BENDEMEER SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

CANDIDATE NAME

CLASS

INDEX NUMBER

MATHEMATICS
Paper 1

4052/01
20 Aug 2024
2 hours 15 minutes

Candidates answer on the Question Paper.
No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid/tape.
DO **NOT** WRITE ON ANY BARCODES.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question, it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 90.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

FOR EXAMINER'S USE
90

MATHEMATICAL FORMULAE

Compound Interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle ABC} = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1 Factorise each of the following completely.

(a) $4a^2 - b^2$

Answer ..... [1]

(b) $5x - 1 + 10x^2y - 2xy$

Answer ..... [2]

2 **(a)** Simplify $(2x^3y)^3$.

Answer ..... [1]

(b) Use the laws of indices to solve the following equation for *x*. Show your working clearly.

$2^2 \times 5^3 + \frac{1}{125^x} = 5^4$.

Answer *x* =..... [2]

3 **(a)** Express 1176 as a product of its prime factors.

Answer ..... [1]

(b) The number 1176k is a perfect cube.
Find the smallest positive integer value of k.

Answer k = ... [1]

(c) The highest common factor of two distinct integers, n and 1176, is 28.
Given that $500 < n < 1000$, find the smallest possible value of n.

Answer n = ... [1]

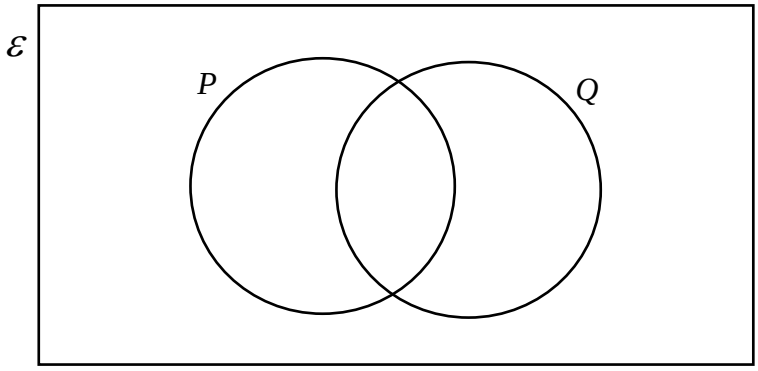
4 The volume of a right pyramid is 4.8×10^{-8} m^3 and its length of the square base is 1.5×10^{-3}m. Giving your answer in standard form, find its height.

Answer ..... m [2]

5 Benjamin invested \$8000 at a rate of 3.3% per annum compounded monthly.
What is the value of his investment at the end of 6 months?

Answer \$ ..... [2]

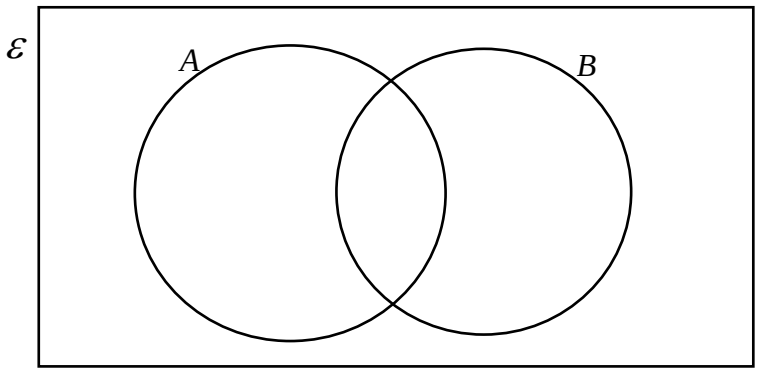
6 **(a)** In the Venn diagram below, shade the region $P \cup Q'$.



[1]

(b) A universal set ε and its subset A and B are given by
$\mathcal{E} = \{x: x \text{ is an integer and } 0 < x < 12\}$,
$A = \{x: x \text{ is a factor of } 24\}$,
$B = \{x: 2x - 7 \geq 5\}$.

(i) Write all the elements of $\mathcal{E}$ in the Venn diagram below.



[2]

(ii) Another number is included in the universal set $\mathcal{E}$.
This number is in the region $A \cap B$.
Write down a possible value of this number.

Answer …..... [1]

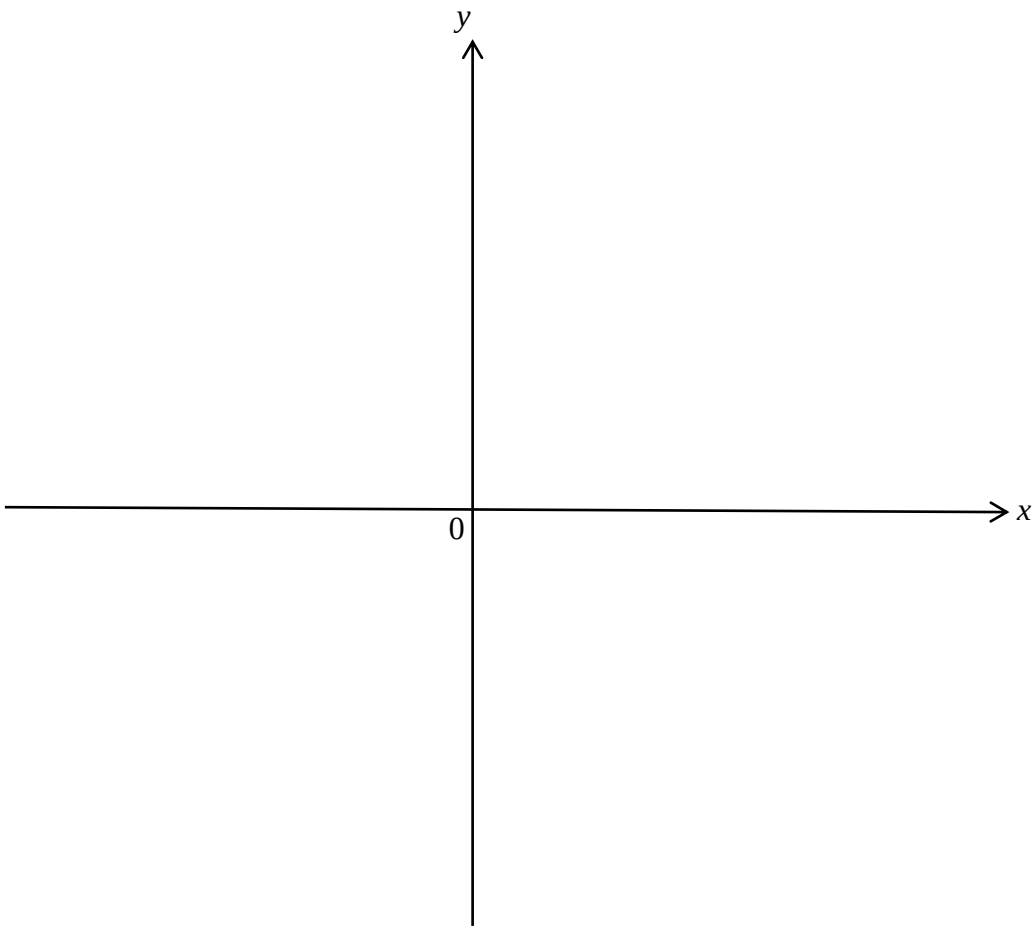
7 The expression $2x^2 + 8x + 9$ is equivalent to $2(x + a)^2 + b$.

(a) Find the value of *a* and the value of *b*.

Answer a = ... [1]

b = ... [1]

(b) Sketch the curve $y = 2x^2 + 8x + 9$ on the given axes below, clearly showing the y-intercept and the turning point.



[2]

8 Given that the formula of y is inversely proportional to the square of $(x + 2)$ and the value of $y = \frac{1}{3}$ when $x = 7$.

(a) Express y in terms of x.

Answer $y =$ ..... [2]

(b) Hence, or otherwise, make x the subject of the formula.

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

9 Explain why $(2n+3)^2-(4n+3)(n-6)$ is a multiple of 3 for all integer values of n.

Answer

.....

.....

[2]

10 Simplify $\frac{2x+3}{x^2+3x+2}-\frac{5}{x+1}$ as a single fraction.

Answer ..... [3]

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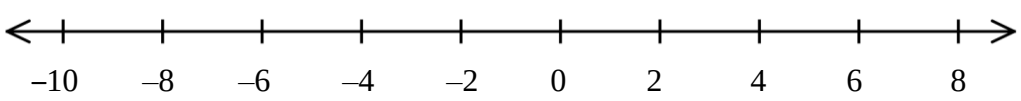
11 **(a)** Solve the inequality $x - 7 \leq \frac{3x-5}{2} < 8$.

Represent your solution on the number line below.

Answer



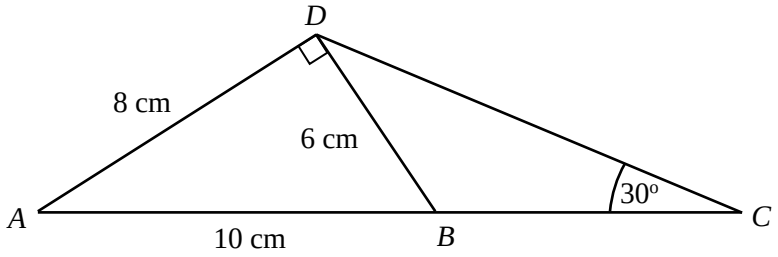
[3]

(b) Hence, write down the largest prime number that satisfy the inequality

$x - 7 \leq \frac{3x-5}{2} < 8.$

Answer x = ... [1]

12 In the diagram below, *ADB* is a right-angled triangle with angle $ADB = 90°$ and *ACD* is a triangle with *AD* = 8 cm and angle $DCA = 30°$.
B is a point on *AC* such that *AB* = 10 cm and *DB* = 6 cm.



(a) Write down, as a fraction in its simplest form, the value of $sin\angle DBC$.

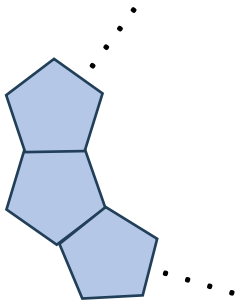
Answer ..... [1]

(b) **Hence**, calculate the length of *DC*.

Answer ..... cm [2]

13 Dorothy wants to make a bracelet using gemstones. Every gemstone is a regular pentagon of the same size.

How many gemstones does she need to make a bracelet assuming that there is no gap between each gemstone?



Answer ..... [3]

14 Each term in the following sequence is found by multiplying the same constant to the previous term.

p, 12, q, 48, r, …

(a) Write down two possible values of q.

Answer q = ... or ..... [2]

(b) Write down the value of $\frac{p}{r}$.

Answer ……..... [1]

(c) Write down the nth term of the sequence.

Answer ……..... [1]

(d) Explain why 400 is not a term in this sequence.

.....

.....

..... [1]

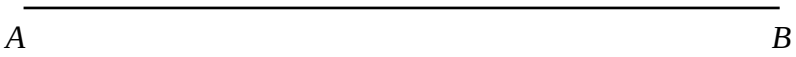
15 A bag initially contains 6 blue balls, x green balls and y red balls. The probability of drawing a green ball is $\frac{1}{4}$. If 4 blue balls are added into the bag and 1 red ball is removed from the bag, the possibility of drawing a green ball from the bag is $\frac{2}{9}$.

Find the value of x.

Answer $x =$ ..... [4]

16 **(a)** Construct triangle *ABC* where *AB* = 10 cm, *BC* = 7 cm and angle *ABC* = 60°.
AB has already been drawn. [1]

*Answer **(a), (b), (c)** and **(d)***

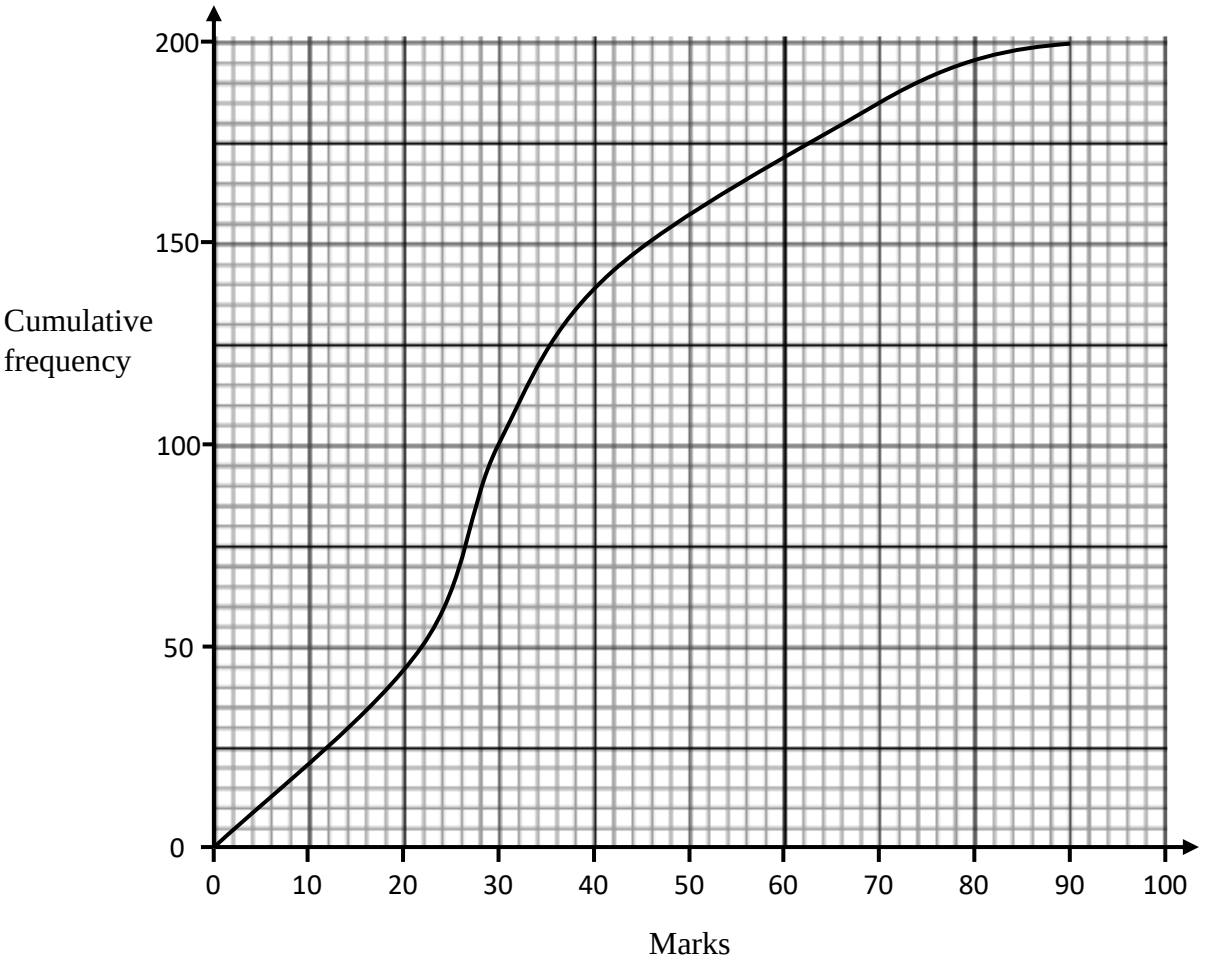


(b) Construct the perpendicular bisector of *AB*. [1]

(c) Construct the bisector of angle *BAC*. [1]

(d) Mark clearly a possible point which is inside the triangle, equidistant from the lines *AB* and *AC*, and is nearer to point *A* than point *B*.
Label this point P. [1]

17 The cumulative frequency graph shows the distribution of the marks of 200 students for a Biology test



(a) Use the curve to estimate

(i) the median mark for the test,

Answer ..... [1]

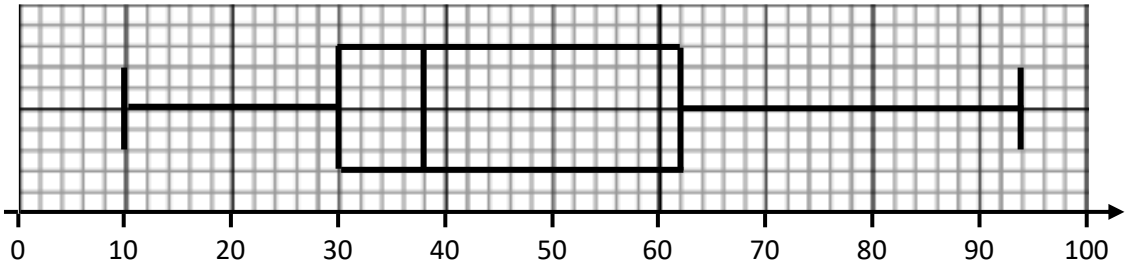
(ii) the interquartile range for the test,

Answer ..... [1]

(iii) the percentage of the students scored more than 70 marks for the test.

Answer ..... % [2]

(b) The box-and-whisker plot represents the distribution of marks of the same 200 students for a Chemistry test.



Make two comparisons between the marks for the two tests.
Use figures to support your answers.

1. .....

.....

..... [1]

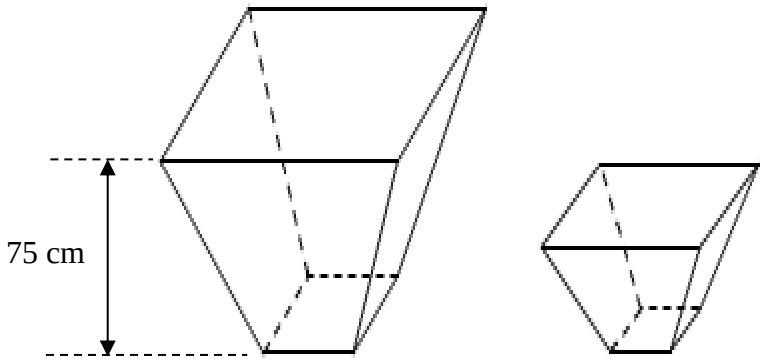
2. .....

.....

..... [1]

18 The volumes of two geometrically similar troughs X and Y are 4050 cm^3 and 1200 cm^3 respectively.

Trough X has a height of 75 cm and base area of 162 cm^2.



trough X trough Y

Find

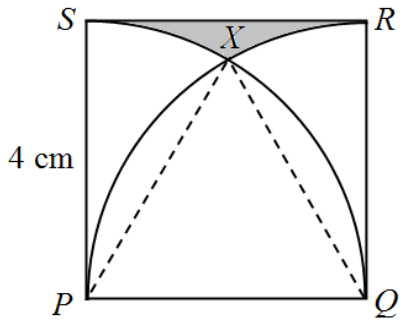
(a) the height of trough Y,

Answer ..... cm [2]

(b) the area of the base of trough Y.

Answer ..... cm^2 [2]

19 The diagram shows a square *PQRS* of side 4 cm. Two quadrants are drawn with *P* and *Q* as their centres respectively. The two quadrants intersect at point *X*.



(a) Catherine said the triangle *PXQ* is an equilateral triangle.
State whether you agree or disagree with Catherine and explain your decision.

I ....., because .....

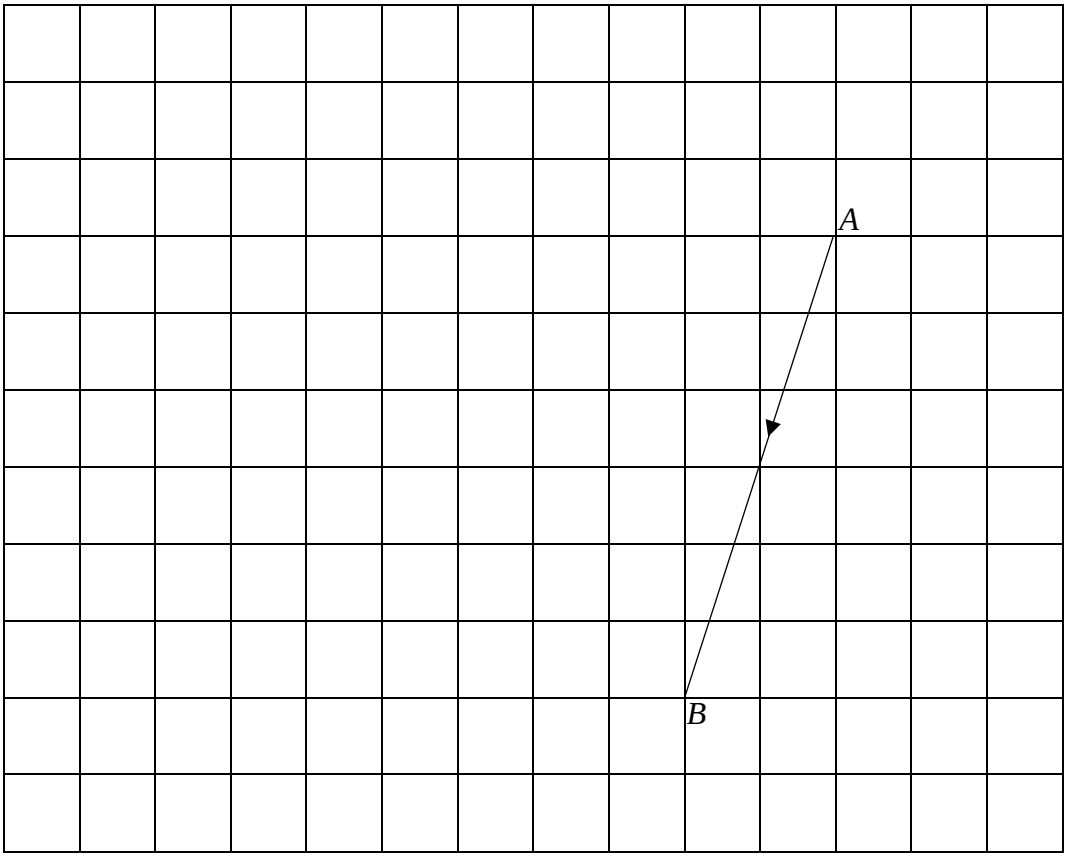
.....

..... [1]

(b) Find the area of the shaded region *SXR*.

Answer ..... cm^2 [3]

20 The diagram shows the points A and B where $\overrightarrow{AB} = \begin{pmatrix} -2 \\ -6 \end{pmatrix}$.



(a) Given that $\overrightarrow{BC} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$, mark and label the point C on the diagram. [1]

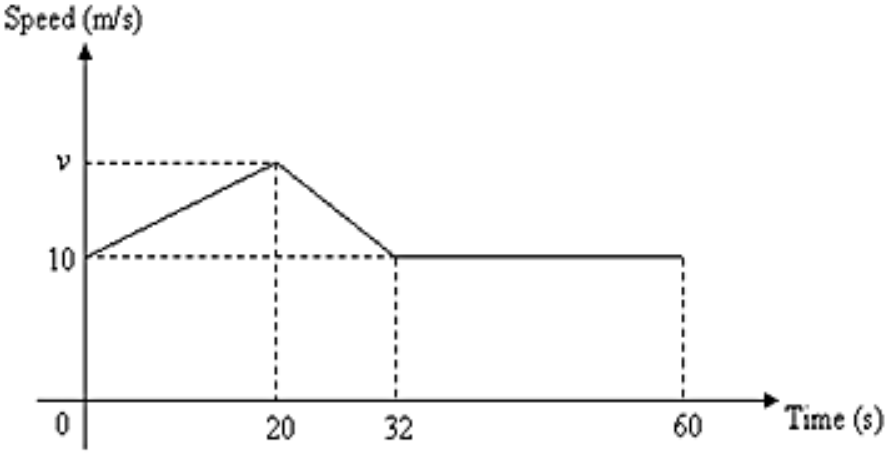
(b) D is the point such that $\left|\overrightarrow{BC}\right| = \left|\overrightarrow{CD}\right|$ and $ABCD$ is a kite. Express $\overrightarrow{CD}$ as a vector.

Answer ..... [1]

(c) Find $\left|\overrightarrow{AC}\right|$.

Answer ..... units [2]

21 The graph shows the speed-time graph of a car during a period of 60 seconds.
The distance travelled in the first 20 seconds is 250 m.



(a) Show that the maximum speed v is 15 m/s.

Answer

[1]

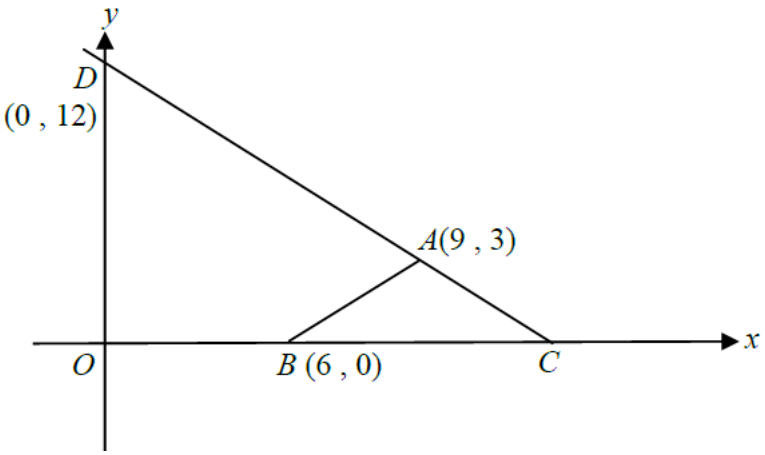
(b) Calculate the deceleration during the motion.

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

(c) Calculate the average speed during the 60 seconds.

Answer ..... m/s [2]

22 In the figure below, O is the origin, A is the point (9, 3), B is the point (6, 0) and D is the point (0, 12).



(a) C is another point on the x-axis such that $AB = AC$.

Find the coordinates of C.

Answer C (..... , ...) [1]

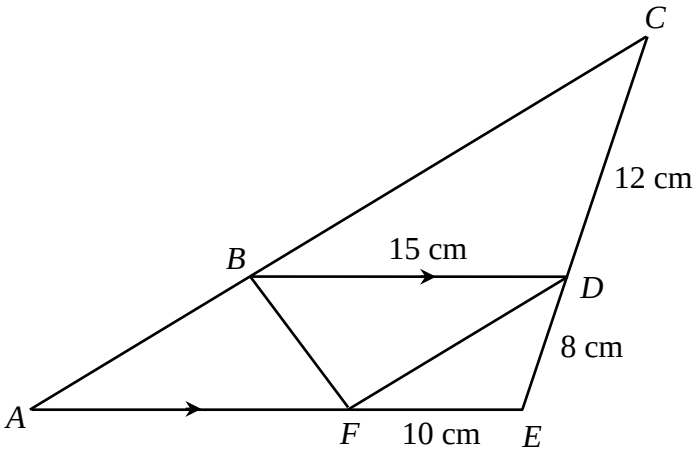
(b) Find the equation of line AB.

Answer ..... [2]

(c) Find the shortest distance from O to the straight line CD.

Answer ..... units [2]

23 In the diagram, *ABC*, *CDE* and *AFE* are straight lines. *BD* is parallel to *AE*.
BD = 15 cm, *CD* = 12 cm, *DE* = 8 cm and *EF* = 10 cm.



(a) Show that triangles *CDB* and *DEF* are similar.
Give a reason for each statement you make.

.....

.....

..... [2]

(b) Find the ratio of area of triangle *CDB* : area of triangle *DEF*.

Answer ..... : ..... [1]

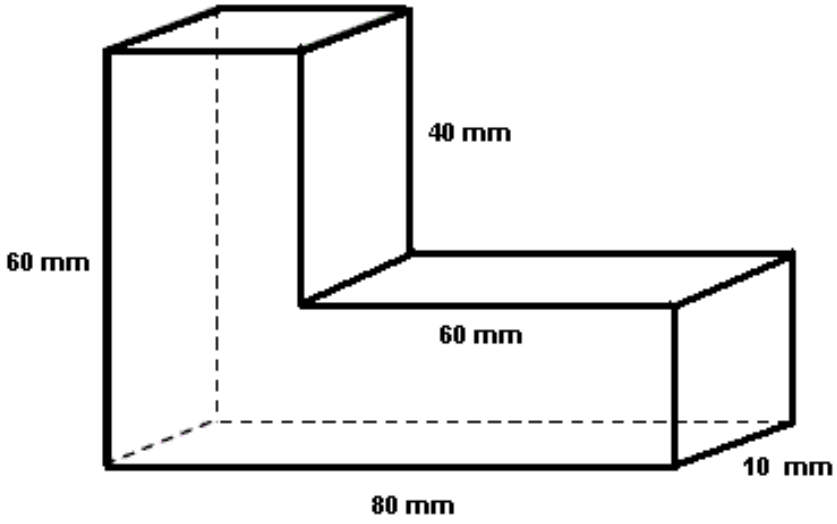
(c) Show that *ABDF* is a parallelogram.

.....

.....

..... [2]

24 The diagram shows a closed L-shaped rectangular structure with dimensions stated.



(a) Calculate the volume of the L-shaped rectangular structure.

Answer ..... mm^3 [2]

(b) Edison wants to put a thin and long metal rod inside the structure.
What is the longest length of the metal rod that Edison can put in?

Answer ..... mm [3]

End of Paper