



**AHMAD IBRAHIM SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2021**

SECONDARY 3 EXPRESS

Name:	Class:	Register No.:
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MATHEMATICS

Paper 1

**4048/01
29 September 2021
2 hours**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index 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.

Answer **all** questions.

Give non-exact numerical answers to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an approved scientific calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

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 number of marks for this paper is 80.

For Examiner's Use

/80

Mathematical Formulae*Compound Interest*

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

Mensuration

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

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

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

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

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

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

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

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 (a) Calculate $\frac{56.8}{\left(\sqrt[3]{18.22} - 1.4\right)^2}$.

Write down the first five digits on your calculator display.

Answer [1]

(b) Write your answer to **part (a)** correct to 3 significant figures.

Answer [1]

- 2 A pond contains 5.62×10^6 drops of water and 2.91×10^9 micro-organisms.
Let N be the average number of micro-organism per drop of water.
Find the value of N .
Give your answer in standard form.

Answer $N = \dots\dots\dots$ [2]

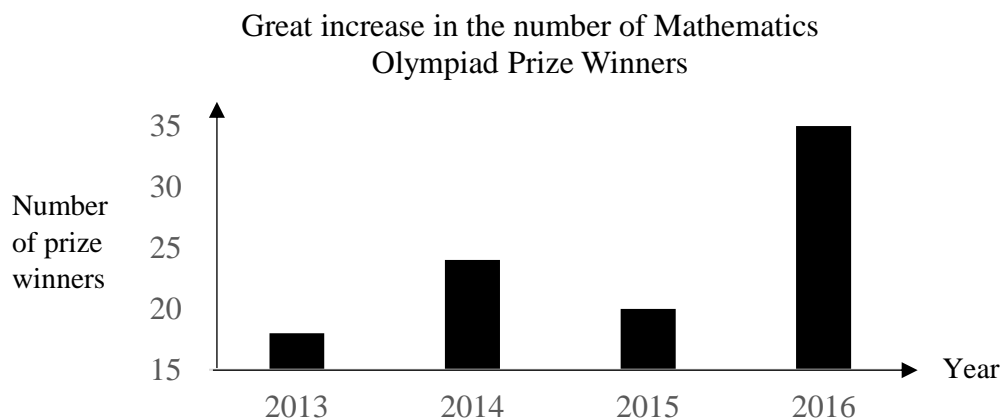
- 3 A 4-litre orange juice mixture (water and orange juice syrup) has 16% of orange juice syrup.
How much water must be added to reduce the concentration of orange juice syrup to 8%?

Answer l [2]

- 4 Without using a calculator, show that $7^{2021} - 7^{2020}$ is a multiple of 3.

[2]

5



The graph shows the number of Mathematics Olympiad Prize winners over a number of years.

(a) State one misleading feature of the graph.

.....

[1]

(b) Explain how this feature affects the reader's interpretation of the graph.

.....

[1]

6

Simplify $\left(\frac{625x^{12}}{y^8}\right)^{\frac{1}{4}}$.

Answer [2]

7 Simplify $\frac{8x^2 - 2y^2}{12x^2 + 6xy}$

Answer [3]

8 Factorise completely $a^2 - a^4 - b + a^2b$.

Answer [3]

- 9 A bank guarantees an interest of \$ x at the end of 2 years with a compound interest of 4% per annum, compounded half yearly, for a principal amount of \$5000.
Calculate the amount of guaranteed interest earned at the end of 2 years.

Answer \$..... [3]

- 10** 5 men are hired to paint a house.
 If an additional man is hired, the painting can be completed 4 days earlier.
 Calculate the number of additional men to be hired if the painting is to be completed 18 days earlier.

Answer [3]

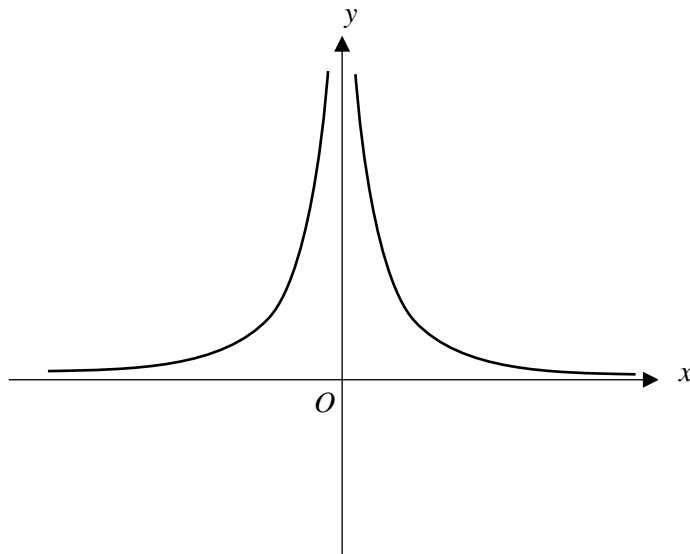
- 11** It is given that $p = \sqrt[3]{\frac{1-2r^2}{4q+r^2}}$.
 Express r in terms of p and q .

Answer $r =$ [3]

12 Solve the equation $\frac{2}{x-5} - 3 = \frac{4x+1}{3}$.

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

13 (a) The sketch shows the graph of $y = kx^n$.



Write down a possible value of n .

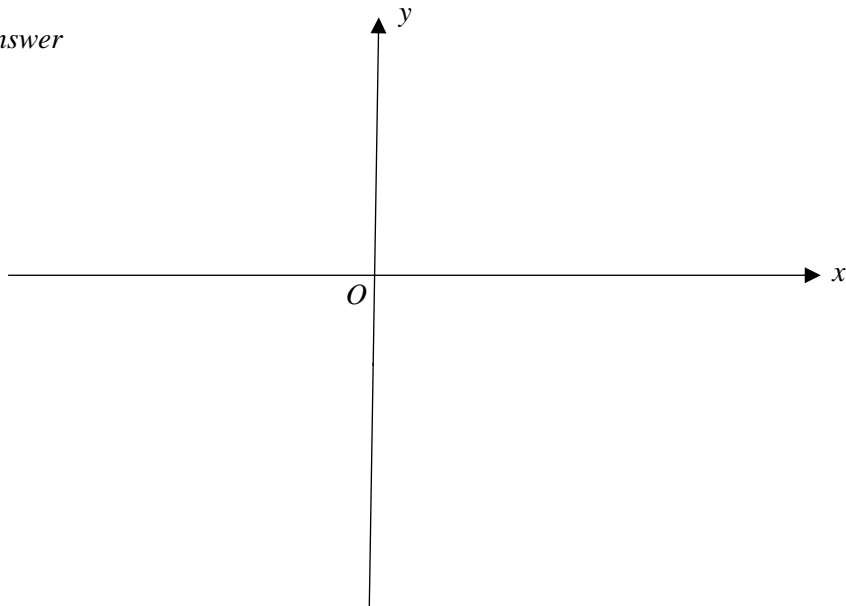
Answer $n = \dots\dots\dots$ [1]

(b) State the range of values of k .

Answer $\dots\dots\dots$ [1]

- (c) Sketch the graph of $y = -3^x$

Answer



[1]

- 14** Two geometrically similar figurines are made of the same material.
The base areas of the smaller and larger figurines are 210 cm^2 and 680.4 cm^2 respectively.
- (a) Find the ratio of the height of the smaller figurine : the height of the larger figurine.

Answer : [1]

- (b) The mass of the smaller figurine is 750 g.
Find the mass of the larger figurine.

Answer g [2]

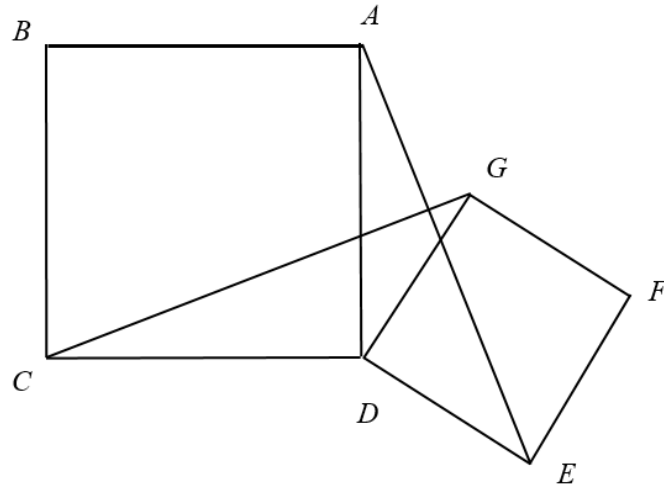
- 15 (a) Solve the inequalities $\frac{3x-2}{3} \leq 4x-1 < 16-\frac{x}{4}$.

Answer [3]

- (b) Write down the smallest rational number which satisfies $\frac{3x-2}{3} \leq 4x-1 < 16-\frac{x}{4}$.

Answer [1]

16



$ABCD$ and $DEFG$ are squares.

Show that triangle ADE is congruent to triangle CDG .

Give a reason for each statement you make.

[3]

- 17 Given that the coordinates of Q is $(1, -2)$, the gradient of PQ is -1 and the length of PQ is $\sqrt{50}$ units, find two possible coordinates of P .

Answer

(.....,) or

(.....,)[4]

- 18 (a) Given that $3a \times 10^5 + 5b \times 10^4 = c \times 10^6$, find b in terms of a and c .
Give your answer in its simplest form.

Answer [2]

- (b) Two integers, A and B , can be written as product of prime factors.

$$A = 2^{m+2} \times 3^n$$

$$B = 2^m \times 3^{n+1} \times 5$$

- (i) Find the lowest common multiple of A and B .
Give your answer as a product of its prime factors in terms of m and n .

Answer [1]

- (ii) Hence find the smallest value of the lowest common multiple of A and B .

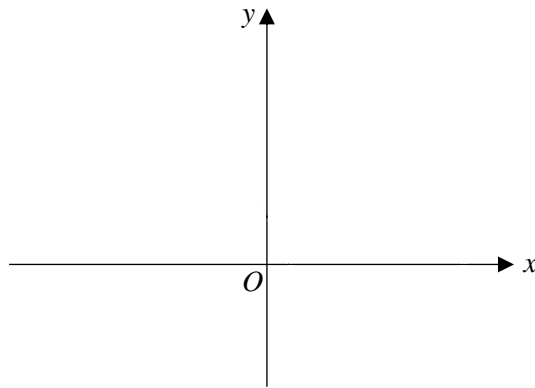
Answer [1]

- 19 (a) Express $4 - 6x + x^2$ in the form $p + (x - q)^2$.

Answer [2]

- (b) Hence sketch the graph of $y = 4 - 6x + x^2$.
Indicate clearly the values where the graph crosses the coordinate axes.

Answer



[2]

- (c) Write down the equation of the line of symmetry of the graph.

Answer [1]

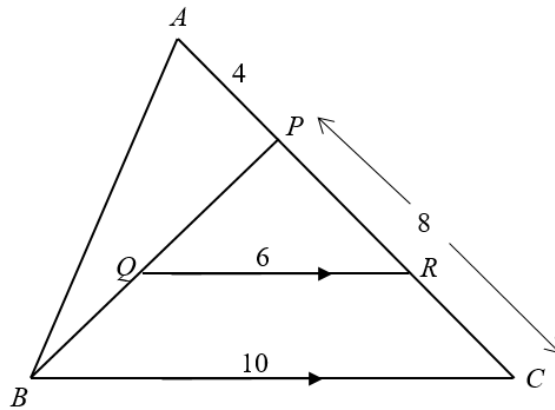
- (d) Explain why the equation $4 - 6x + x^2 = k$ does not have solutions for some values of k .

Answer

.....

..... [1]

20



BQP and $APRC$ are straight lines and QR is parallel to BC .

- (a) Show that triangle PQR and triangle PBC are similar.
Give a reason for each statement you make.

[2]

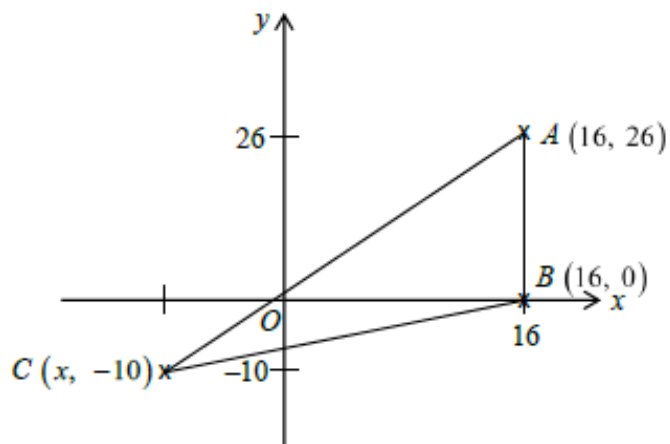
- (b) Given that $QR = 6$ cm, $BC = 10$ cm, $PC = 8$ cm and $AP = 4$ cm.
Calculate PR .

Answer $PR = \dots\dots\dots$ cm [1]

- (c) Find the ratio area of triangle PQR : area of triangle ABP .

Answer $\dots\dots\dots$ [2]

21



A , B and C are points $(16, 26)$, $(16, 0)$ and $(x, -10)$.

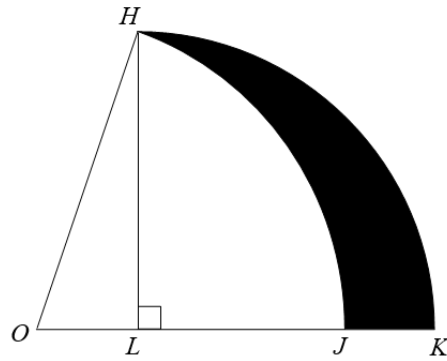
- (a) Given that $\cos \angle ABC = -\frac{5}{13}$, find the x -coordinate of C .

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

- (b) D is a point such that $ACDB$ is a trapezium where AB is parallel to CD .
The area of $ACDB$ is 648 units^2 .
Find the coordinates of point D .

Answer $D (\dots\dots\dots, \dots\dots\dots)$ [2]

22



HLK is a quadrant, centre L , and $LK = 4$ cm.
 J is a point on LK such that OHJ is a sector of a circle centre O .
 $OL = 2$ cm.

- (a) Calculate angle HOK in degree.

Answer Angle $HOK = \dots\dots\dots$ [1]

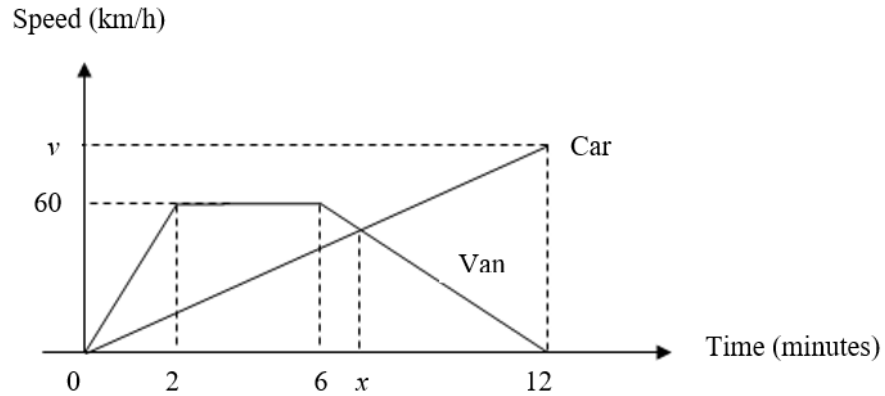
- (b) Calculate the length of the JK .

Answer $JK = \dots\dots\dots$ cm [2]

- (c) Calculate the area of the shaded region.

Answercm² [3]

23



The diagram shows the speed-time graphs of a car's and a van's journey during a period of 12 minutes.

The car and van start from the same point at the same time and travel in the same direction.

- (a) Calculate the acceleration of the van at the first minute of the journey.

Answerkm/h² [1]

- (b) Given that the two vehicles travelled the same distance in the 12 minutes journey, find the speed, v km/h, of the car at the end of the 12 minutes.

Answerkm/h [2]

- (c) The car and van are travelling at the same speed when time is x minutes.
Find the value of x .

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

End of Paper