

Class	Index Number	Candidate Name
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**ANG MO KIO SECONDARY SCHOOL  
PRELIMINARY EXAMINATION 2021  
SECONDARY FOUR EXPRESS / FIVE NORMAL ACADEMIC**

**MATHEMATICS**  
**Paper 1**

**4048/01**

**Monday**

**30 August 2021**

**2 hours**

Candidates answer on the Question Paper.

**READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class in the spaces at the top of this page.

Write in dark blue or black pen on both sides of the paper.

You may use a pencil for any diagrams or graphs.

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

Answer **all** questions.

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  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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 **80**.

For Examiner's Use
<b>80</b>

***Mathematical Formulae****Compound interest*

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

*Mensuration*

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

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

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

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

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

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

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

*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) Simplify  $\left(\frac{3}{x}\right)^{-2}$ .

Answer ..... [1]

(b) Solve  $3^y \times 4^y = 12^{5-y}$ .

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

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2 Given that  $2x - 3 < \frac{2}{3}(9x - 6)$ , solve the inequality and hence find the smallest possible value of  $x$  if  $x$  is a prime number.

Answer  $x =$  ..... [3]

- 3 The coordinates of points  $A$  and  $B$  are  $(5, -3)$  and  $(7, 2)$  respectively.

(a) Find the length of the line  $AB$ .

*Answer* ..... [2]

- (b) The line  $hx - 2y = k$  is parallel to  $AB$  and passes through the point  $(3, 8)$ .  
Find the value of  $h$  and of  $k$ .

*Answer*  $h =$  .....  $k =$  ..... [3]

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- 4 Express as a single fraction in its simplest form

$$2 - \frac{3a-b}{a+b}.$$

*Answer* ..... [2]

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- 5 The number of people living in a city in 2010 was given as 279 400, correct to the nearest hundred.

The number of people living in the same city in 2020 was given as 531 000, correct to the nearest thousand.

Find the maximum increase in the number of people living in the city between the year 2010 and the year 2020.

*Answer* ..... [2]

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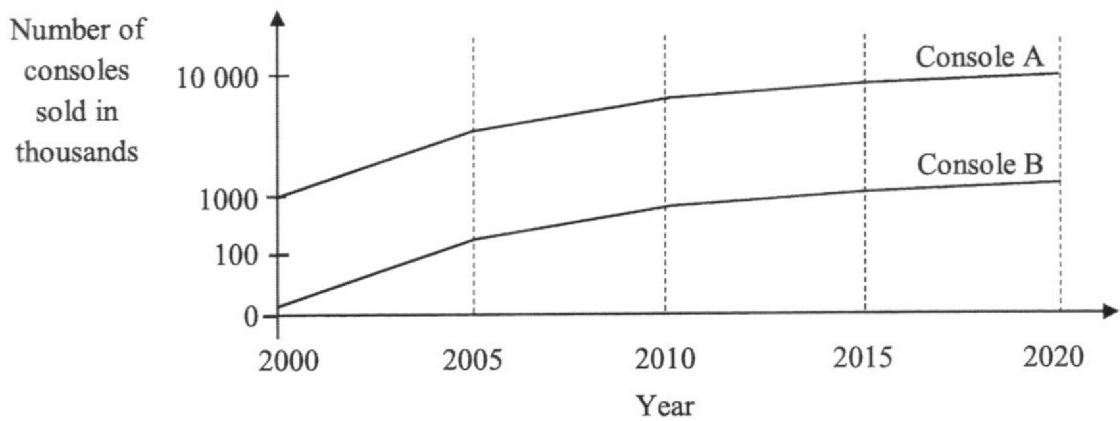
- 6 Solve the simultaneous equations

$$x - 4y = 17,$$

$$2x + 3y = 1.$$

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

- 7 The graph shows the sales figures of 2 gaming consoles manufactured by a company.



A sales executive from the company claimed that the chart showed comparable growth in the sales of the 2 gaming consoles. Do the chart support his claim? Justify your answer with reference to the chart.

Answer .....

.....

.....

- 8 Two coloured chips are taken from a box at random with replacement.  
The box contains 3 green chips and 8 yellow chips.

- (a) Emily said that the probability that both chips are yellow is  $\frac{28}{55}$ .

Explain what she has done wrong.

*Answer* .....

.....

.....

.....

.....

[1]

- (b) Find the probability that at least one of the chips is yellow.

*Answer* .....

[2]

- 9  $x$  is inversely proportional to the cube root of  $y$ .  
It is given that  $x=6$  for a particular value of  $y$ .  
Find the new value of  $x$  when this value of  $y$  decreases by 87.5%.

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

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- 10 An online sales platform offers  $x\%$  cash rebate capped at \$  $y$  dollars for each order.  
Find the minimum amount in dollars, in terms of  $x$  and  $y$ , one should purchase in each order to maximise the rebate.

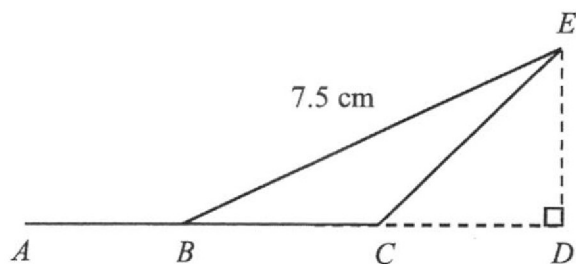
*Answer* \$ ..... [2]

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- 11 In the diagram,  $ABCD$  is a straight line.  $BE = 7.5$  cm, angle  $CDE = 90^\circ$  and  $\cos \angle ABE = -\frac{4}{5}$ .

Find the length of  $ED$ .



Answer ..... cm [2]

- 12 Patrick made a fruit cordial drink by mixing water and syrup in the ratio of 18 : 7. After finding the drink was too sweet, he added 1.3 litres of water such that the ratio of water to syrup became 17 : 3. Find the amount of the syrup used.

Answer ..... litres [3]

- 13 (a) Express 180 as a product of its prime factors.

Answer ..... [1]

- (b) The number  $180pq$  is a perfect square.

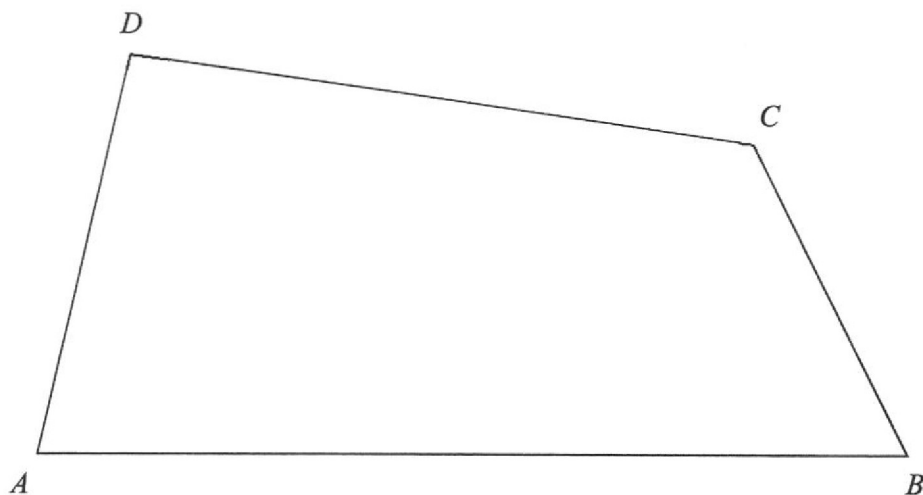
$p$  and  $q$  are composite numbers that are larger than 10 and  $p$  is smaller than  $q$ .

Find the smallest possible value of  $p$  and the value of  $q$ .

Answer  $p =$  .....  $q =$  ..... [2]

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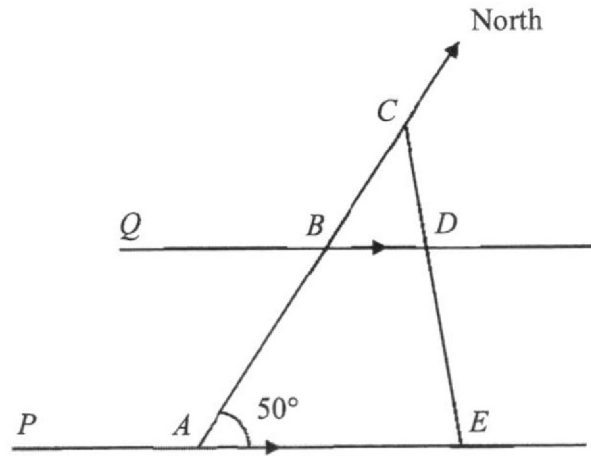
- 14 The diagram shows a quadrilateral  $ABCD$ .



On the diagram,

- (a) construct the perpendicular bisector of  $BC$ , [1]
- (b) construct the angle bisector of angle  $ABC$ , [1]
- (c) A point  $E$ , inside the quadrilateral  $ABCD$ , is equidistant from  $B$  and  $C$  and closer to  $AB$  than  $BC$ . Mark and label a possible location of point  $E$ . [1]

- 15 In the diagram,  $A$  and  $B$  are due south of  $C$ . The lines  $PAE$  and  $QBD$  are parallel. Angle  $BAE = 50^\circ$  and the bearing of  $D$  from  $C$  is  $137^\circ$



Find

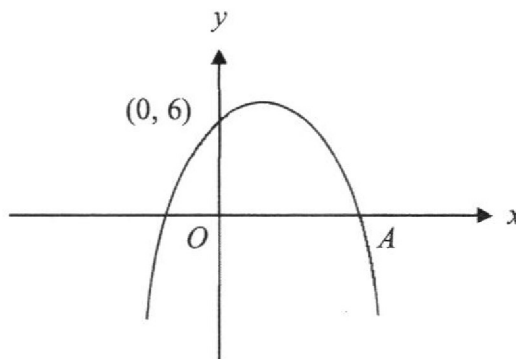
- (a) the bearing of  $Q$  from  $B$ ,

Answer .....<sup>°</sup> [1]

- (b) reflex angle  $DEA$ .

Answer .....<sup>°</sup> [2]

- 16 The curve  $y = -(x-3)(2x+b)$  cuts the  $x$ -axis at the point  $A$  and the  $y$ -axis at the point  $(0, 6)$ .



- (a) Find the value of  $b$ .

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

- (b) State the coordinates of point  $A$ .

Answer (  $\dots\dots\dots$  ,  $\dots\dots\dots$  ) [1]

- (c) Find the maximum value of  $y$ .

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

- 17 A restaurant charges different delivery fees for customers staying in different zones. The matrix  $\mathbf{P}$  shows the number of orders from zone  $A$ ,  $B$  and  $C$  on a Saturday and Sunday respectively.

$$\mathbf{P} = \begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{pmatrix} 85 & 42 & 16 \\ 90 & 65 & 28 \end{pmatrix} & \begin{matrix} \text{Saturday} \\ \text{Sunday} \end{matrix} \end{matrix}$$

- (a) The restaurant charges \$2, \$ $x$  and \$8 for each delivery to zone  $A$ ,  $B$  and  $C$  respectively. Represent this information in a  $3 \times 1$  matrix  $\mathbf{Q}$ .

Answer  $\mathbf{Q} =$

$$\begin{pmatrix} \\ \\ \end{pmatrix}$$

[1]

- (b) Find, in terms of  $x$ , the matrix  $\mathbf{R} = \mathbf{PQ}$ .

Answer  $\mathbf{R} =$

[2]

- (c) Given that on Sunday the restaurant collected \$232.50 more in delivery fees compared to Saturday, find the value of  $x$ .

Answer  $x =$  .....

[1]

- 18 The stem-and-leaf diagram shows the amount of time spent on exercising in a gym by 20 members on a particular day.

Stem	Leaf
2	5
3	0 2 6 9
4	3 5 5
5	1 6 8
6	0 0 0 3 4 8
7	0 5
8	0

Key: 2 | 5 represents 25 minutes

- (a) Find the modal time spent on exercising.

Answer ..... min [1]

- (b) Find the mean time spent on exercising.

Answer ..... min [1]

- (c) Given that 70% of the gym members exercised for more than  $x$  minutes, state the smallest possible integer value of  $x$ .

Answer  $x =$  ..... [1]

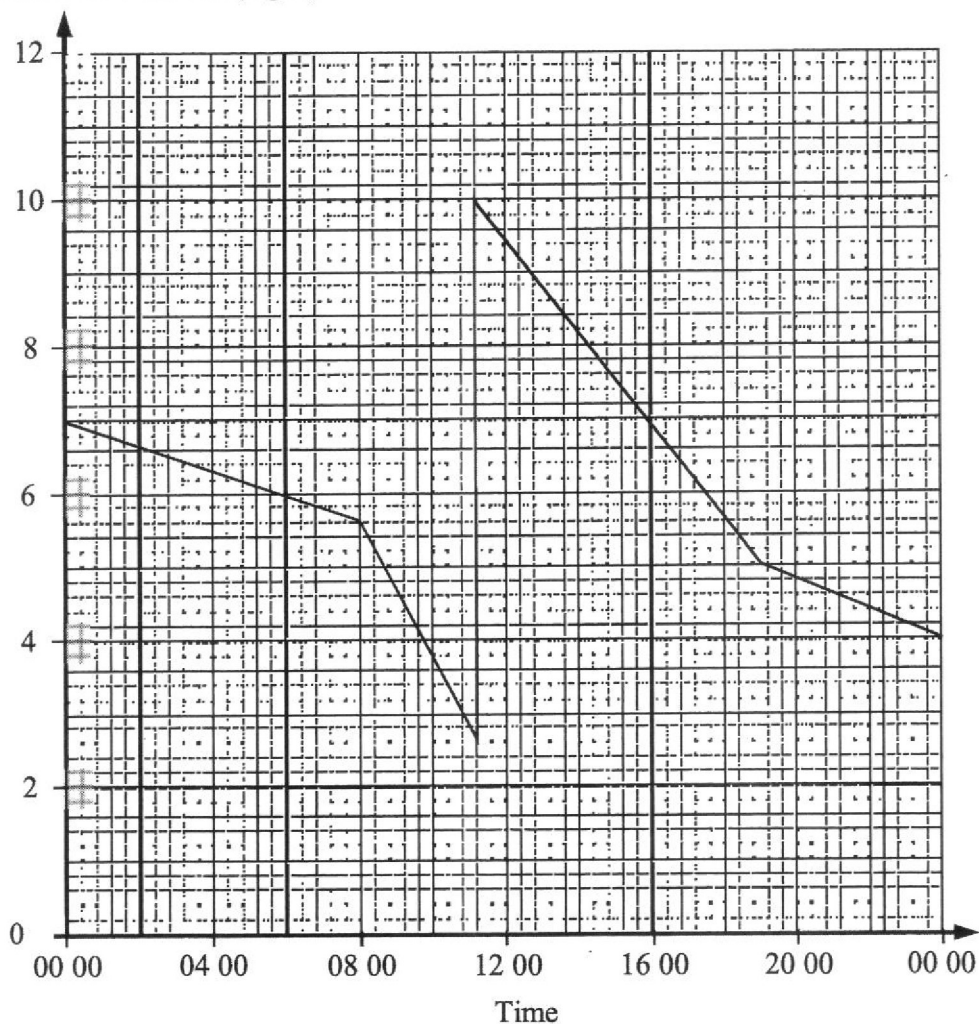
- (d) It is discovered that 2 of the values have been recorded wrongly.  
The number 32 should have been 40 and the number 51 should have been 43.  
Explain how the mean will be affected.

Answer .....

..... [1]

- 19 The graph shows the concentration of chlorine, in milligrams per litre, of water in a swimming pool throughout a particular day. A device replenishes chlorine automatically when the concentration falls below a certain level. (1 milligram =  $10^{-3}$  gram)

Concentration of Chlorine (mg/L)



- (a) At what time was the chlorine replenished?

Answer ..... [1]

- (b) The concentration of chlorine drops slowly as time passes but rapidly when the pool is being used. Given that the pool is not open for 24 hours, write down the possible opening hours of the pool.

Answer ..... to ..... [1]



- (c) Given that there are 2 million litres of water in the pool, find the amount of chlorine, in kilograms, added to the pool.

*Answer* ..... kg [2]

- 20** In a hexagonal tile, 2 interior angles are  $x^\circ$  each and remaining interior angles are  $y^\circ$  each. Explain if it's possible to place 3 of these tiles adjacent to one another so that there is no gap in between. Justify your answer with working.

*Answer* .....

.....

.....

.....

..... [2]

- 21 (a)  $\varepsilon = \{x : x \text{ is a positive integer and } x \leq 15\}$   
 $A = \{x : x \text{ is an even number}\}$   
 $B = \{x : x \text{ is an integer whose last digit is } 5\}$

(i) List the elements in set  $A'$ .

Answer ..... [1]

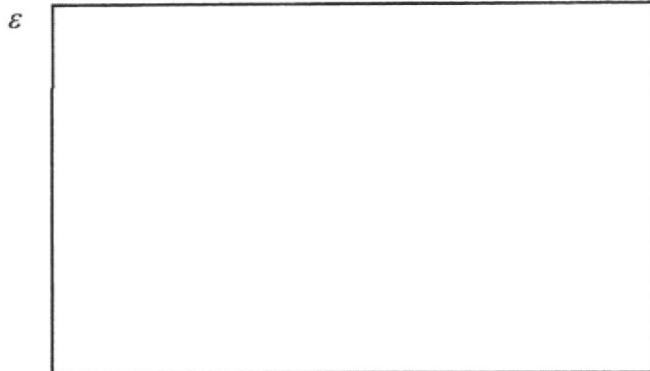
(ii) State the number of elements in the set  $A \cap B$ .

Answer ..... [1]

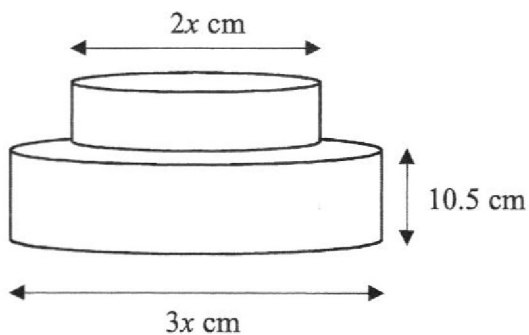
- (b) The universal set,  $\varepsilon$ , contains three sets,  $C$ ,  $D$  and  $E$ . The three sets satisfy the following conditions:

$$D \subset C, D \cap E = \emptyset \text{ and } C' \cap E \neq \emptyset.$$

Complete the Venn diagram below to illustrate these sets.



- 22 The diagram shows a birthday cake made up of 2 geometrically similar cylindrical tiers. The diameters of the upper tier and lower tier are  $2x$  cm and  $3x$  cm respectively. The height of the lower tier is 10.5 cm.



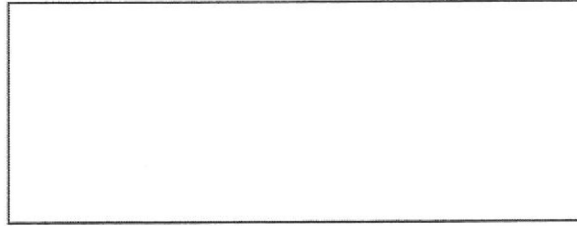
- (a) Find the total height of the cake.

Answer ..... cm [2]

- (b) Given that the cake weighs a total of 1.4 kg, find the weight of the lower tier.

Answer ..... kg [2]

- 23 The diagram shows the floor plan of each level of a 6-storey shopping mall drawn to the scale of 1 cm represent 15 metres.



The Gross Floor Area (GFA) of a building is the sum of the floor areas of all the spaces within the building.

- (a) Using the plan, find the total gross floor area of the shopping mall.

Answer ..... m<sup>2</sup> [2]

- (b) Occupancy limit of the mall was changed from one person per 10 square metres of GFA to one person per 16 square metres of GFA. Find the decrease in number of people allowed in the mall.

Answer ..... [2]

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- 24 (a) Factorise completely  $12xy - 5 + 20x - 3y$ .

Answer ..... [2]

- (b) The total surface area of a solid cube is  $(6a^2 - 48ab + 96b^2) \text{ cm}^2$ .

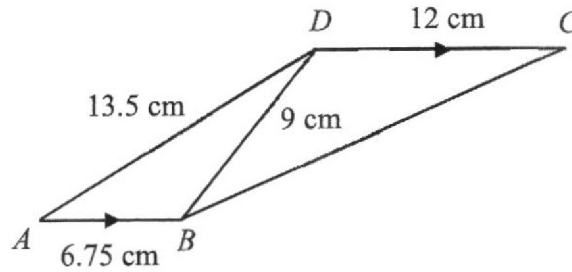
- (i) Find, in terms of  $a$  and  $b$ , the length of each side of the cube.

Answer ..... [2]

- (ii) Hence find the volume of the cube if  $a = 7$  and  $b = 1$ .

Answer .....  $\text{cm}^3$  [1]

- 25 The diagram shows a trapezium  $ABCD$  with  $AB$  parallel to  $DC$ .  $AB = 6.75$  cm,  $BD = 9$  cm,  $DC = 12$  cm and  $AD = 13.5$  cm.



- (a) Show that triangle  $ABD$  is similar to triangle  $BDC$ .  
Give a reason for each statement you make

Answer .....

.....

.....

.....

..... [3]

- (b) Find the perimeter of trapezium  $ABCD$ .

Answer ..... cm [2]