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Preliminary Examination Secondary 4 (O-Level Programme)

Mathematics

4052/01

Paper 1

25 August 2025

2 hours 15 minutes

Additional Materials: Booklets A and B

Candidates answer in the space provided on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in the space provided.

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 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, unless the question requires the answer in terms of π .

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

The total of the marks for this paper is **90**.

For Examiner's Use
90

MATHEMATICAL FORMULAE

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

1 Simplify $\frac{5}{2-x} + \frac{4x-8}{(x-2)^2}$.

Answer _____ [3]

2 Rearrange the formula to make p the subject.

$$pr = \frac{6p^2 - 1}{p}$$

Answer _____ [2]

3 Factorise the following expressions completely.

(a) $5m + 2n - mn - 10$

Answer _____ [2]

(b) $x^2 + 4xy - 9 + 4y^2$

Answer _____ [2]

- 4 The product of two numbers, x and y , is 6300 and their highest common factor is 6. Given $6 < x < y$, find the value of x and the value of y .

Answer $x =$ _____

$y =$ _____ [2]

- 5 Simplify $\left(\frac{49x^4}{y^{16}}\right)^{-\frac{3}{2}}$, leaving your answer in positive indices.

Answer _____ [2]

- 6 (a) Express $-x^2 - 8x - 19$ in the form of $-(x + p)^2 + q$.

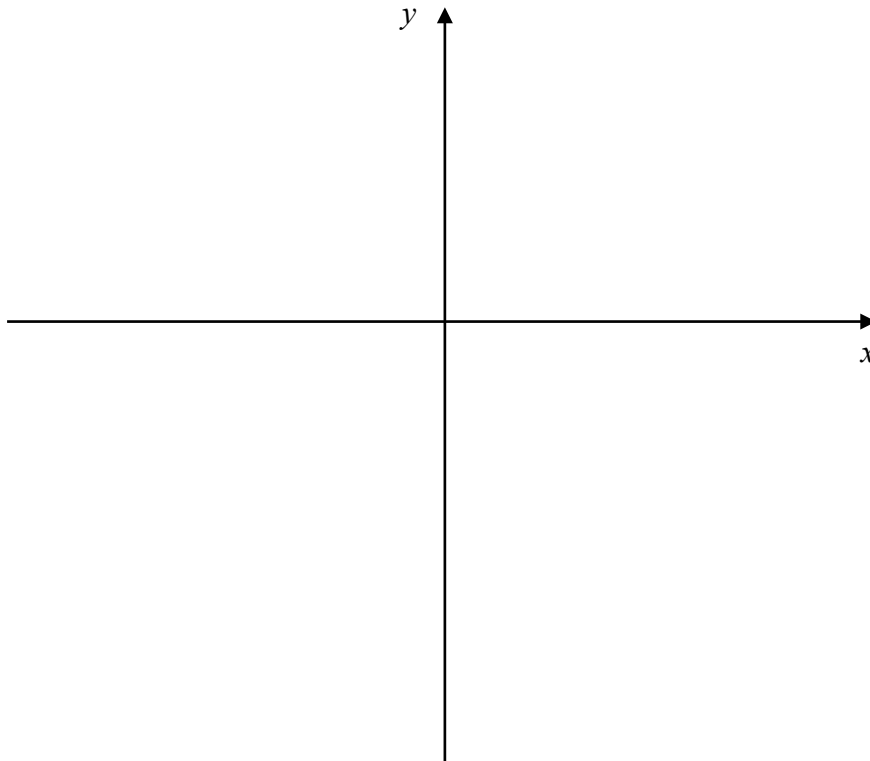
Answer _____ [2]

- (b) Hence, sketch the graph of $y = -x^2 - 8x - 19$ on the axes below.

Indicate clearly the turning point and axes intercept(s).

Answer

[2]



7 Andy places an order for some polo shirts that come in three sizes S , M and L .

The ratio of the number of polo shirts $S : M = 3 : 8$.

The ratio of the number of polo shirts $S : L = 5 : 2$.

There are 306 more polo shirts in size M than L .

Find the total number of polo shirts ordered.

Answer _____ [2]

8 Solve $2^p \times 6 = 96$.

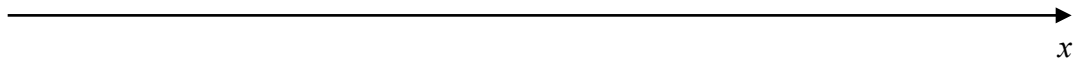
Answer $p =$ _____ [2]

9 Solve the inequality $x - 6 \leq 3x - 17 < 32 - 4x$.

Show your solution on the number line below.

Answer _____ [2]

Answer _____ [1]



10 The cash price of a refrigerator is \$2499.

The hire-purchase price of the refrigerator is \$2999.

The hire-purchase price is a deposit of 25% of the cash price plus 24 equal monthly payments.

Calculate one monthly payment.

Answer \$ _____ [2]

- 11** Michael deposited some money into bank A which pays a simple interest rate of 3% per annum for 18 months.

If he had deposited the same amount of money with bank B, which pays a simple interest rate of 2.5% per annum for 24 months, he would receive \$500 more in interest.

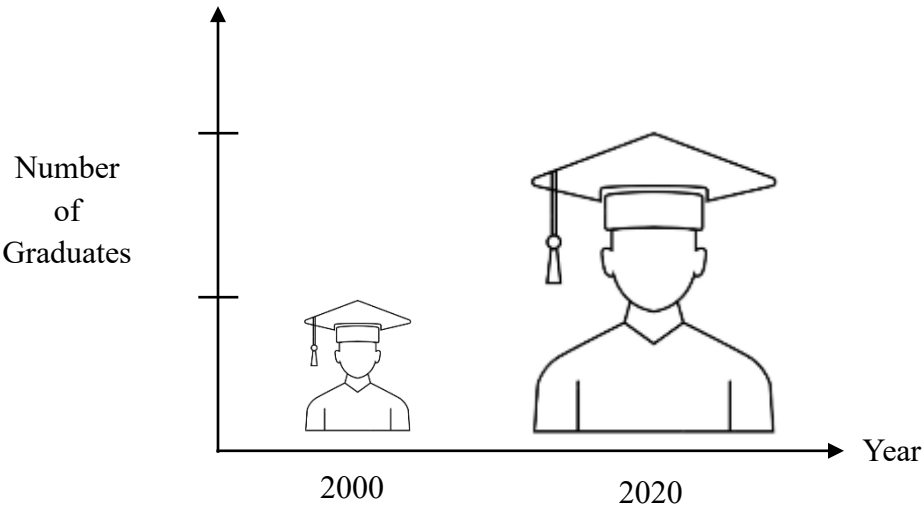
- (a)** Find the amount of money he deposited.

Answer \$ _____ [2]

- (b)** Find the amount of interest Michael would receive if he were to deposit his money into bank C, which pays a compound interest of 1.9% per annum compounded every 6 months for 24 months.

Answer \$ _____ [2]

- 12 The number of university graduates for the year 2000 and year 2020 are represented by the chart below. Statistics have shown that the number of university graduates in year 2020 is doubled the number of university graduates in year 2000.



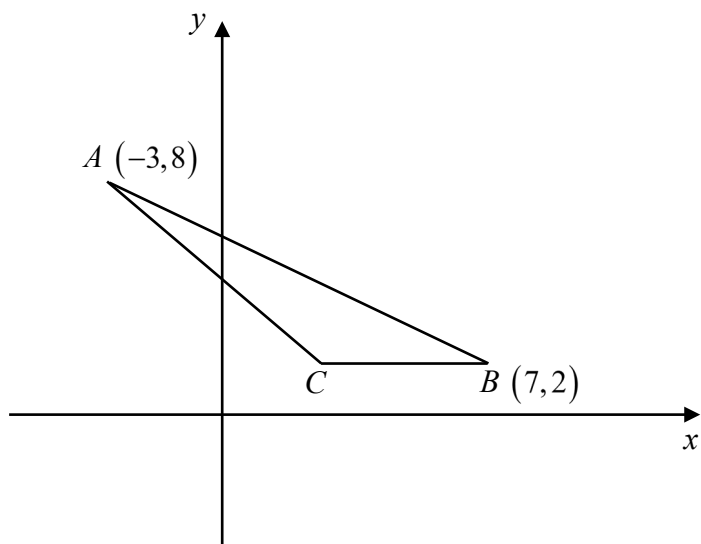
Explain how the above chart may be misleading and suggest a possible way to improve the chart.

[2]

- 13 The vertices of A and B are $(-3, 8)$ and $(7, 2)$.

The line BC is parallel to the x – axis.

The area of triangle ABC is 12 square units.



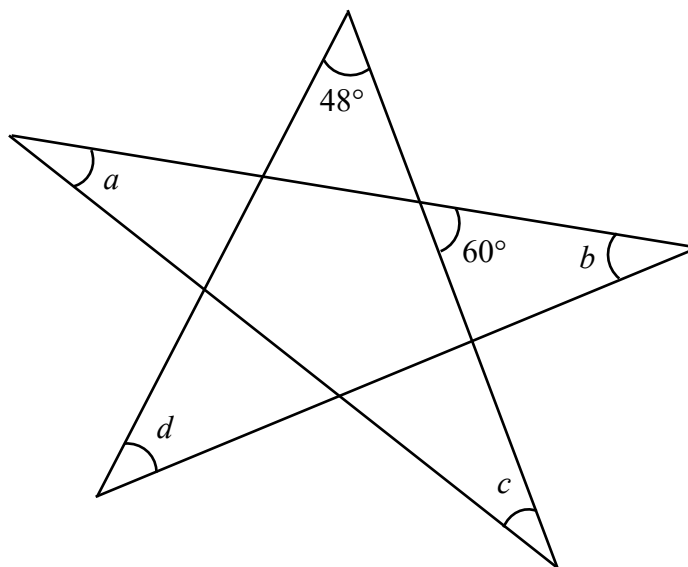
- (a) Find the coordinates of C .

Answer _____ [2]

- (b) Find the exact value of $\cos \hat{ACB}$.

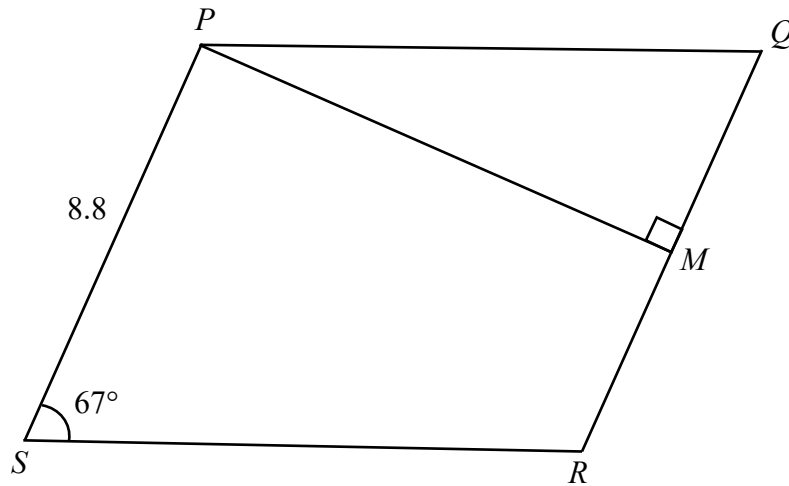
Answer _____ [2]

14 Find $\angle a + \angle b + \angle c + \angle d$.



Answer _____ $^\circ$ [2]

- 15** $PQRS$ is a parallelogram. PM is perpendicular to QR and M is the midpoint of QR .
 $PS = 8.8\text{cm}$ and angle $PSR = 67^\circ$.
Find the area of $PQRS$.



Answercm² [3]

16 The first four terms of a sequence are 1, 5, 9 and 13.

(a) Find an expression, in terms of n , for the n th term of the sequence.

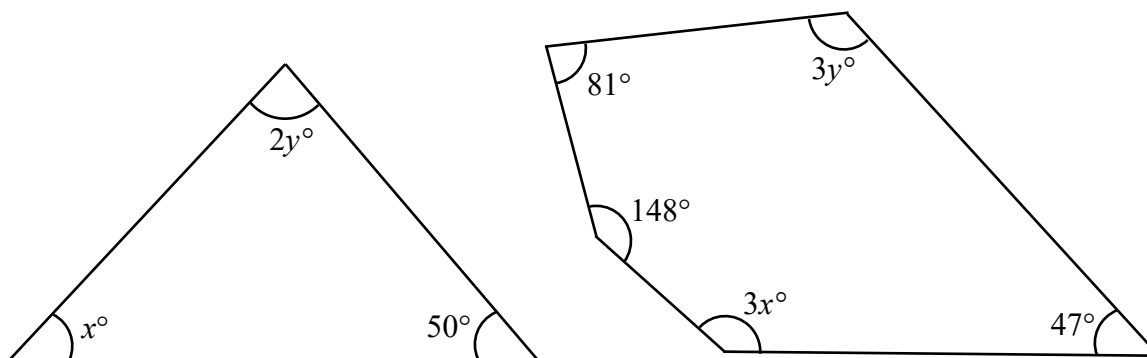
Answer _____ [1]

(b) Find an expression, in terms of n , for the $(n + 1)$ th term of the sequence.

Answer _____ [1]

(c) Explain why the difference between the squares of two consecutive terms is always a multiple of 8.

[2]



- (a) Using the information shown in the diagrams, write down and simplify two equations in x and y .

Answer

[3]

- (b) Solve these equations to find the value of x and of y .

Answer $x =$ _____

$y =$ _____ [2]

- 18 (a) In a company of 120 workers, the ratio of female worker to male workers is 2 : 3.

	Female	Male
Full time	p	q
Part time	9	r

20% of the workers work part time.

Find the value of p , of q and of r .

Answer $p =$ _____

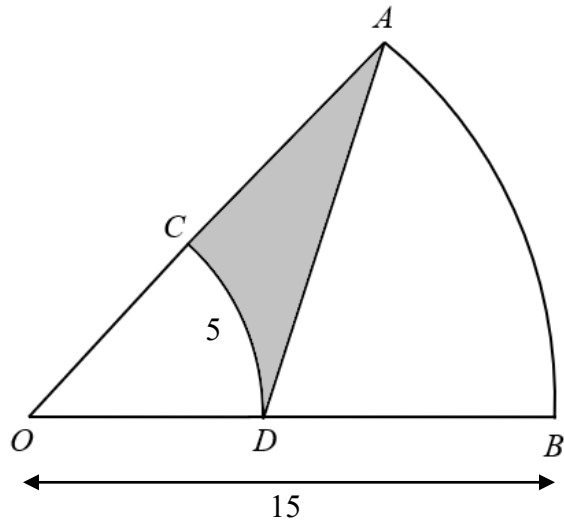
$q =$ _____

$r =$ _____ [2]

- (b) The annual salary of a particular male worker is \$85000 in 2023. His salary in 2023 was 12% higher than in 2021. Find his annual salary in 2021.

Answer \$ _____ [1]

- 19 The diagram shows two sectors OAB and OCD with centre at O . OB is 15 cm and CD has an arc length of 5 cm. The ratio of area of sector OCD : area of $ABDC$ is 16 : 65.



- (a) Find angle COD in radian.

Answer _____ rad [3]

(b) Find the area of the shaded region.

Answercm² [3]

20 In this table, p is inversely proportional to q^2 .

p	0.08	0.5	b
q	a	4	2

Calculate the value of a and of b .

Answer $a =$ _____

$b =$ _____ [3]

- 21** **(a)** A river with an actual length of 1 km is represented on a map with a length of 8 cm.
Find the map scale in the form 1 : n .

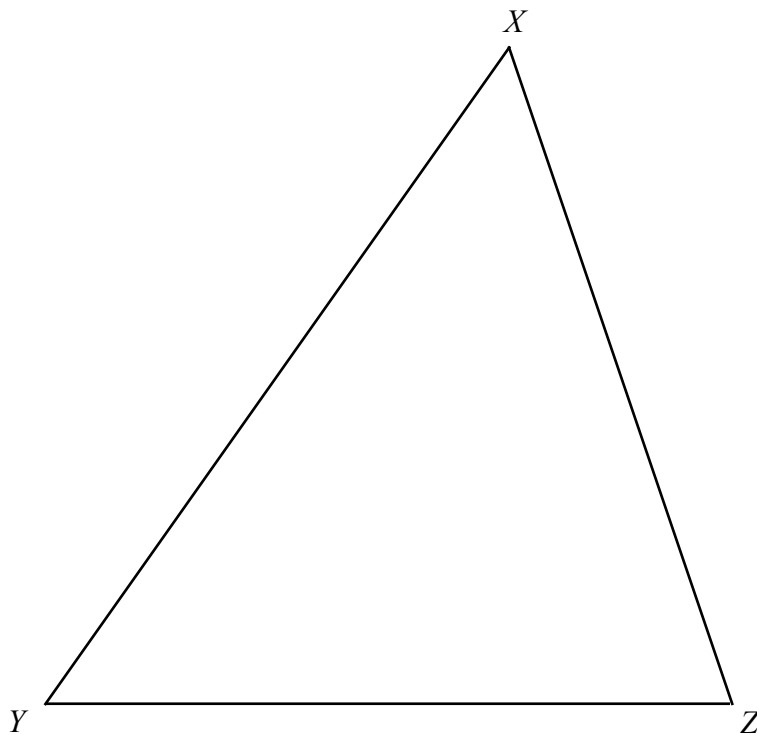
Answer _____ [1]

- (b)** A forest is represented by an area of 200 cm^2 on the map. Calculate the actual area of forest in square metres, giving your answer in standard form.

Answer m^2 [2]

22 A triangle XYZ is shown below.

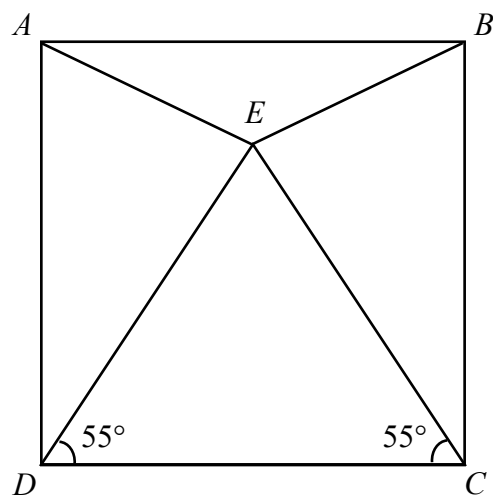
Answer



- (a) Construct
- (i) the perpendicular bisector of XY , [1]
 - (ii) the bisector of angle XYZ . [1]
- (b) Mark clearly a possible point which is inside the triangle, equidistant from X and Y , and nearer to YZ than XY . Label this point P . [1]
- (c) The point M is such that angle $YZM = 100^\circ$ and $XM = 5$ cm. Mark and label the point M at the position that is closer to point Z . Measure and write down the length ZM .

Answer _____ [2]

- 23 $ABCD$ is a square and angle $EDC = \text{angle } ECD = 55^\circ$.



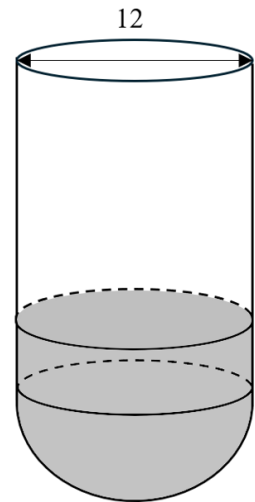
Prove that triangle AEB is an isosceles triangle.

- 24 (a) A container is made from a hemisphere and cylinder.

The container has a diameter of 12 cm.

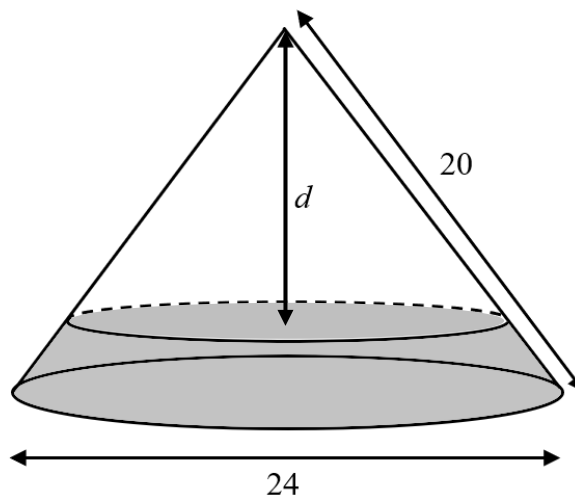
The container is filled with water such that the total surface area of water in contact with the container is 120π .

Find the volume of water in the container, leaving your answer in terms of π .



Answercm³ [4]

- (b) All the water in the container was poured into a cone with diameter 24 cm and a slant height of 20 cm. The cone was covered and inverted as shown in the diagram below. Calculate the depth, d , of the empty space.

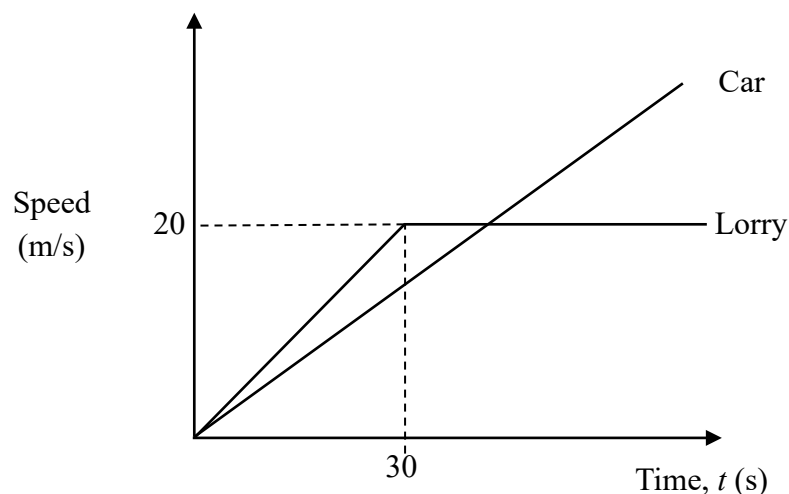


Answer $d =$ _____ cm [4]

- 25** The diagram shows the speed-time graphs of a car and lorry traveling along the same road in the same direction. Both vehicles begin their journey from the same starting point.

The lorry accelerates for 30 seconds and then travels at a constant speed of 20 m/s.

The car accelerates at a uniform rate of 0.5 m/s^2 from rest.



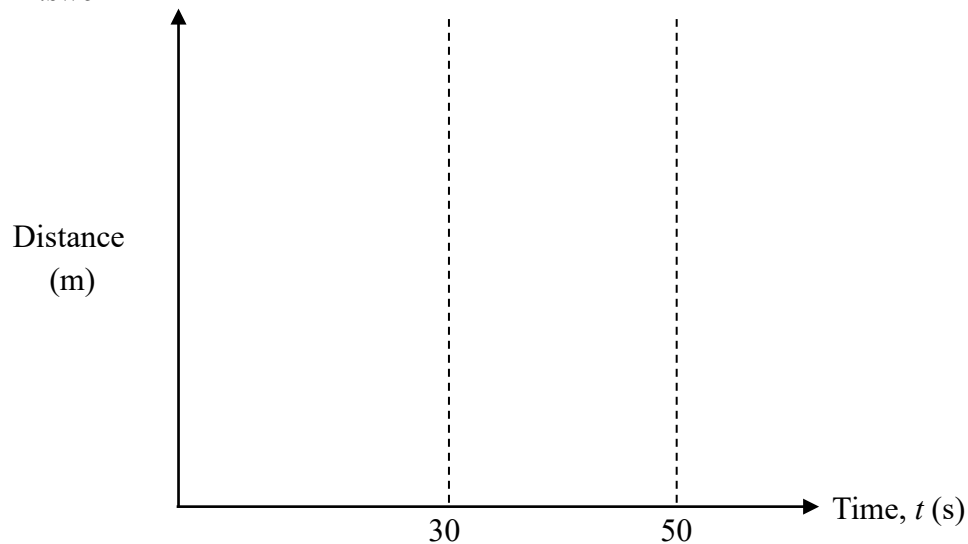
- (a)** Find the speed of lorry at 12 seconds.

Answer _____ m/s [2]

- (b)** Draw the distance-time graph of the lorry for $0 \leq t \leq 50$ s.

Answer

[2]



- (c) Find the time taken for the car to meet the lorry.

Answer _____s [4]