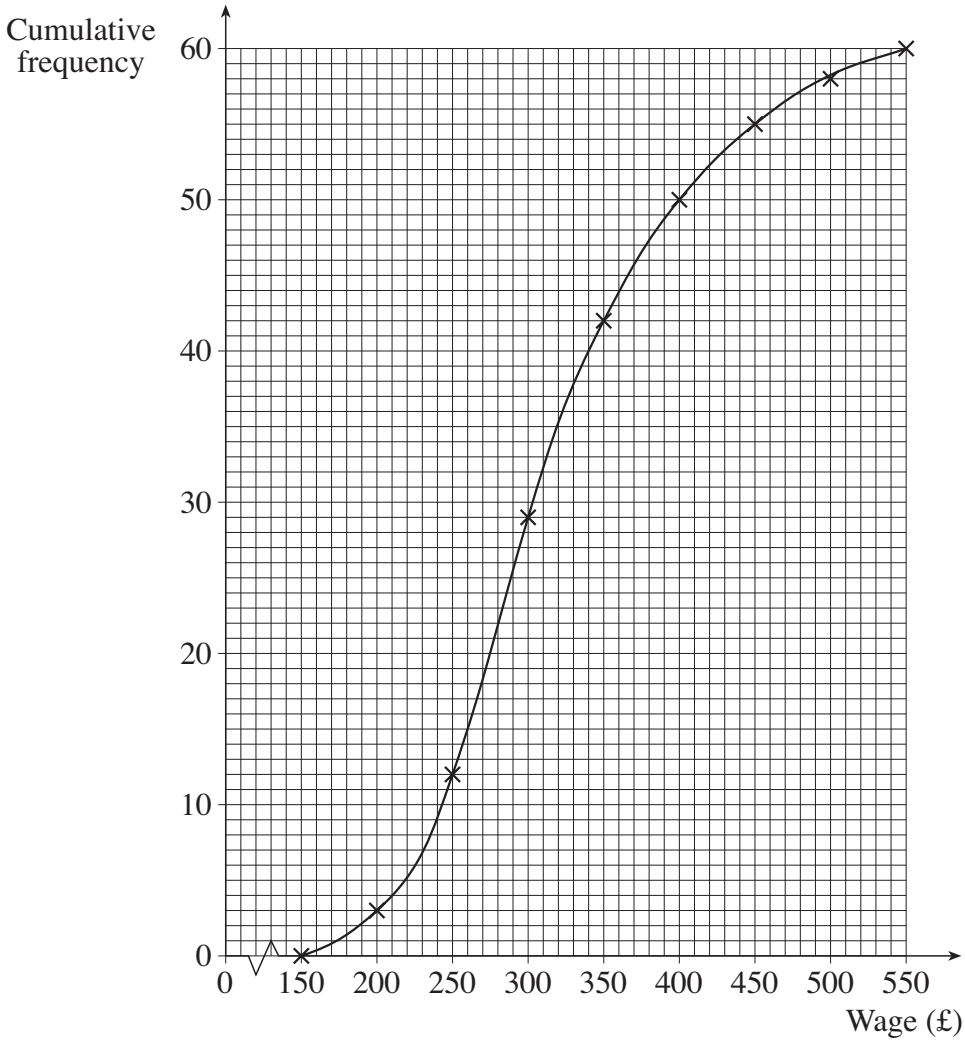
C The solution of $7x - 2 > 3x + 4$ is $x > \frac{3}{2}$.

D The solution of $2x > 3 - x$ is $x > 1$.

23 Which **one** of the following is the solution of the equation $3x^2 - 11x - 7 = 0$?

A $\frac{11 \pm \sqrt{205}}{6}$ **B** $\frac{11 \pm \sqrt{205}}{6}$ **C** $\frac{11 \pm \sqrt{37}}{6}$ **D** $\frac{11 \pm \sqrt{37}}{6}$

24 Gokhan owns a clothing company with 60 employees. He draws this cumulative frequency curve to show the weekly wage of his employees.



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

A The median weekly wage is £350.

B The lower quartile is approximately £260.

C 10 employees have a weekly wage greater than £400.

D 20% of the employees have a weekly wage of £250 or less.

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

A Given $0° \leqslant x \leqslant 45°$ then $\tan x \leqslant 1$.

B For any angle x, $-1 \leqslant \sin x \leqslant 1$.

C For any angle x, $\cos x = \cos(-x)$.

D The graph of $y = \sin x$ is symmetrical about the y-axis.

26 The length of each edge of a solid cuboid is doubled to make a similar cuboid.

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

A The length of the diagonal of a face is doubled.

B The area of each face of the cuboid is increased by a factor of 4.

C The total surface area of the cuboid is increased by a factor of 6.

D The volume of the cuboid is increased by a factor of 8.

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

A The vector $5\mathbf{i} + 12\mathbf{j}$ has magnitude 13.

B The vector $-\mathbf{i} + \mathbf{j}$ is a unit vector.

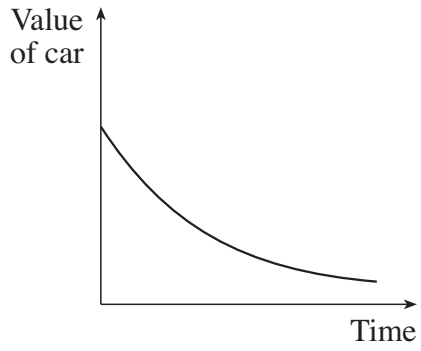
C The vectors $6\mathbf{i}$ and $5\mathbf{j}$ are perpendicular.

D The vectors $2\mathbf{i} + \mathbf{j}$ and $4\mathbf{i} + 2\mathbf{j}$ have the same direction.

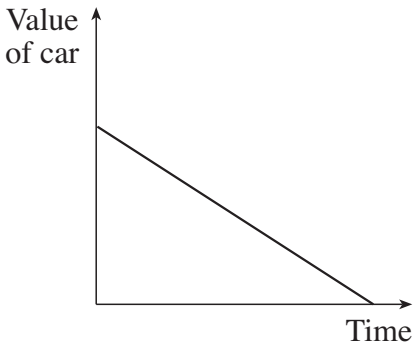
28 Harry buys a car for £12 000. He estimates that its value will decrease each year by [illegible] value at the start of that year.

Which **one** of the following sketches best represents the value of his car over many years?

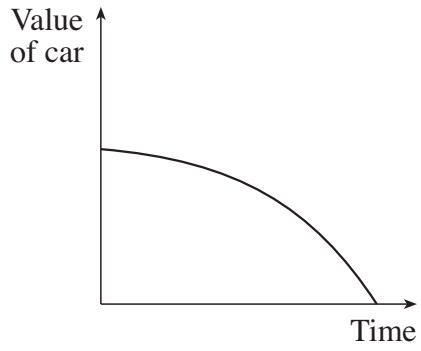
A



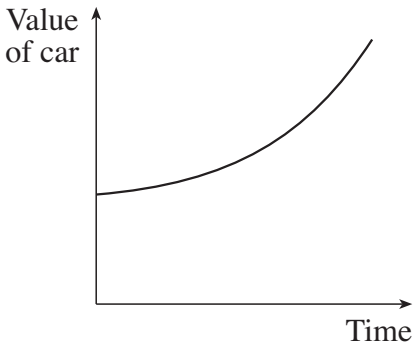
B



C



D



29 Pads of paper cost p pounds each, rulers cost r pence each and a packet of 10 pens costs n pence.

Which **one** of the following expressions gives the **total** cost of 10 pads of paper, 30 rulers and 60 pens?

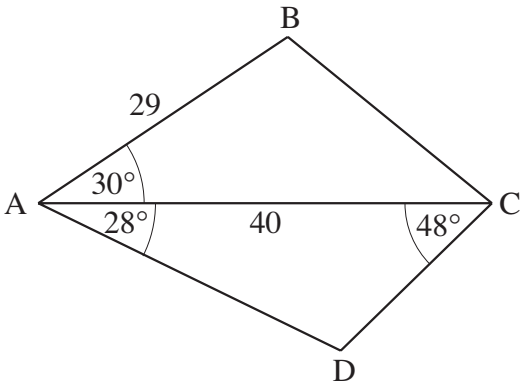
A $£(10p + 0.3r + 0.06n)$

B $£100(10p + 30r + 6n)$

C $£(10p + 30r + 6n)$

D $£\frac{1}{100}(10p + 30r + 60n)$

30 In the diagram the lengths shown are in metres.



Not to scale

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

A BC = 21 m, correct to the nearest metre.

B AD = 31 m, correct to the nearest metre.

C The area of triangle ABC is 580 m^2.

D Angle BCD is obtuse.

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

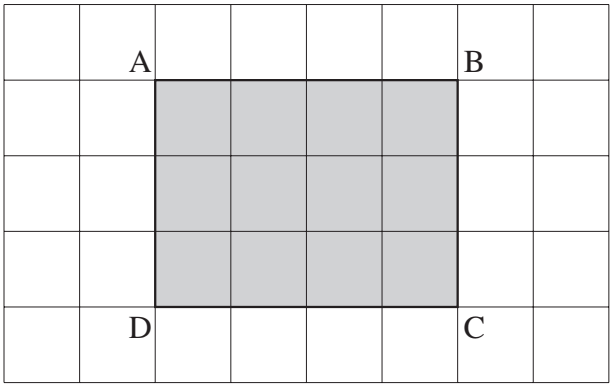
A $s = ut + \frac{1}{2}at^2$ may be rearranged to give $a = \dfrac{2(s - ut)}{t^2}$.

B $y = 4x - 5$ may be rearranged to give $x = \dfrac{y}{4} + 5$.

C $x = \sqrt{\dfrac{A}{6}}$ may be rearranged to give $A = 6x^2$.

D $\dfrac{PV}{T} = R$ may be rearranged to give $P = \dfrac{RT}{V}$.

32 This map, on a centimetre square grid, shows a large rectangular field ABCD.



Scale: 2 cm represents 1 km

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

A The scale is 1 : 50 000.

B The actual perimeter of the field is 14 km.

C The actual area of the field is 3 km^2.

D The actual length of the diagonal of the field is 2.5 km.

33 Which **one** of the following is the **correct** x-value for this pair of simultaneous equations?

$$\begin{aligned} x + 3y &= 5 \\ 3x - 15y &= 1 \end{aligned}$$

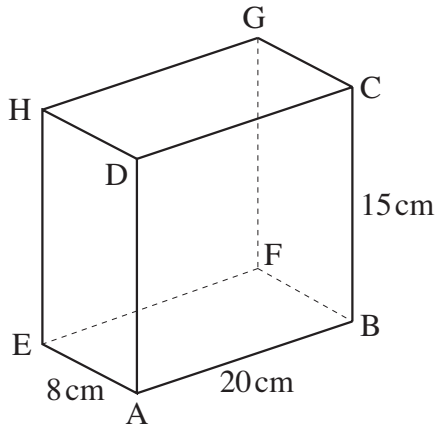
A $x = -3$ **B** $x = -3.25$ **C** $x = -12$ **D** $x = -13$

34 A school has 50 Year 12 students. 30 are boarders and 20 are day students. Two of these students are chosen at random.

Which **one** of the following is the probability, correct to 2 decimal places, that exactly one of the two students is a boarder?

A 0.24 **B** 0.48 **C** 0.49 **D** 0.50

35 The diagram shows a cuboid with AB = 20 cm, BC = 15 cm and AE = 8 cm.



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

A The lengths EG and BD are equal.

B AG = $\sqrt{689}$ cm

C Angle GEF = 37°, correct to the nearest degree.

D Angle HCE = 55°, correct to the nearest degree.

36 Georgia has been given the first five terms of a quadratic sequence. She works out the 1st differences and the 2nd differences as shown below.

Sequence	4	13	26	43	64	…	…
1st difference	9	13	17	21	…	…	
2nd difference	4	4	4	…	…		

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

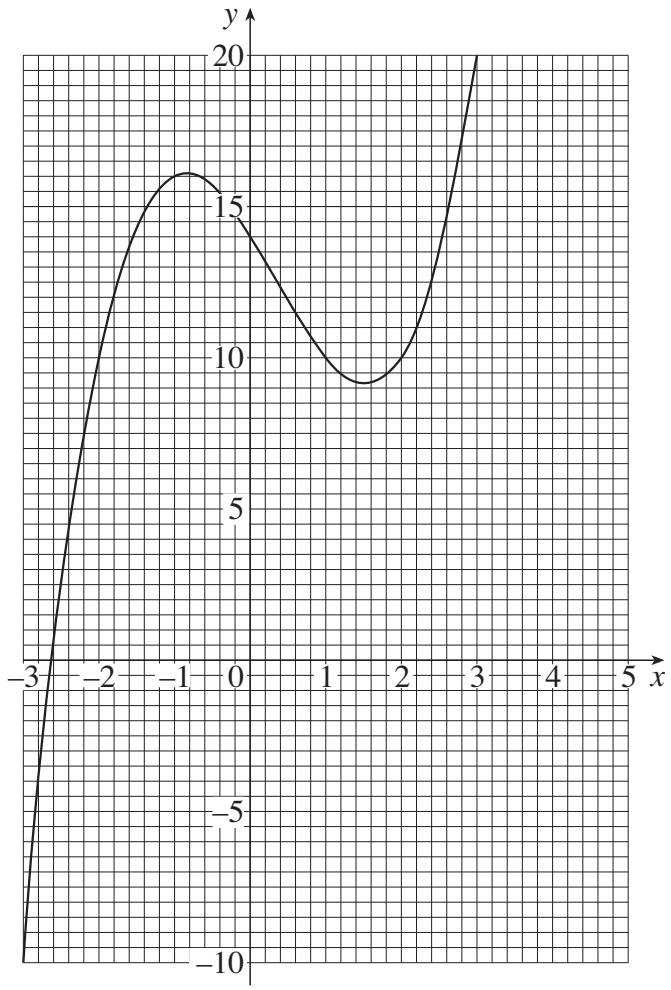
A The next number in the 1st differences row is 25.

B The seventh term in the sequence is 118.

C The 10th term in the sequence is an even number.

D The nth term of the sequence is given by $2n^2 + 3n - 1$.

37 The diagram shows the graph of $y = x^3 - x^2 - 4x + 14$.



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

A The equation $x^3 - x^2 - 4x + 14 = 0$ has exactly one real root.

B The equation $x^3 - x^2 - 4x + 14 = 12$ has exactly three real roots.

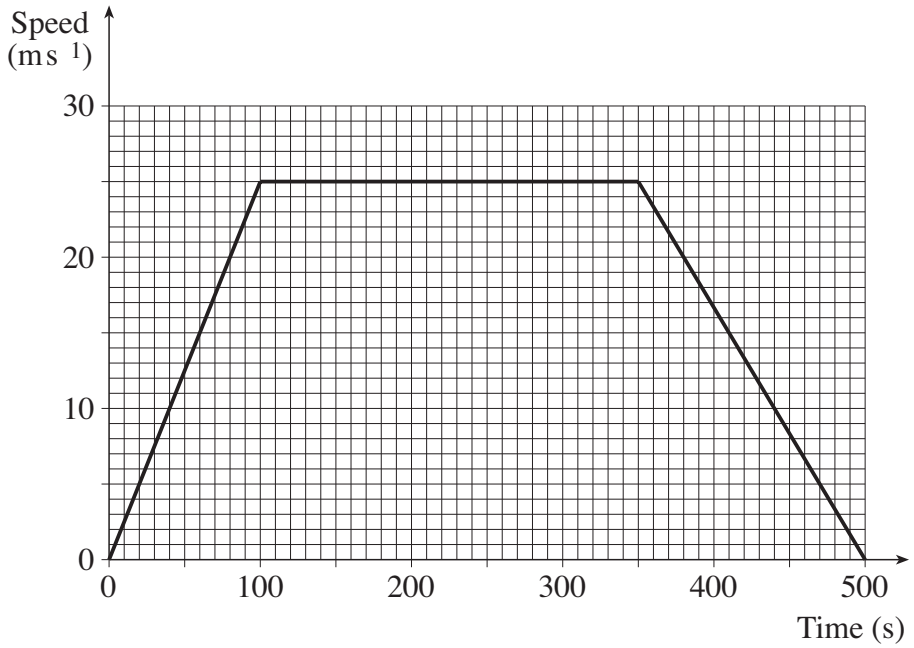
C The curve $y = x^3 - x^2 - 4x + 14$ has negative gradient when $x = -2$.

D There are two points on the curve $y = x^3 - x^2 - 4x + 14$ at which the gradient is zero.

38 Which **one** of the following is the **correct** simplification of $\frac{2(2x+1)}{3} - \frac{x-3}{5}$?

A $\frac{17x+24}{15}$ **B** $\frac{17x+19}{15}$ **C** $\frac{17x+14}{15}$ **D** $\frac{17x+1}{15}$

39 This graph shows the speed of a train as it travels from station A to station B.



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

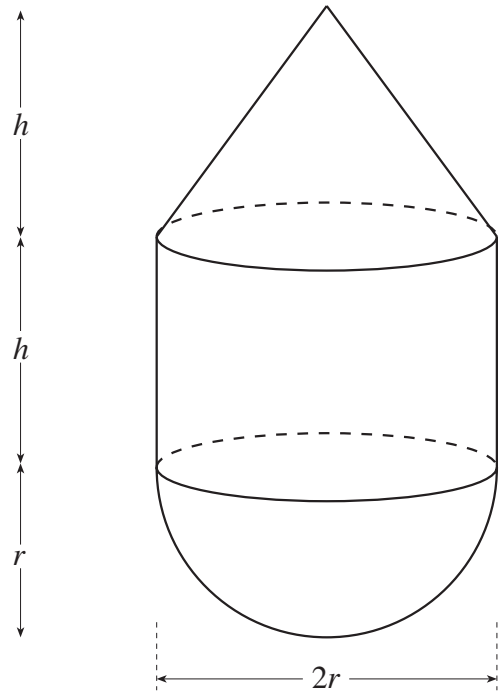
A The distance from station A to station B is 6.25 km.

B The acceleration of the train as it moves away from station A is $\frac{1}{4}$ m s ^{2}.

C The deceleration of the train as it approaches station B is $\frac{1}{6}$ m s ^{2}.

D The train is travelling at a constant speed for exactly half the time.

40 A solid is made up of three parts as shown in the diagram.



- The hemisphere has radius r and volume $\frac{2}{3}\pi r^3$.
- The cylinder has radius r, height h and volume $\pi r^2 h$.
- The cone has radius r, height h and volume $\frac{1}{3}\pi r^2 h$.

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

A The volume of the solid is given by $\frac{2}{3}\pi r^2(r + 2h)$.

B When $r = 3$ and $h = 5$ the volume of the solid is 78π.

C When $h = r$ the volume of the cylinder equals half the volume of the solid.

D The volume of the hemisphere is always greater than the volume of the cone.

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