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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π, use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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1 **(a)** The total cost of a taxi journey is calculated as

View solution

- \$0.50 per kilometre

plus

- \$0.40 per minute.

(i) Calculate the total cost of a journey of 32 km that takes 30 minutes.

\$ ..... [2]

(ii) The total cost of a journey of 100 km is \$98.

View solution

Show that the time taken is 2 hours.

[3]

(b) Three taxi drivers travel a total of 8190 km in the ratio 5 : 2 : 7.

View solution

Calculate the distance each driver travels.

Driver 1 ..... km

Driver 2 ..... km

Driver 3 ..... km [3]

(c) After midnight, the cost of any taxi journey increases by 45%.
One journey costs \$84.10 after midnight.

View solution

Calculate the cost of the same journey before midnight.

\$ ..... [2]

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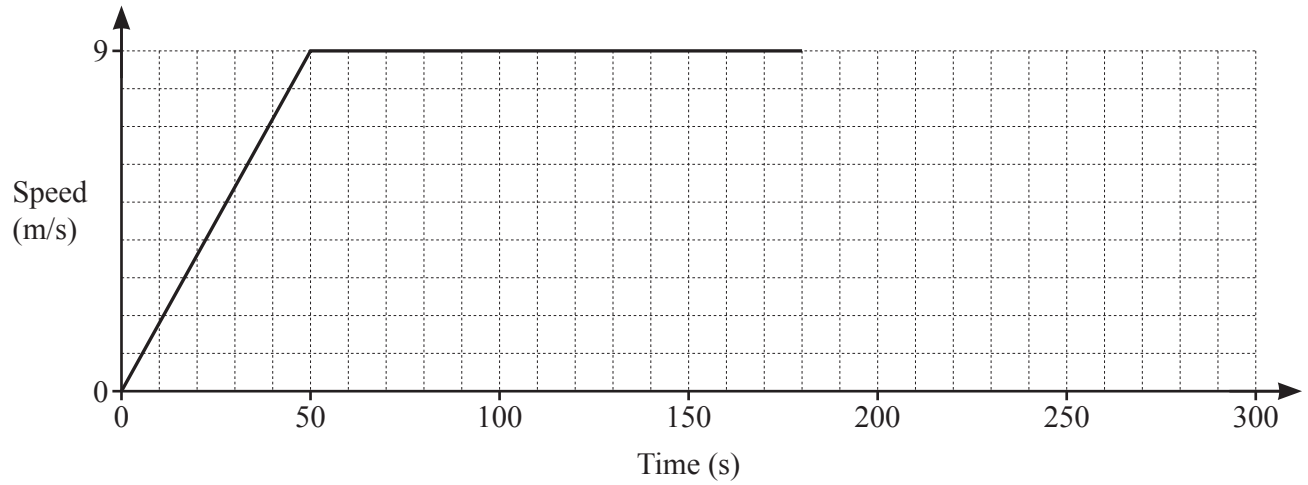
2 The diagram shows the speed−time graph for the first 180 seconds of a train journey.



(a) Find the acceleration, in m/s^2, of the train during the first 50 seconds.

View solution

..... m/s^2 [1]

(b) After 180 seconds, the train decelerates at a constant rate of 1944 $\mathbf{km/h^2}$.

View solution

Show that the train decelerates for 60 seconds until it stops.

[2]

View solution

(c) Complete the speed−time graph. [1]

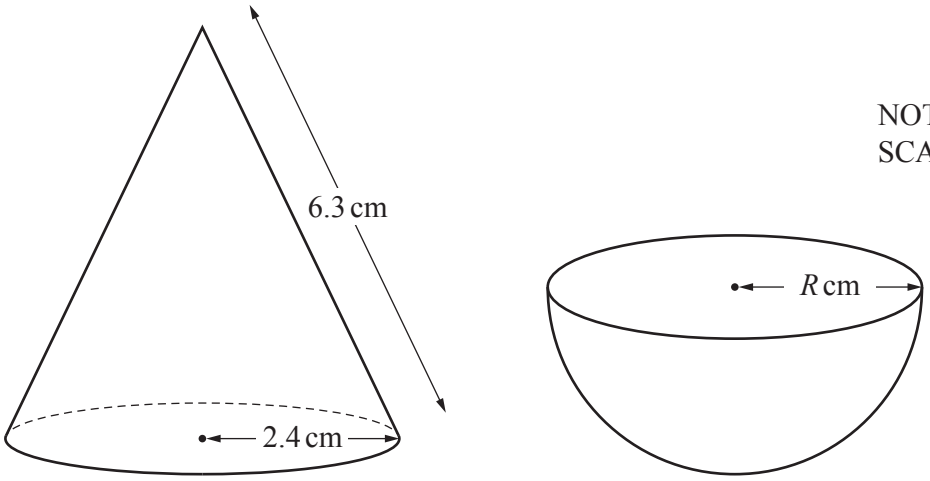
(d) Calculate the average speed of the train for the whole journey.

View solution

..... m/s [4]

3 (a)

View solution



The diagram shows a solid cone and a solid hemisphere.
The cone has radius 2.4 cm and slant height 6.3 cm.
The hemisphere has radius R cm.
The **total** surface area of the cone is equal to the **total** surface area of the hemisphere.

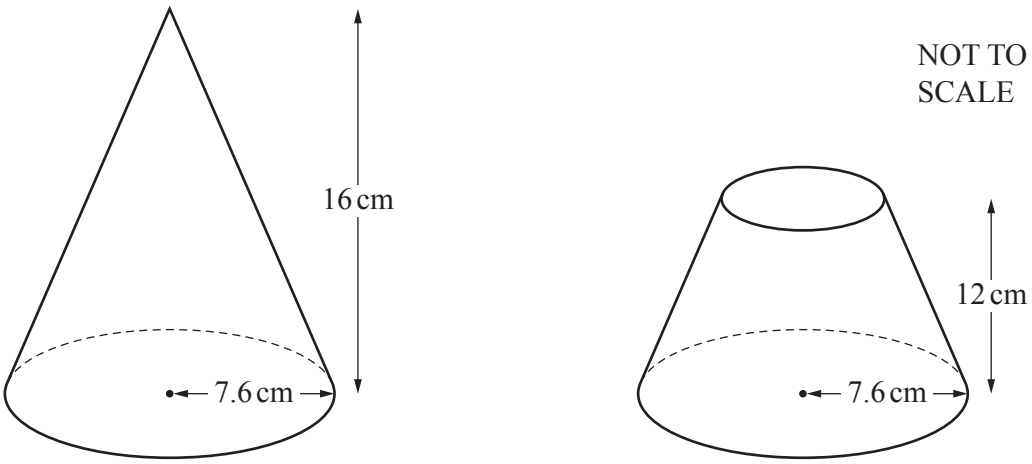
Calculate the value of R.

[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]
[The curved surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

$R =$ ..... [4]

(b)

View solution



The diagram shows a solid cone with radius 7.6 cm and height 16 cm.
A cut is made parallel to the base of the cone and the top section is removed.
The remaining solid has height 12 cm, as shown in the diagram.

Calculate the volume of the remaining solid.

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

..... cm^3 [4]

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4 **(a)** The exchange rate is 1 euro = \$1.142 .

View solution

(i) Johann changes \$500 into euros.

Calculate the number of euros Johann receives.
Give your answer correct to the nearest euro.

..... euros [2]

View solution

(ii) Johann buys a computer for \$329.
The same computer costs 275 euros.

Calculate the difference in cost in dollars.

\$ ..... [2]

View solution

(b) Lucy spends $\frac{3}{8}$ of the money she has saved this month on a book that costs \$5.25 .

Calculate how much money Lucy has saved this month.

\$ ..... [2]

View solution

(c) Kamal invests \$6130 at a rate of r% per year compound interest.
The value of his investment at the end of 5 years is \$6669.

Calculate the value of r.

$r =$ ..... [3]

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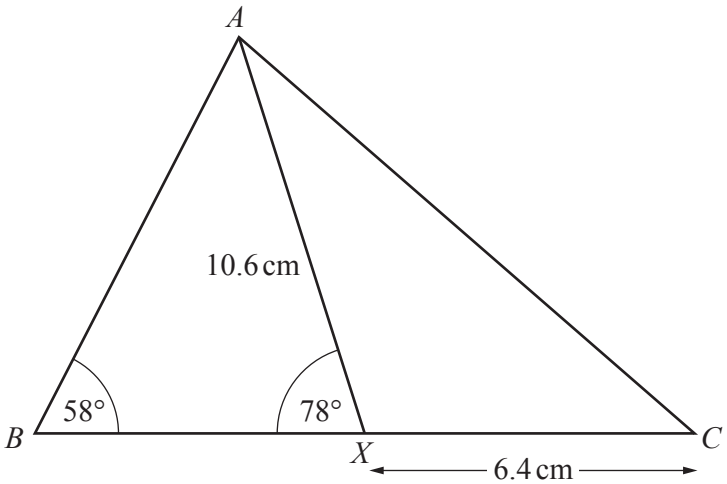
5



NOT TO SCALE

The diagram shows triangle ABC.
X is a point on BC.
$AX = 10.6$ cm, $XC = 6.4$ cm, angle $ABC = 58°$ and angle $AXB = 78°$.

(a) Calculate AC.

View solution

$AC =$ ..... cm [4]

(b) Calculate BX.

View solution

$BX =$ ..... cm [4]

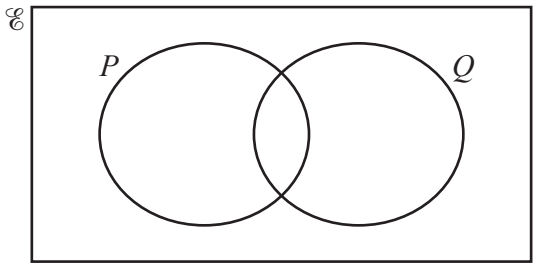
(c) Calculate the area of triangle ABC.

View solution

..... cm^2 [3]

6 **(a)** In the Venn diagram, shade the region $P' \cup Q$.

View solution



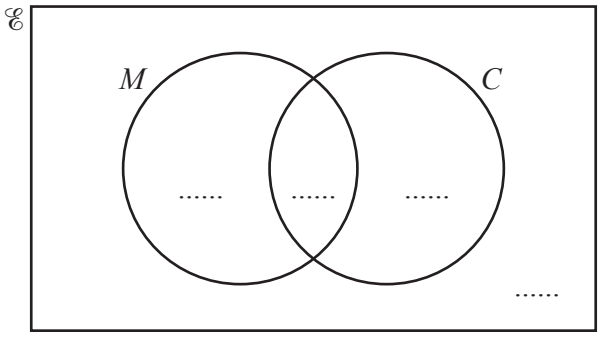
[1]

(b) There are 50 students in a group.

View solution

34 have a mobile phone (M).
39 have a computer (C).
5 have no mobile phone and no computer.

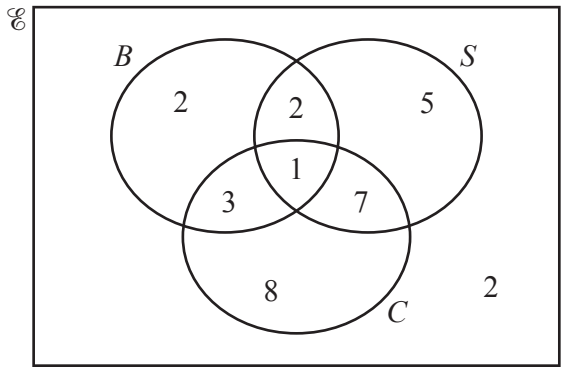
Complete the Venn diagram to show this information.



[2]

(c) The Venn diagram shows the number of students in a group of 30 who have brothers (B), sisters (S) or cousins (C).

View solution



(i) Write down the number of students who have brothers.

..... [1]

(ii) Write down the number of students who have cousins but do not have sisters.

..... [1]

(iii) Find $\mathrm{n}(B \cup S \cup C)'$.

..... [1]

(iv) Use set notation to describe the set of students who have both cousins and sisters but do not have brothers.

..... [1]

(v) One student is picked at random from the 30 students.

Find the probability that this student has cousins.

..... [1]

(vi) Two students are picked at random from the students who have cousins.

Calculate the probability that both these students have brothers.

..... [3]

(vii) One student is picked at random from the 30 students.

Event A This student has sisters.
Event B This student has cousins but does not have brothers.

Explain why event A and event B are equally likely.

.....

..... [1]

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7 **(a)** Simplify.

View solution

$$\frac{x^2-25}{x^2-x-20}$$

..... [3]

(b) Write as a single fraction in its simplest form.

View solution

$$\frac{x+5}{x}+\frac{x+8}{x-1}$$

..... [3]

(c) A curve has equation $y = 2x^3 - 4x^2 + 6$.

View solution

(i) Find $\frac{dy}{dx}$, the derived function of y.

..... [2]

(ii) Calculate the gradient of the curve $y = 2x^3 - 4x^2 + 6$ at $x = 4$.

View solution

..... [2]

(iii) Find the coordinates of the two stationary points on the curve.

View solution

(..... , ...) and (..... , ...) [4]

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8 **(a)** The table shows information about the mass, in kilograms, of each of 50 children.

View solution

Mass (k kg)	$0 < k \leqslant 10$	$10 < k \leqslant 25$	$25 < k \leqslant 35$	$35 < k \leqslant 40$	$40 < k \leqslant 50$
Frequency	3	19	21	5	2

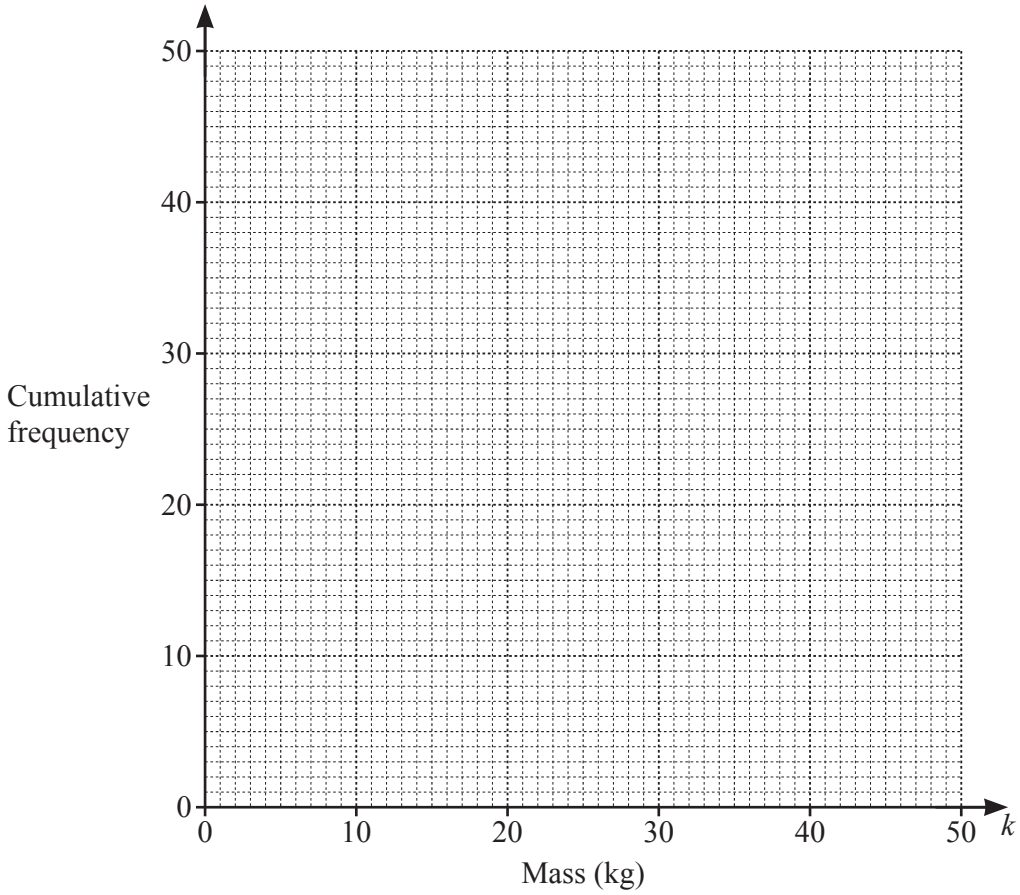
(i) Complete the cumulative frequency table.

Mass (k kg)	$k \leqslant 10$	$k \leqslant 25$	$k \leqslant 35$	$k \leqslant 40$	$k \leqslant 50$
Cumulative frequency					

[2]

(ii) On the grid, draw a cumulative frequency diagram to show this information.

View solution



[3]

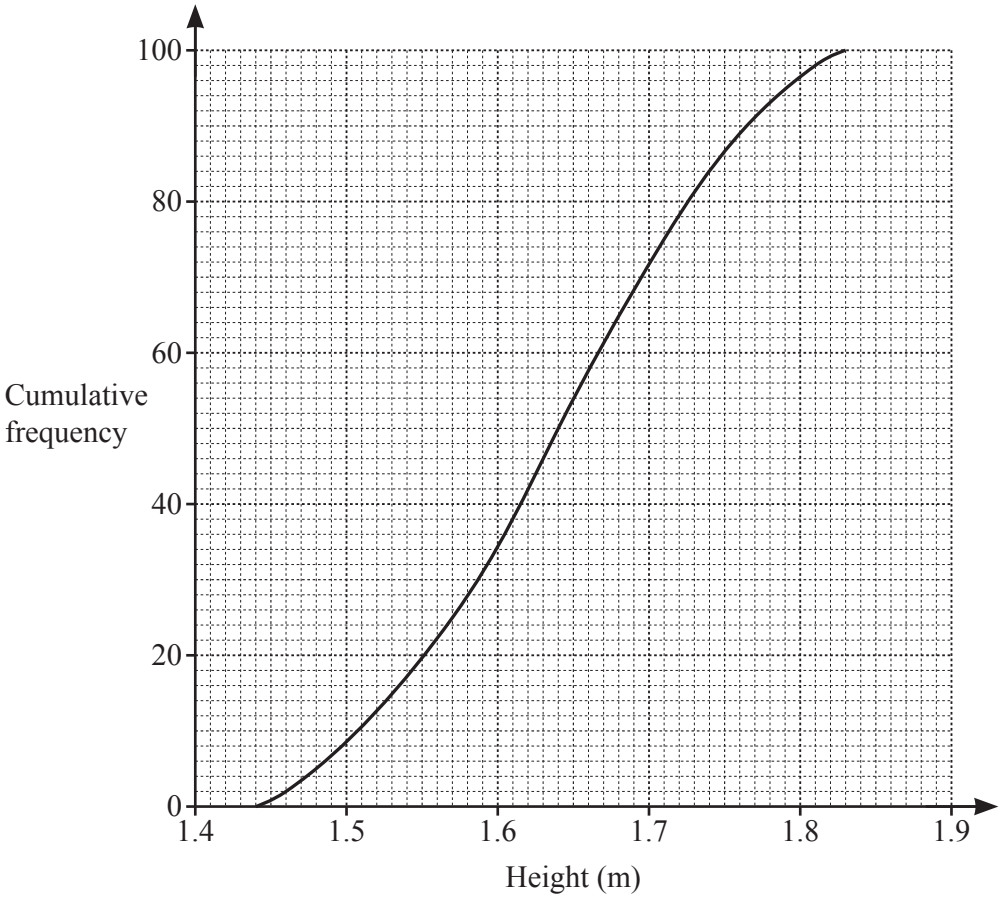
(iii) Use your diagram to find an estimate of the number of children with a mass of 32 kg or less.

..... [1]

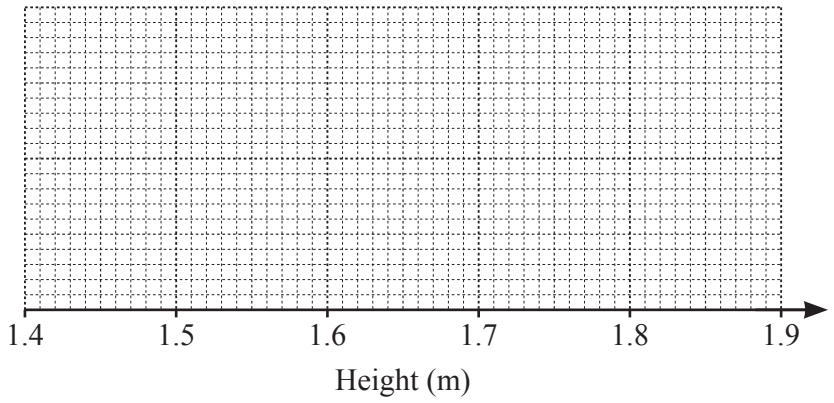
View solution

(b) This cumulative frequency diagram shows information about the height, in metres, of each of 100 students.

View solution



The height of the tallest student is 1.83 metres.
The height of the shortest student is 1.45 metres.



On this grid, draw a box-and-whisker plot for the heights of the 100 students. [4]

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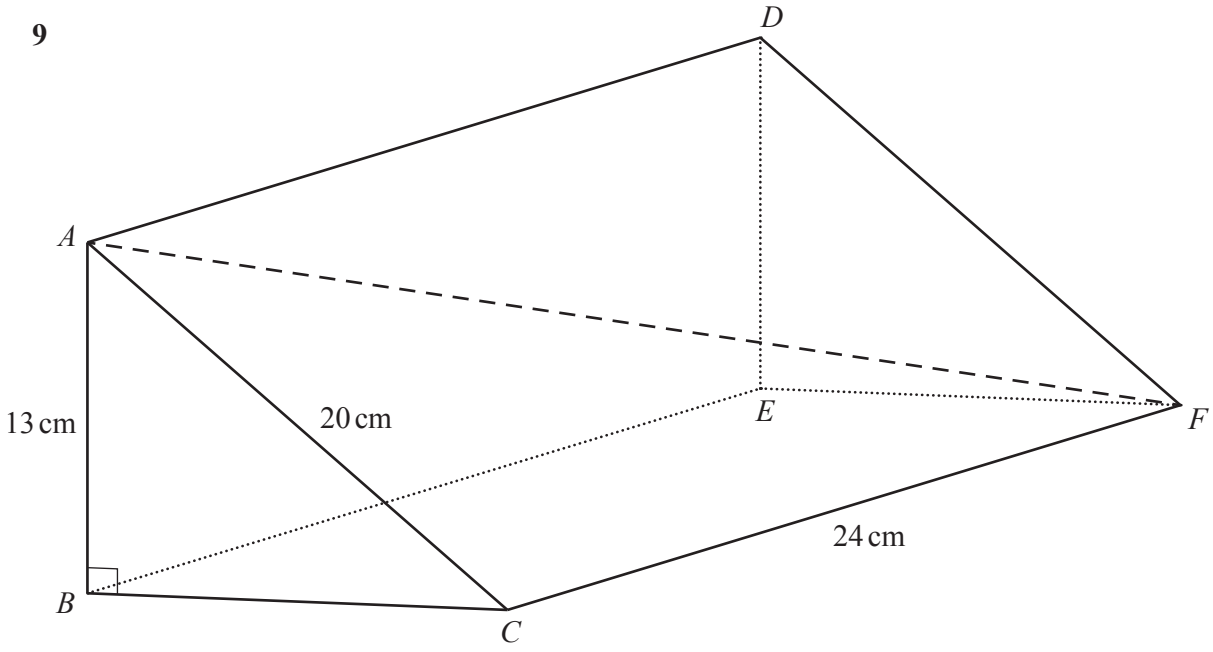

NOT TO SCALE

The diagram shows a prism, $ABCDEF$.
$AB = 13$ cm, $AC = 20$ cm, $CF = 24$ cm and angle $ABC = 90°$.

(a) Calculate the total surface area of the prism.

View solution

..... cm^2 [6]

(b) Calculate the volume of the prism.

View solution

..... cm^3 [1]

(c) Calculate the angle that AF makes with the base $BCFE$.

View solution

..... [4]

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10 The table shows some values of $y = 3 + 4x - x^2$ for $-1 \leqslant x \leqslant 5$.

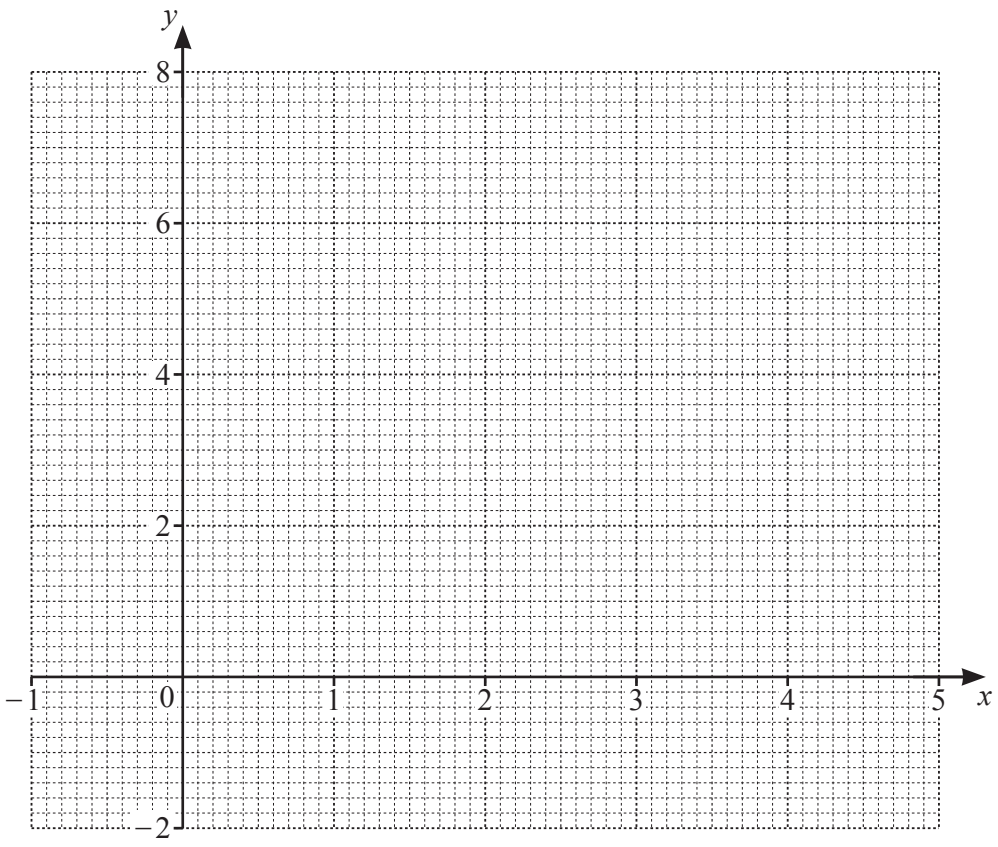
x	-1	-0.5	0	1	2	3	4	4.5	5
y	-2			6		6			-2

View solution

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = 3 + 4x - x^2$ for $-1 \leqslant x \leqslant 5$.

View solution



[4]

(c) Write down an **integer** value of k for which the equation $3 + 4x - x^2 = k$ has no solutions.

View solution

..... [1]

(d) By drawing a suitable straight line on the grid, solve the equation $-1 + \frac{9}{2}x - x^2 = 0$.

View solution

$x =$ ..... or $x =$ ..... [4]

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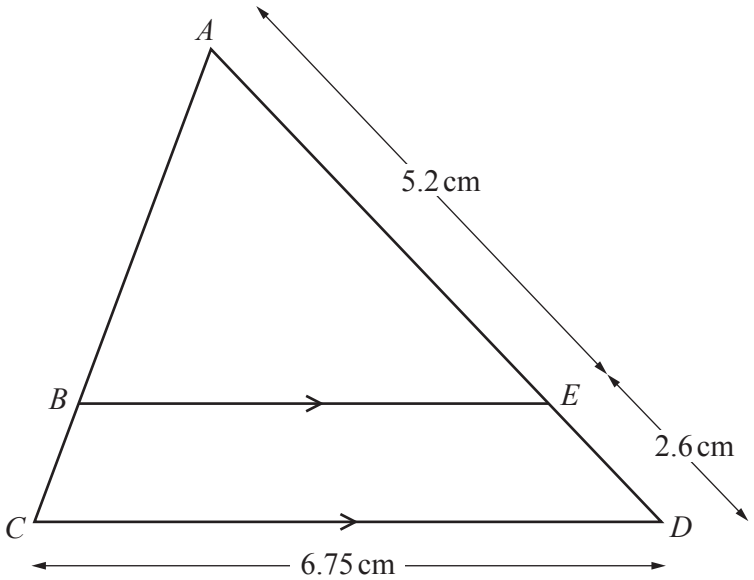
11 (a) Find the size of an exterior angle of a regular polygon with 18 sides.

View solution

..... [2]

(b)

View solution



NOT TO SCALE

In triangle ACD, B lies on AC and E lies on AD such that BE is parallel to CD.
$AE = 5.2$ cm and $ED = 2.6$ cm.

Calculate BE.

$BE =$ ..... cm [2]

(c) Two solids are mathematically similar.
The smaller solid has height 2 cm and volume 32 cm^3.
The larger solid has volume 780 cm^3.

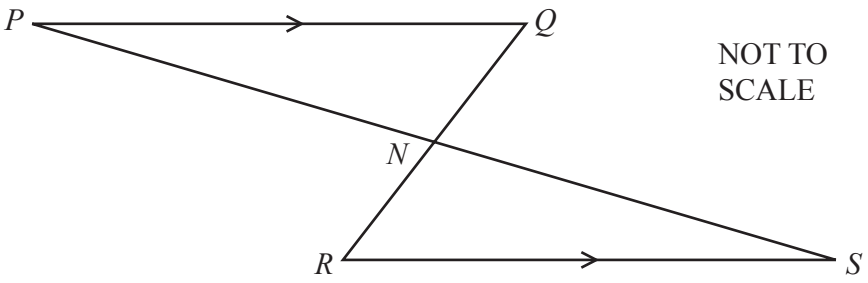
View solution

Calculate the height of the larger solid.

..... cm [3]

(d)

View solution



PQ is parallel to *RS*, *PNS* is a straight line and *N* is the midpoint of *RQ*.

Explain, giving reasons, why triangle *PQN* is congruent to triangle *SRN*.

.....

.....

.....

..... [4]

12 $f(x) = 3 - 2x$ $g(x) = x^2 + 5$ $h(x) = x^3$

(a) Find $f(-5)$.

View solution

..... [1]

(b) Find $ff(x)$.
Give your answer in its simplest form.

View solution

..... [2]

(c) Solve $g(x) = f(x) + 37$.

View solution

$x =$ ..... or $x =$ ..... [4]

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

View solution

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

(e) Find $hf(x) + g(x)$.
Give your answer in its simplest form.

View solution

..... [5]

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