



# SEKOLAH BUKIT SION

## IGCSE Mock Examination 2021

STUDENT  
NAME

EXAM  
NUMBER

CLASS

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### 0580 MATHEMATICS (PAPER 4)

Year 10/Year 11

12 April 2021

2 hours

Additional Materials:

- Scientific Calculator
- Ruler
- Graphing Paper

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### READ THESE INSTRUCTIONS FIRST

Write your name, exam number and grade on all the work you hand in.

Write in dark blue or black pen.

Use an HB pencil for any diagrams or graphs.

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

Answer **all** questions.

At the end of the examination, fasten all your work securely together.

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 100.

Score :

**QUESTION 01**

The fares for a train journey are shown in the table below.

From London to Marseille	Standard fare	Premier fare
Adult	\$84	\$140
Child	\$60	\$96

(a) For the **standard fare**, write the ratio **adult fare: child fare** in its simplest form.

$$84 : 60$$

Answer: .....  $7:5$  ..... [1]

(b) For an **adult**, find the percentage increase in the cost of the standard fare to the premier fare.

$$\frac{140 - 84}{84} \times 100\% = \frac{56}{84} \times 100\%$$

Answer: .....  $66\frac{2}{3}\%$  ..... [3]

(c) For one journey from London to Marseille, the ratio

$$\text{number of adults : number of children} = 11 : 2.$$

$$220 : 40$$

$$\frac{220}{11} \times 2 = 40$$

There were **220 adults** in total on this journey.

All of the children and 70% of the adults paid the standard fare.

The remaining adults paid the remaining fare.

$$70\% \times 220 = 154$$

Calculate the total of the fares collected from all the adults and children.

$$\begin{array}{r} 40 \times \$60 = 2400 \\ 154 \times \$84 = 12936 \\ 66 \times \$140 = 9240 \\ \hline \$24576 \end{array}$$

Answer: .....  $\$24576$  ..... [4]

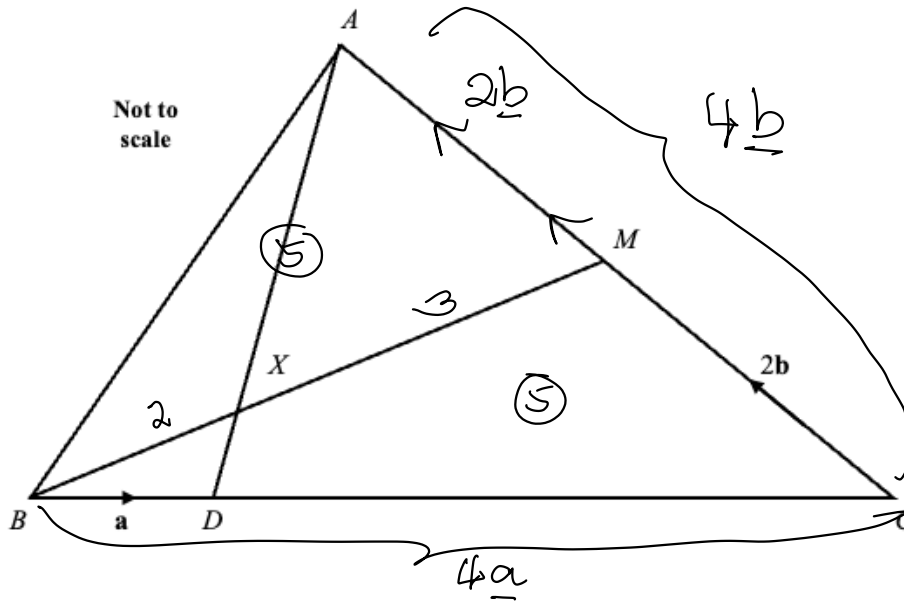
(d) The child's standard fare of \$60 is 20% more than the child's standard fare last year.

Calculate the child's standard fare last year.

Before	After
100%	120%
x	\$60

Answer: .....  $\$50$  ..... [2]

QUESTION 02



In the diagram,  $BC = 4BD$  and  $DA = 5DX$ .  $M$  is the midpoint of  $AC$ .  $\overrightarrow{BD} = \mathbf{a}$  and  $\overrightarrow{CM} = 2\mathbf{b}$ .

(a) Express, as simple as possible, in terms  $\mathbf{a}$  and/or  $\mathbf{b}$ ,

(i)  $\overrightarrow{DC}$

Answer:  $3\mathbf{a}$  ..... [1]

(ii)  $\overrightarrow{DA}$ , 
$$\begin{aligned} \overrightarrow{DA} &= \overrightarrow{DC} + \overrightarrow{CA} \\ &= 3\mathbf{a} + 4\mathbf{b} \end{aligned}$$

Answer:  $3\mathbf{a} + 4\mathbf{b}$  ..... [1]

(iii)  $\overrightarrow{DX}$ , 
$$\overrightarrow{DX} = \frac{1}{5} \overrightarrow{DA} = \frac{1}{5} (3\mathbf{a} + 4\mathbf{b})$$

Answer:  $\frac{1}{5} (3\mathbf{a} + 4\mathbf{b})$  ..... [1]

(b) Show that  $\overrightarrow{BX} = \frac{4}{5} (2\mathbf{a} + \mathbf{b})$ .

$$\begin{aligned} \overrightarrow{BX} &= \overrightarrow{BD} + \overrightarrow{DX} \\ &= \mathbf{a} + \frac{3}{5}\mathbf{a} + \frac{4}{5}\mathbf{b} \\ &= \frac{8\mathbf{a}}{5} + \frac{4}{5}\mathbf{b} \end{aligned}$$

$$\overrightarrow{BX} = \frac{4}{5} (2\mathbf{a} + \mathbf{b}) \quad \text{shown}$$

[2]

(c) Express  $\overline{BM}$  as simply as possible, in terms of **a** and **b**.

$$\begin{aligned} \overrightarrow{BM} &= \overrightarrow{BC} + \overrightarrow{CM} \\ &= 4\mathbf{a} + 2\mathbf{b} \end{aligned}$$

$$2(2\mathbf{a} + \mathbf{b})$$

$$4\mathbf{a} + 2\mathbf{b}$$

Answer: ..... [1]

(d) Find

(i)  $\frac{BX}{BM}$ ,

$$\frac{\frac{4}{5}}{2} = \frac{4}{10} = \frac{2}{5}$$

$$\frac{2}{5}$$

Answer: ..... [1]

(ii)  $\frac{\text{area of } \triangle ABX}{\text{area of } \triangle AMX}$ ,

$$\frac{2}{3}$$

Answer: ..... [1]

(iii)  $\frac{\text{area of } \triangle ABX}{\text{area of } \triangle ABC}$

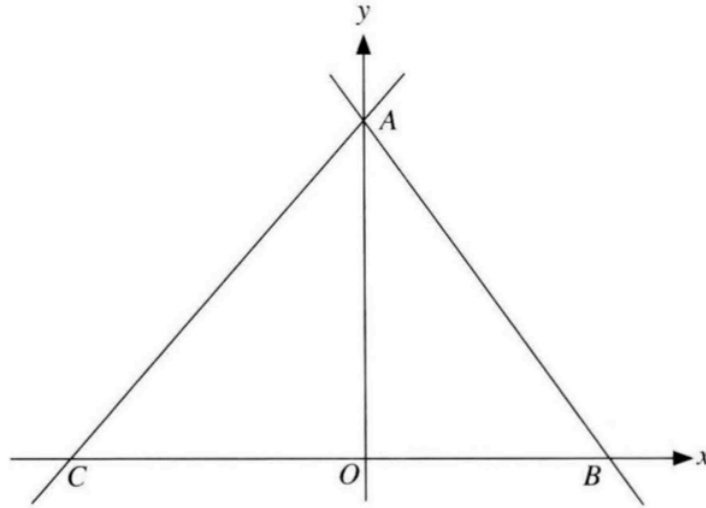
$$\frac{2}{10}$$

$$\frac{1}{5}$$

Answer: ..... [2]

**QUESTION 03**

In the diagram,  $B$  is the  $(4, 0)$  and the equation of  $AC$  is  $7y = 8x + 56$ .  
Find the



(a) coordinates of  $A$  and of  $C$ ,

Answer:  $A(0, 8)$  [1]  
 $C(-7, 0)$  [1]

(b) equation of line  $AB$ ,

$$y = mx + c$$

$$y = -2x + 8$$

Answer:  $y = -2x + 8$  [2]

(c) area of triangle  $ABC$

$$44$$

Answer: ..... [1]

(d) coordinates of  $D$  such that  $ABCD$  is a parallelogram.

$$(-11, 8)$$

Answer: ..... [2]

**QUESTION 04**

The table below shows the time, in seconds, taken by each of 120 boys to solve a puzzle.

	25	32.5	37.5	50	80
Time ( $t$ seconds)	$20 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$	$40 < t \leq 60$	$60 < t \leq 100$
Frequency	38	27	21	16	18

freq density  $\frac{38}{25} \quad 5.4 \quad 4.2 \quad 0.8 \quad 0.45$

(a) Write down the modal class and the median class.

Answer: Modal class:  $20 < t \leq 30$  [1]

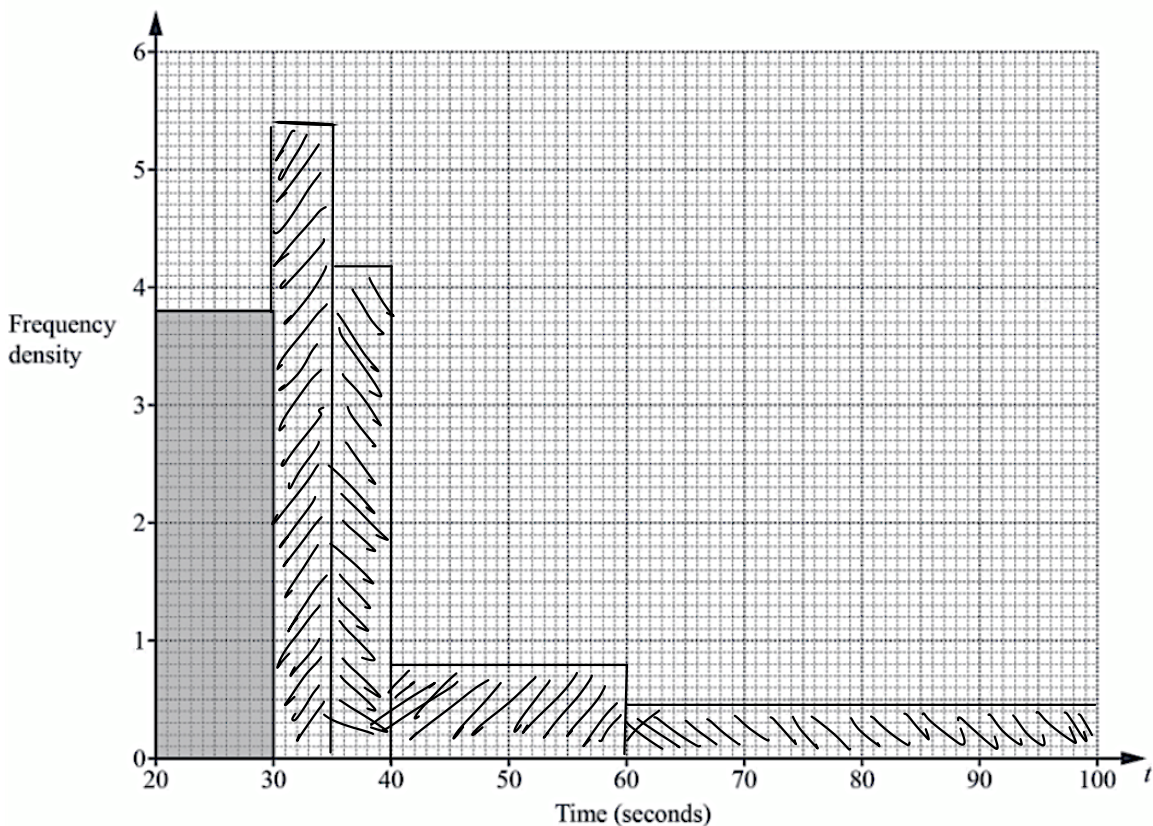
Median class:  $30 < t \leq 35$  [1]

(b) Calculate an estimate of the mean.

$$\bar{x} = \frac{25(38) + 32.5(27) + 37.5(21) + 50(16) + 80(18)}{120}$$

$\bar{x} = 40.4583 \dots$  Answer:  $40.5 \text{ sec}$  [3]

(c) On the grid, complete the histogram to show the information in the frequency table. [4]



**QUESTION 05**

Angelo has a bag containing 3 white counters and  $x$  black counters. He takes two counters at random from the bag, **without replacement**.

(a) Complete the following statement.

The probability that Angelo takes two black counters is

$$\frac{x}{x+3} \times \frac{x-1}{x+2} \quad [2]$$

(b) The probability that Angelo takes two black counters is  $\frac{7}{15}$ .

(i) Show that  $4x^2 - 25x - 21 = 0$ . [4]

$$\begin{aligned} \frac{x}{x+3} \cdot \frac{x-1}{x+2} &= \frac{7}{15} \quad \checkmark \\ 15(x)(x-1) &= 7(x+3)(x+2) \quad \checkmark \\ 15x^2 - 15x &= 7x^2 + 35x + 42 \quad \checkmark \\ \frac{8x^2 - 50x - 42}{2} &= 0 \quad \checkmark \\ 4x^2 - 25x - 21 &= 0 \quad \text{shown} \end{aligned}$$

(ii) Solve by factorization  $4x^2 - 25x - 21 = 0$ .

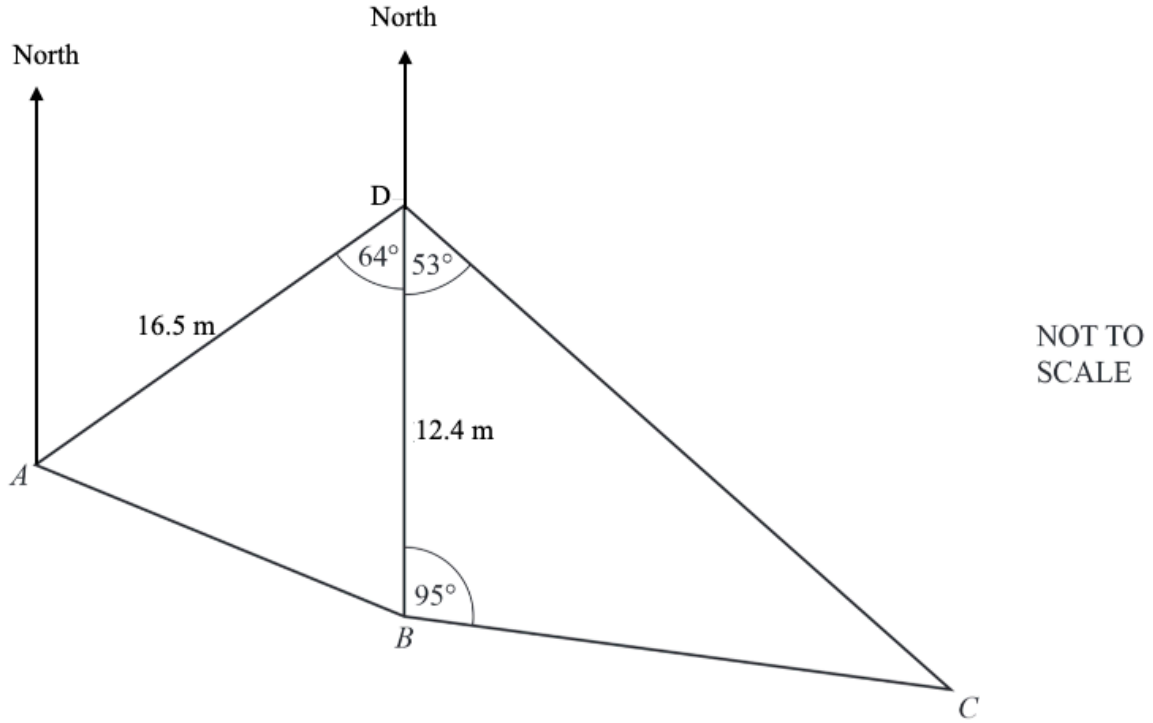
$$\begin{aligned} (4x + 3)(x - 7) &= 0 \\ 4x &= -3 \\ x &= -\frac{3}{4} \quad x = 7 \end{aligned}$$

Answer: .....  $x=7, -\frac{3}{4}$  ..... [3]

(c) Write down the number of black counters in the bag.

Answer: .....  $7$  ..... [1]

**QUESTION 06**



Four posts  $A$ ,  $B$ ,  $C$  and  $D$  mark the boundaries of Martha's garden as shown in the diagram above.

Post  $D$  is 16.5 metres away from  $A$ .

Post  $B$  is 12.4 metres south of  $D$ .

$C$  has a bearing of  $95^\circ$  from  $B$ .

(a) Write down the bearing of  $D$  from  $A$ .

Answer:  $064^\circ$  [1]

(b) Write down the bearing of  $C$  from  $D$ .

Answer:  $127^\circ$  [1]

(c) Find  $AB$ .

$$\begin{aligned}
 AB &= \sqrt{16.5^2 + 12.4^2 - 2(16.5)(12.4)\cos 64^\circ} \\
 &= \sqrt{246.6288\dots} \\
 &= 15.7044
 \end{aligned}$$

Answer:  $15.7$  m [4]



(d) Calculate the measure of angle  $DAB$ .

Hence, show that the bearing of  $B$  from  $A$  is  $109^\circ$ , to the nearest degree.

[4]

$$\frac{12.4}{\sin \theta} = \frac{15.7}{\sin 64} \quad \checkmark$$

$$\sin \theta = \frac{12.4 (\sin 64)}{15.7} \quad \checkmark$$

$$\theta = \sin^{-1} \left( \frac{12.4 \sin 64}{15.7} \right)$$

$$\theta = 45.225^\circ \quad \checkmark$$

$$45.2 + 90^\circ \quad \checkmark$$

Bearing:  $109.2^\circ$   
or  
 $109^\circ$

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(e) If  $BC = 18.9$  m, show that the **total area** of Martha's garden is  $209$  sq. m<sup>2</sup>, correct to 3sf.

[3]

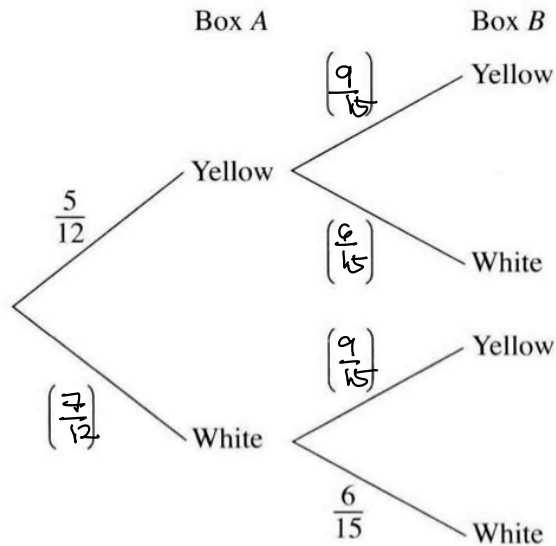
$$\begin{aligned} \text{total Area} &= A_1 + A_2 \\ &= \frac{1}{2} (16.5) (12.4) \sin 64 + \frac{1}{2} \sin 95 (12.4) (18.9) \\ &= 91.9466 \dots + 116.734 \dots \\ &= \underline{\underline{208.6806}} \\ &= \underline{\underline{209 \text{ sq m.}}} \quad \text{shown} \end{aligned}$$

**QUESTION 07**

Box A contains 5 yellow and 7 white marbles.  
 Box B contains 9 yellow and 6 white marbles.

A marble is drawn at random **from each box**.

(a) Complete the probability tree diagram below.



[2]

(b) Find the probability of drawing

(i) two marbles of different colours,

$$P(YW) + P(WY)$$

$$\frac{5}{12} \times \frac{6}{15} + \frac{7}{12} \times \frac{9}{15}$$

Answer: .....  $\frac{31}{60}$  ..... [2]

(ii) two non-yellow marbles,

$$1 - P(YY)$$

$$1 - \frac{5}{12} \times \frac{9}{15}$$

$$1 - \frac{1}{4}$$

Answer: .....  $\frac{3}{4}$  ..... [2]

(iii) a yellow marble from box A given that a white marble was drawn from Box B.

$$P\left(\frac{YW}{YW+WW}\right) = \frac{\frac{5}{12} \times \frac{6}{15}}{\frac{1}{6} + \frac{7}{30}}$$

$$= \frac{\frac{1}{6}}{\frac{2}{5}}$$

Answer: .....  $\frac{5}{12}$  ..... [2]

**QUESTION 08**

$$1 \text{ cm} : 0.25 \text{ km}$$

(a) A map is drawn to a scale of 1 cm to 250 m.

An airport has an area of 240 cm<sup>2</sup> on the map. Find its actual area in km<sup>2</sup>.

$$\begin{aligned} 1 \text{ cm}^2 &: 0.0625 \text{ km}^2 \\ 240 \text{ cm}^2 &= \underline{15 \text{ km}^2} \end{aligned} \quad \begin{array}{l} \text{red arrow} \\ \text{X240} \end{array}$$

$$15 \text{ km}^2$$

Answer: ..... [2]

(b) Two similar containers have capacities of 24 cm<sup>3</sup> and 375 cm<sup>3</sup> respectively.

Write down the ratio of their:

(i) heights,

$$\begin{aligned} 24 &: 375 \\ &\downarrow \\ \sqrt[3]{8} &: \sqrt[3]{125} \\ 2 &: 5 \end{aligned}$$

$$2 : 5$$

Answer: ..... [2]

(ii) surface areas.

$$\begin{aligned} 2 &: 5 \\ 4 &: 25 \end{aligned}$$

$$4 : 25$$

Answer: ..... [2]

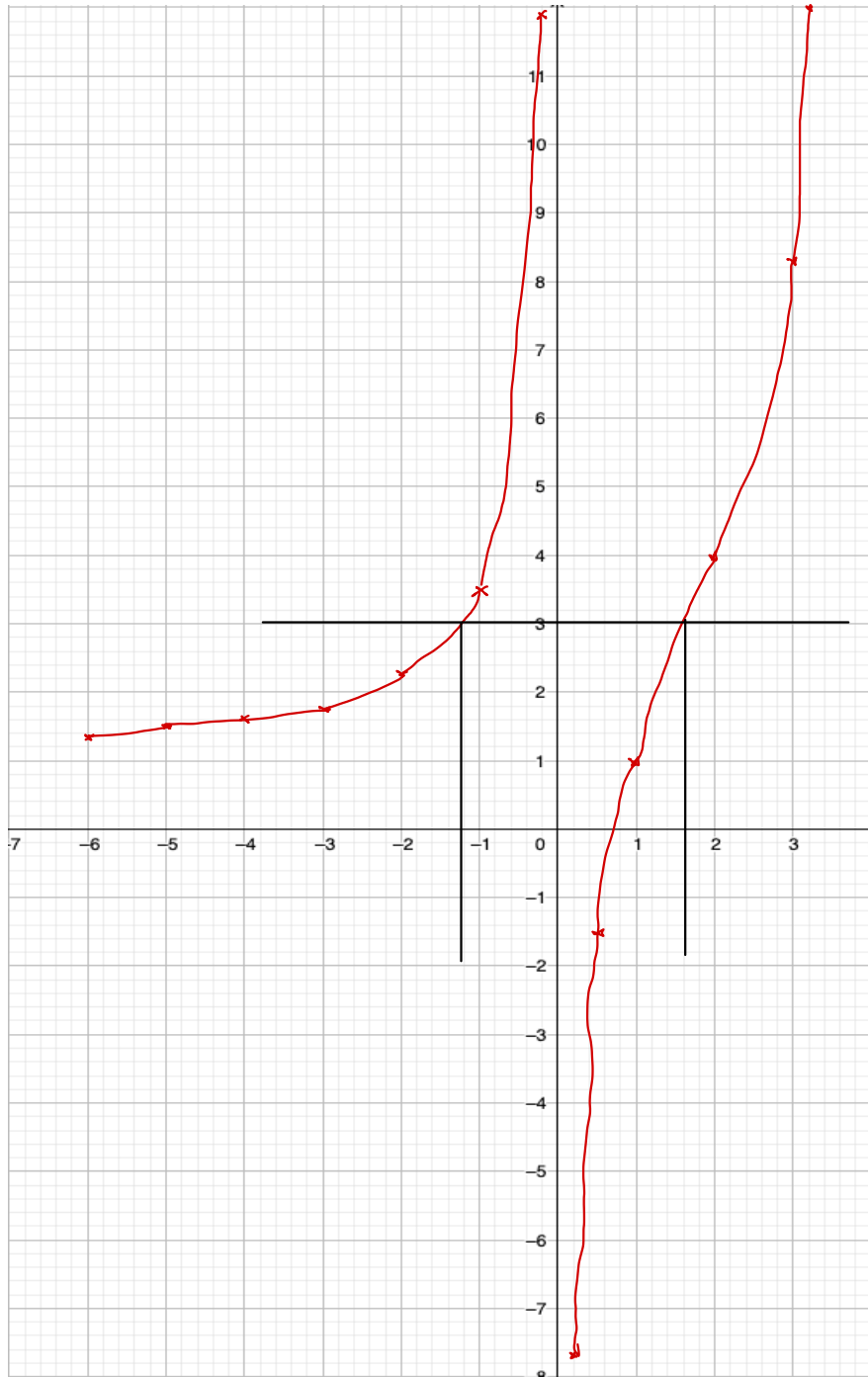
**QUESTION 09**

(a) Complete this table of values for  $y=2^x - \frac{2}{x} + 1$ .

[3]

$x$	-6	-5	-4	-3	-2	-1	-0.2	0	0.2	1	2	3
$y$	1.35	1.43	1.6	1.79	2.25	3.5	11.87	-	-7.85	1	4	8.3

(b) On the grid, draw the graph of  $y=2^x - \frac{2}{x} + 1$  for  $-6 \leq x \leq 3$ , using 2cm  $\rightarrow$  2 units on both axes. [4]



(c) Use your graph to solve  $2^x - \frac{2}{x} + 1 = 3$ .

$$x = -1.20 \rightarrow -1.30$$

$$1.5 \rightarrow 1.7$$

Answer: ..... [2]



(d) Write down the equation of the straight line that must be used to be drawn on the given curve to solve  $2^x - \frac{2}{x} - 3 = \frac{1}{2}x$ . (Line need not be drawn.)

$$+4 \quad +4$$

$$2^x - \frac{2}{x} - 3 = \frac{1}{2}x + 4$$

$$y = \frac{1}{2}x + 4$$

Answer: ..... [1]

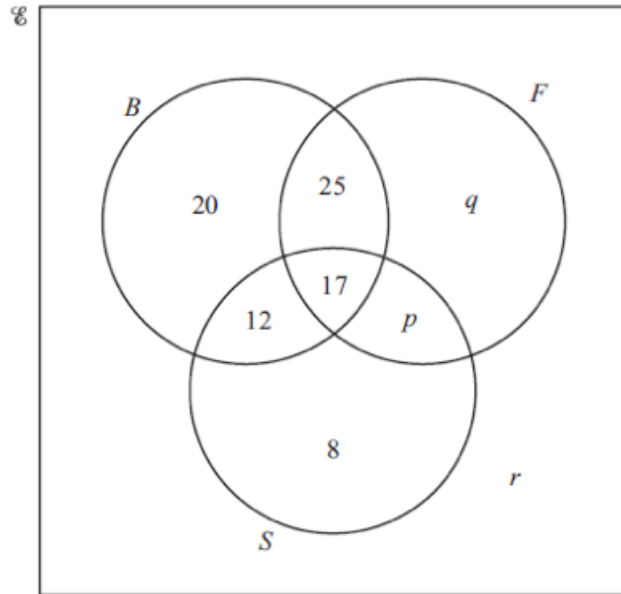


(e) By drawing a suitable line on your graph, find the gradient of the curve at  $x = -3$ .

$$m = \frac{1}{3}$$

Answer: ..... [3]

**QUESTION 10**



In a survey, 100 students are asked if they like basketball ( $B$ ), football ( $F$ ) and swimming ( $S$ ).  
The Venn diagram shows the results.

42 students like swimming.  
40 students like one sport.

(a) Find the values of  $p$ ,  $q$  and  $r$ .

$$p = 5, q = 12, r = 1$$

Answer: ..... [3]

(b) How many students like basketball and swimming but not football?

$$12$$

Answer: ..... [1]

(c) Find  $n((B \cup S) \cap F')$

$$40$$

Answer: ..... [1]

(d) **Two students are chosen** at random from those who like basketball.  
Find the probability that they each like exactly one other sport.

$$\frac{37}{74} \times \frac{36}{73}$$

$$18/73$$

Answer: ..... [2]

**QUESTION 11**

A sphere with radius  $x$  cm has a volume of  $1000 \text{ cm}^3$ .  
Calculate the value of  $x$ .

[The volume,  $V$ , of a sphere with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ .]

$$1000 = \frac{4}{3}\pi r^3$$

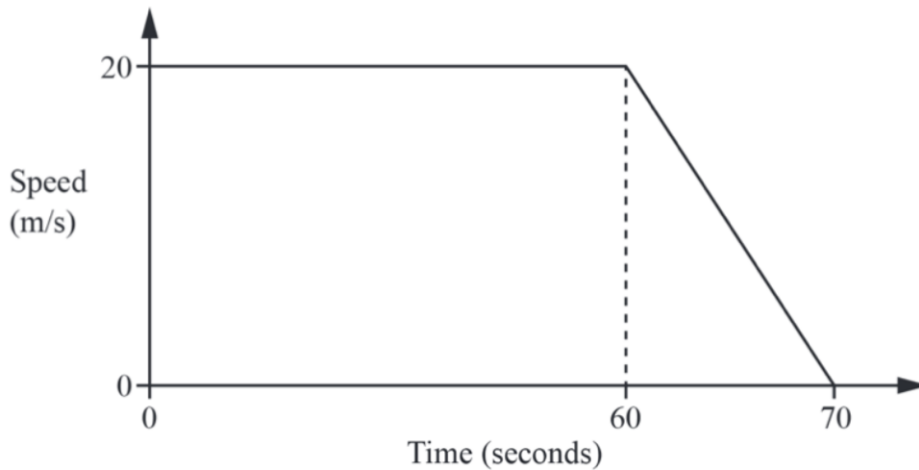
$$\sqrt[3]{\frac{3000}{4\pi}} = \sqrt[3]{r^3}$$

$$r = r = \underline{6.20}$$

6.20

Answer: ..... [3]

**QUESTION 12**



NOT TO SCALE

The diagram shows information about the final 70 seconds of a car journey.

(a) Find the deceleration of the car.

$$2 \text{ m s}^{-2}$$

Answer: ..... [1]

(b) Find the distance travelled by the car during the 70 seconds.

$$\frac{1}{2} \times (60 + 70) \times 20$$

$$1300 \text{ m}$$

Answer: ..... [3]

- END OF EXAMINATION -