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0580/42

May/June 2017

**2 hours 30 minutes**

Additional Materials: Electronic calculator                      Geometrical instruments  
Tracing paper (optional)

**READ THESE INSTRUCTIONS FIRST**

DO **NOT** WRITE IN ANY BARCODES.

For  $\pi$ , use either your calculator value or 3.142.

The total of the marks for this paper is 130.

This document consists of **20** printed pages.

- 1 (a) Annie and Dermot share \$600 in the ratio 11 : 9.

(i) Show that Annie receives \$330.

[1]

(ii) Find the amount that Dermot receives.

\$ ..... [1]

- (b) (i) Annie invests \$330 at a rate of 1.5% per year compound interest.

Calculate the amount that Annie has after 8 years.  
Give your answer correct to the nearest dollar.

\$ ..... [3]

(ii) Find the amount of **interest** that Annie has, after the 8 years, as a percentage of the \$330.

..... % [2]

- (c) Dermot has \$70 to spend.  
He spends \$24.75 on a shirt.

- (i) Find \$24.75 as a fraction of \$70.  
Give your answer in its lowest terms.

..... [1]

- (ii) The \$24.75 is the sale price after reducing the original price by 10%.

Calculate the original price.

\$ ..... [3]

- (d) After one year, the value of Annie's car had reduced by 20%.  
At the end of the second year, the value of Annie's car had reduced by a further 15% of its value at the end of the first year.

- (i) Calculate the overall percentage reduction after the two years.

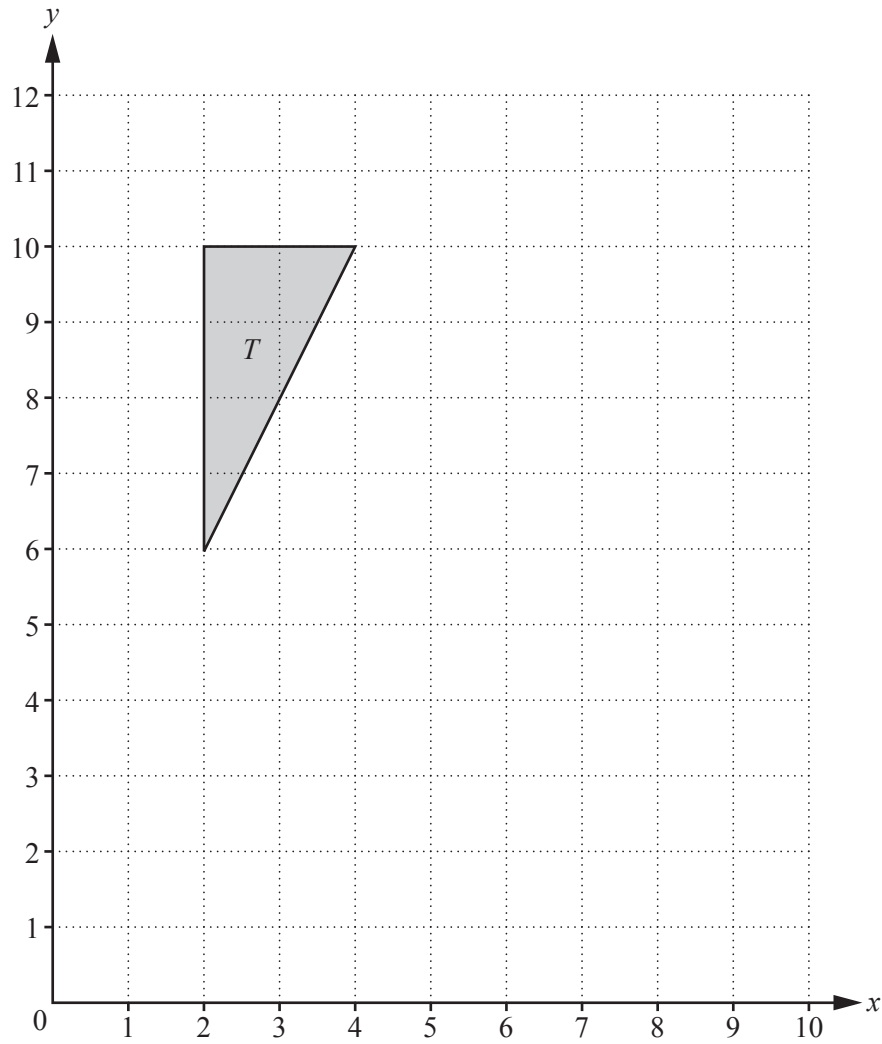
..... % [2]

- (ii) After three years the overall percentage reduction in the value of Annie's car is 40.84%.

Calculate the percentage reduction in the third year.

..... % [2]

2 (a)



On the grid, draw the image of

- (i) triangle *T* after translation by the vector  $\begin{pmatrix} 6 \\ -5 \end{pmatrix}$ , [2]
- (ii) triangle *T* after rotation through  $90^\circ$  anticlockwise with centre (4, 10), [2]
- (iii) triangle *T* after enlargement with scale factor  $\frac{1}{2}$ , centre (10, 0). [2]

(b) Describe fully the **single** transformation that is represented by the matrix  $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ .

..... [2]

(c)  $\mathbf{M} = \begin{pmatrix} 2 & 3 \\ 2 & 4 \end{pmatrix}$        $\mathbf{N} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$        $\mathbf{P} = (1 \ 5)$

(i) Find

(a)  $\mathbf{MN}$ ,

$$\mathbf{MN} = \quad \quad \quad [2]$$

(b)  $\mathbf{NP}$ ,

$$\mathbf{NP} = \quad \quad \quad [2]$$

(c)  $\mathbf{M}^{-1}$ .

$$\mathbf{M}^{-1} = \begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix} \quad [2]$$

(ii) Write down a product of two of the matrices  $\mathbf{M}$ ,  $\mathbf{N}$  and  $\mathbf{P}$  which it is not possible to work out.

..... [1]

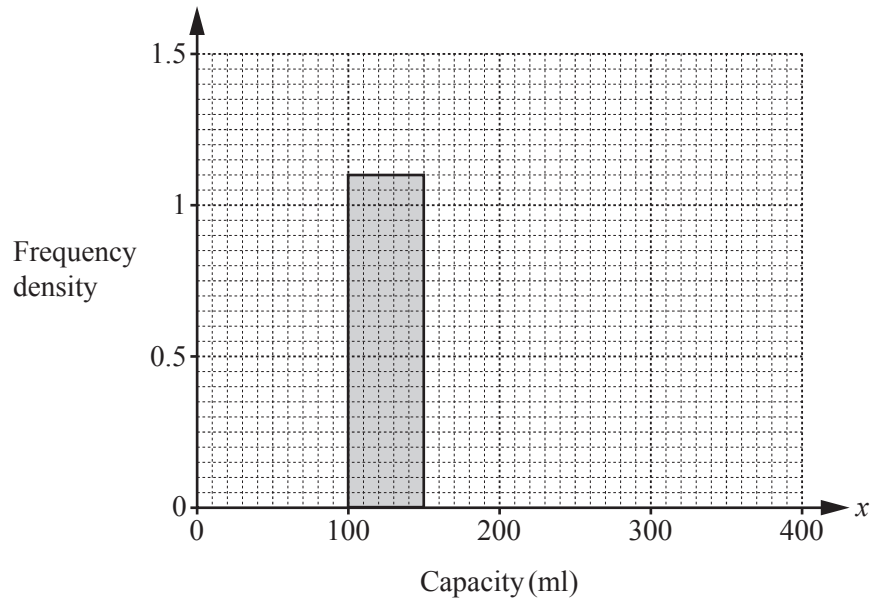
- 3 (a) 200 students estimate the capacity,  $x$  millilitres, of a cup.  
The results are shown in the frequency table.

| Capacity ( $x$ ml) | $0 < x \leq 100$ | $100 < x \leq 150$ | $150 < x \leq 200$ | $200 < x \leq 250$ | $250 < x \leq 400$ |
|--------------------|------------------|--------------------|--------------------|--------------------|--------------------|
| Frequency          | 20               | 55                 | 66                 | 35                 | 24                 |

- (i) Calculate an estimate of the mean.

..... ml [4]

- (ii) Complete the histogram.

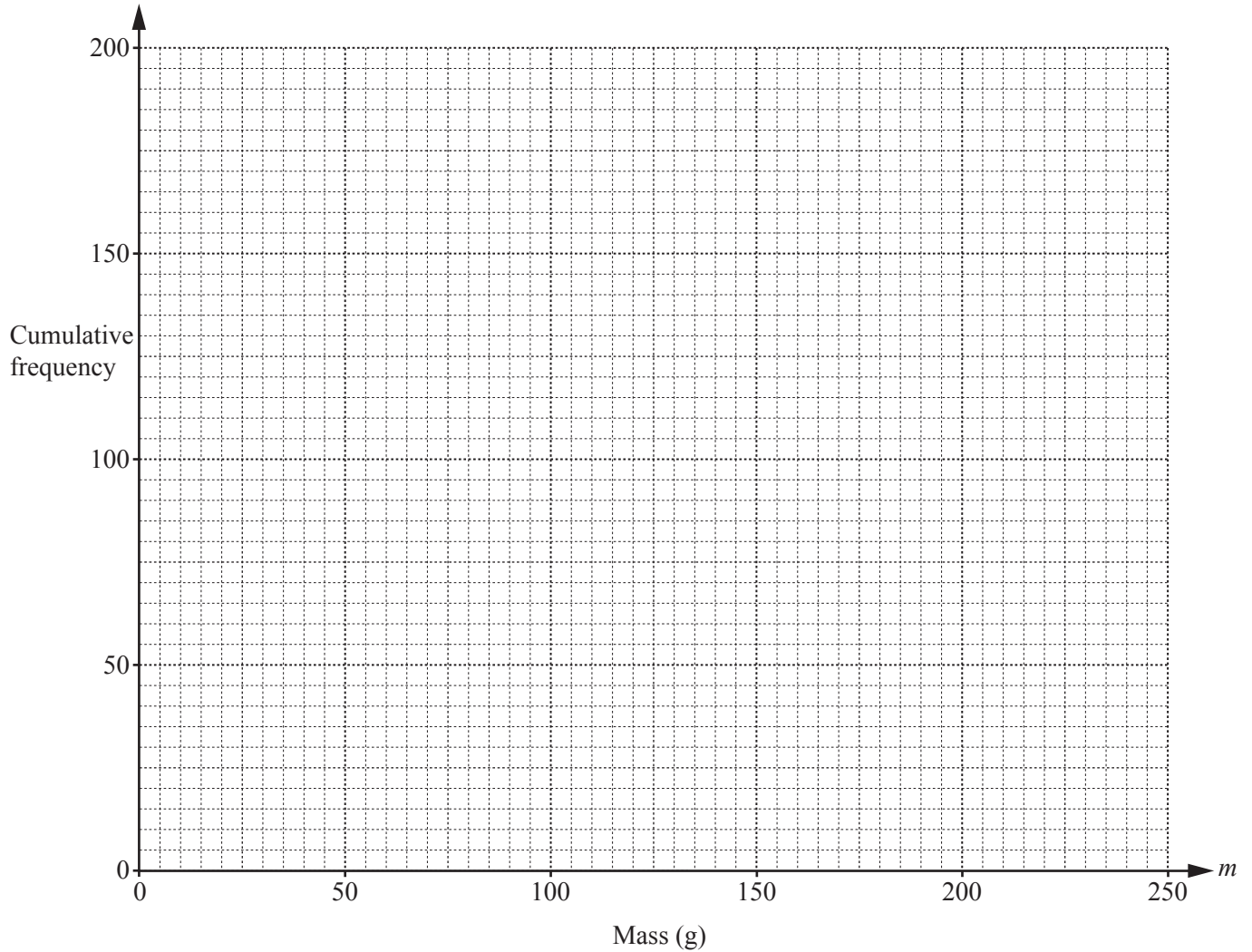


[4]

- (b) The 200 students also estimate the mass,  $m$  grams, of a small rock.  
The results are shown in the cumulative frequency table.

| Mass ( $m$ grams)    | $m \leq 50$ | $m \leq 100$ | $m \leq 150$ | $m \leq 200$ | $m \leq 250$ |
|----------------------|-------------|--------------|--------------|--------------|--------------|
| Cumulative frequency | 28          | 64           | 104          | 168          | 200          |

- (i) On the grid, draw a cumulative frequency diagram.



[3]

- (ii) Find

- (a) the 65th percentile,

..... g [1]

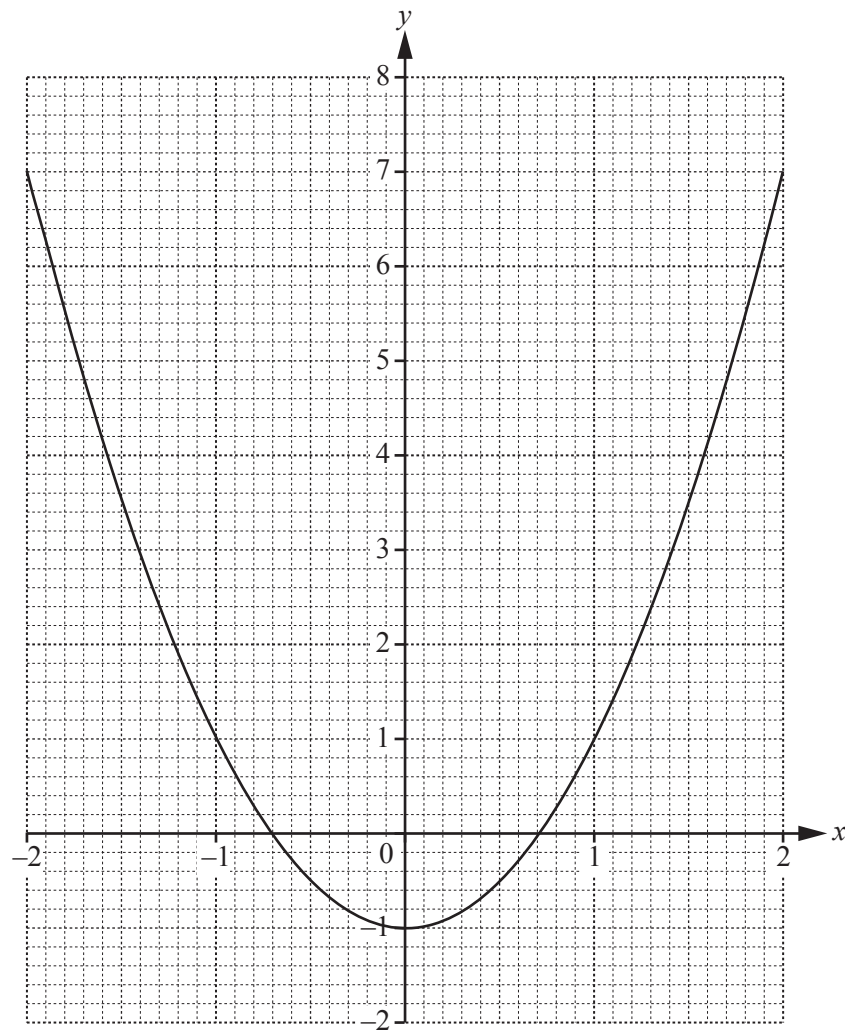
- (b) the number of students who estimated more than 75 g.

..... [2]

4

$$f(x) = 2x^2 - 1$$

The graph of  $y = f(x)$ , for  $-2 \leq x \leq 2$ , is drawn on the grid.



- (a) Use the graph to solve the equation  $f(x) = 5$ .

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [2]

- (b) (i) Draw the tangent to the graph of  $y = f(x)$  at the point  $(-1.5, 3.5)$ . [1]

- (ii) Use your tangent to estimate the gradient of  $y = f(x)$  when  $x = -1.5$ .

$\dots\dots\dots$  [2]

(c)  $g(x) = 2^x$

(i) Complete the table for  $y = g(x)$ .

|     |      |     |   |   |   |
|-----|------|-----|---|---|---|
| $x$ | -2   | -1  | 0 | 1 | 2 |
| $y$ | 0.25 | 0.5 |   | 2 | 4 |

[1]

(ii) On the grid opposite, draw the graph of  $y = g(x)$  for  $-2 \leq x \leq 2$ .

[3]

(d) Use your graphs to solve

(i) the equation  $f(x) = g(x)$ ,

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [2]

(ii) the inequality  $f(x) < g(x)$ .

$\dots\dots\dots$  [1]

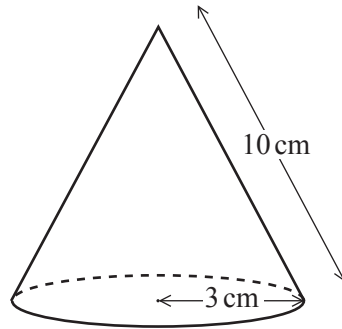
(e) (i) Write down the three values.

$g(-3) = \dots\dots\dots$   $g(-5) = \dots\dots\dots$   $g(-10) = \dots\dots\dots$  [1]

(ii) Complete the statement.

As  $x$  decreases,  $g(x)$  approaches the value  $\dots\dots\dots$  [1]

5

NOT TO  
SCALE

The diagram shows a hollow cone with radius 3 cm and slant height 10 cm.

- (a) (i) Calculate the curved surface area of the cone.

[The curved surface area,  $A$ , of a cone with radius  $r$  and slant height  $l$  is  $A = \pi r l$ .]

.....  $\text{cm}^2$  [2]

- (ii) Calculate the perpendicular height of the cone.

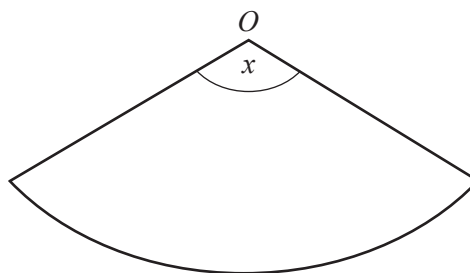
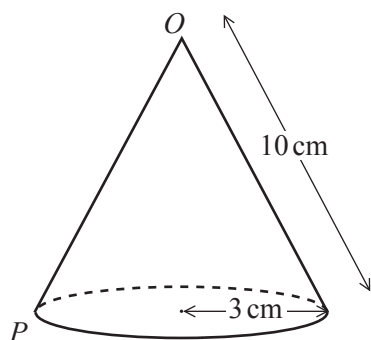
.....  $\text{cm}$  [3]

- (iii) Calculate the volume of the cone.

[The volume,  $V$ , of a cone with radius  $r$  and height  $h$  is  $V = \frac{1}{3}\pi r^2 h$ .]

.....  $\text{cm}^3$  [2]

(b)

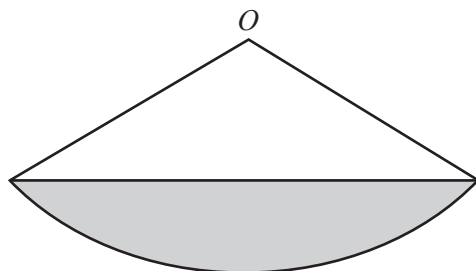
NOT TO  
SCALE

The cone is cut along the line  $OP$  and is opened out into a sector as shown in the diagram.

Calculate the sector angle  $x$ .

$x = \dots\dots\dots$  [4]

(c)

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The diagram shows the same sector as in **part (b)**.

Calculate the area of the shaded segment.

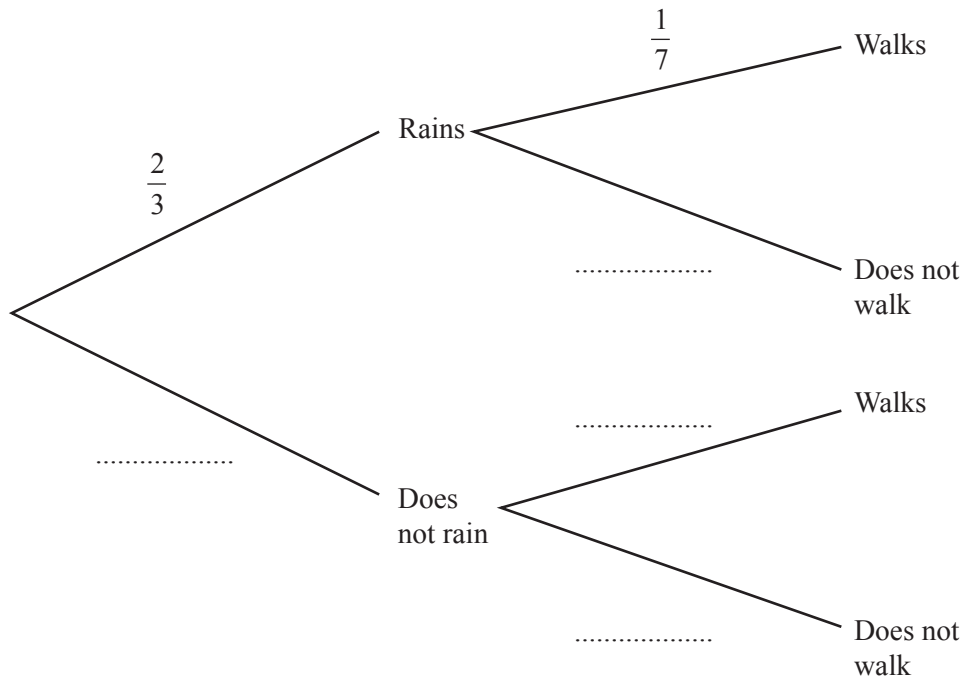
$\dots\dots\dots \text{ cm}^2$  [4]

- 6 Each morning the probability that it rains is  $\frac{2}{3}$ .

If it rains, the probability that Asha walks to school is  $\frac{1}{7}$ .

If it does not rain, the probability that Asha walks to school is  $\frac{4}{7}$ .

- (a) Complete the tree diagram.



[2]

- (b) Find the probability that it rains and Asha walks to school.

..... [2]

- (c) (i) Find the probability that Asha does not walk to school.

..... [3]

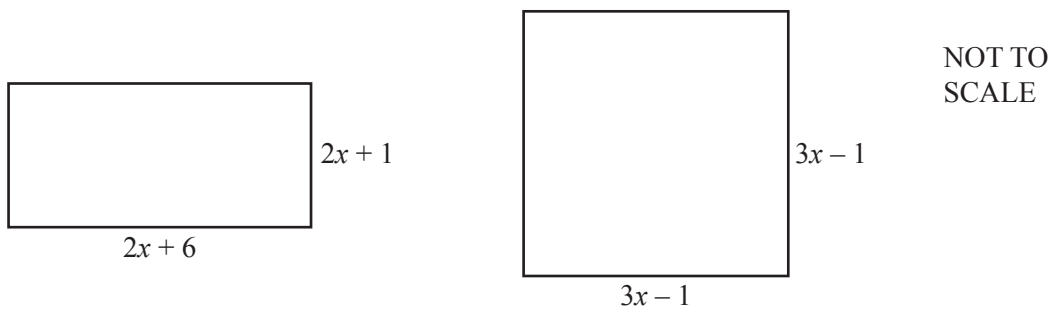
- (ii) Find the expected number of days Asha does not walk to school in a term of 70 days.

..... [2]

- (d) Find the probability that it rains on exactly one morning in a school week of 5 days.

..... [2]

- 7 (a) In this part, all lengths are in centimetres.



- (i) Find the value of  $x$  when the perimeter of the rectangle is equal to the perimeter of the square.

$$x = \dots\dots\dots [3]$$

- (ii) Find the value of  $x$  when the area of the rectangle is equal to the area of the square.  
Show all your working.

$$x = \dots\dots\dots [7]$$

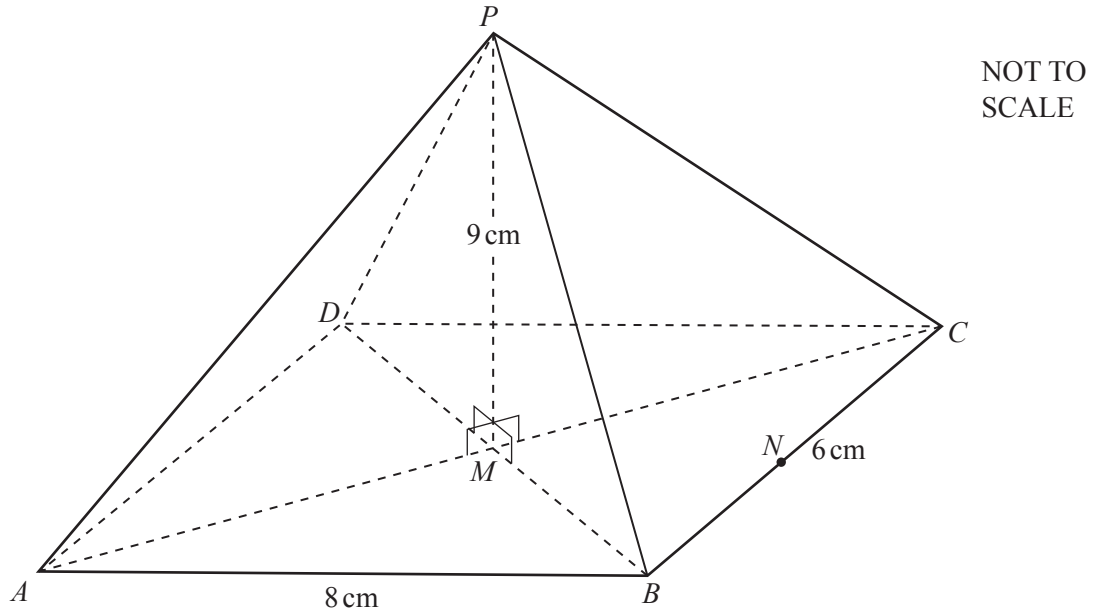
- (b) (i) Factorise  $x^2 + 4x - 5$ .

..... [2]

- (ii) Solve the equation  $\frac{5}{x} - \frac{8}{x+1} = 1$ .

Show all your working.

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [4]



The diagram shows a pyramid on a rectangular base  $ABCD$ .  
 $AC$  and  $BD$  intersect at  $M$  and  $P$  is vertically above  $M$ .  
 $AB = 8\text{ cm}$ ,  $BC = 6\text{ cm}$  and  $PM = 9\text{ cm}$ .

- (a)  $N$  is the midpoint of  $BC$ .

Calculate angle  $PNM$ .

Angle  $PNM = \dots\dots\dots$  [2]

- (b) Show that  $BM = 5\text{ cm}$ .

[1]

- (c) Calculate the angle between the edge  $PB$  and the base  $ABCD$ .

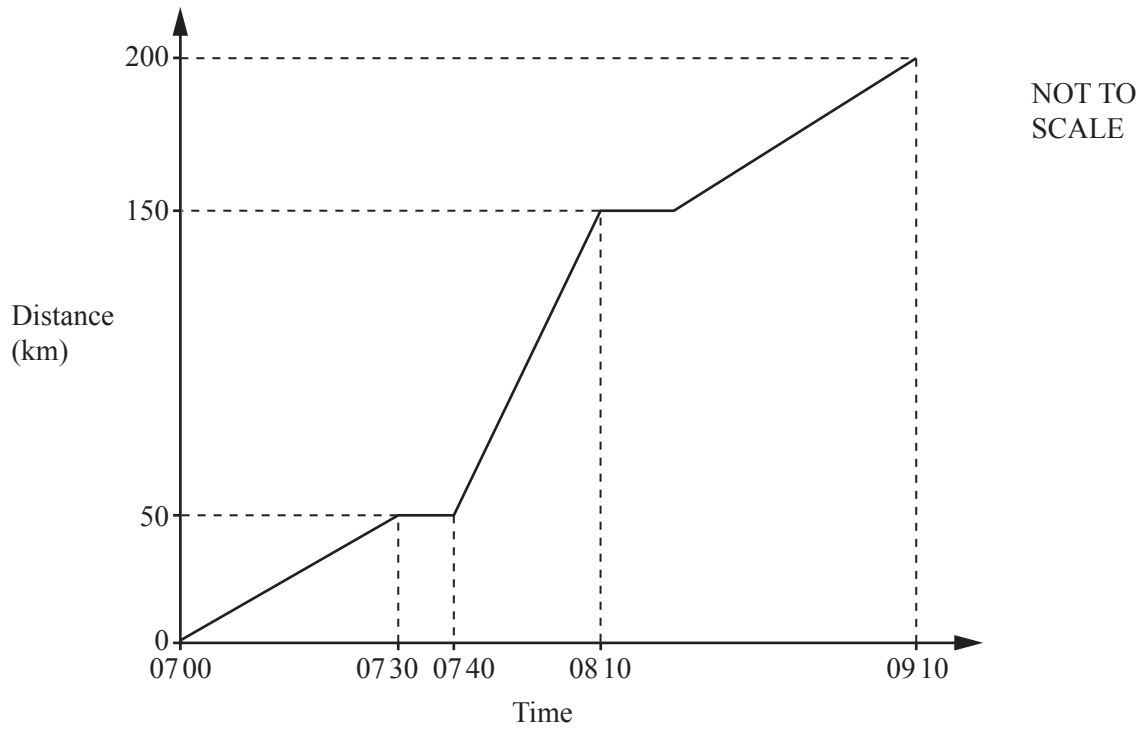
..... [2]

- (d) A point  $X$  is on  $PC$  so that  $PX = 7.5$  cm.

Calculate  $BX$ .

$BX =$  ..... cm [6]

9 (a)



The distance-time graph shows the journey of a train.

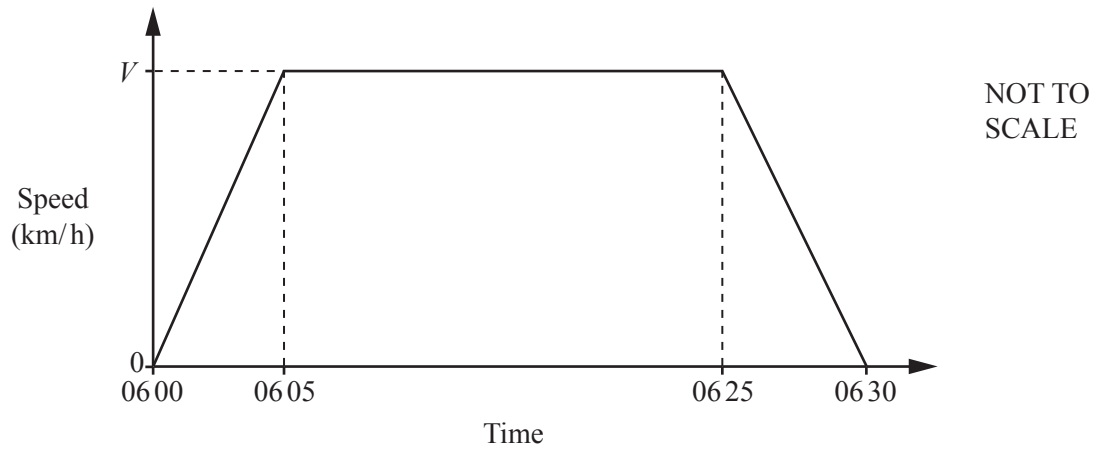
(i) Find the speed of the train between 07 00 and 07 30.

..... km/h [1]

(ii) Find the average speed for the whole journey.

..... km/h [3]

(b)



The speed-time graph shows the first 30 minutes of another train journey.  
 The distance travelled is 100 km.  
 The maximum speed of the train is  $V$  km/h.

(i) Find the value of  $V$ .

$V = \dots\dots\dots$  [3]

(ii) Find the acceleration of the train during the first 5 minutes.  
 Give your answer in  $\text{m/s}^2$ .

$\dots\dots\dots \text{m/s}^2$  [2]

Question 10 is printed on the next page.

10       $f(x) = 3x - 2$                    $g(x) = x^2$                    $h(x) = 3^x$

(a) Find  $f(-3)$ .

..... [1]

(b) Find the value of  $x$  when  $f(x) = 19$ .

$x =$  ..... [2]

(c) Find  $fh(2)$ .

..... [2]

(d) Find  $gf(x) + f(x) + x$ .  
Give your answer in its simplest form.

..... [3]

(e) Find  $f^{-1}(x)$ .

$f^{-1}(x) =$  ..... [2]

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