Name:	Class:	Index Number:

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PRELIMINARY EXAMINATION 2022

Mathematics **4048/01**

Paper 1

Date of Exam: 24 August 2022

Level: Secondary 4 Express & 5 Normal Academic Duration: 2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class register number and class 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.
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 number of marks for this paper is **80**.

For Examiner's Use	
Total	80

Set by: Mrs Diane Ang

Checked by: Mr Clarence Lim

This question paper consists of **20** printed pages including the cover page.

[Turn Over

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

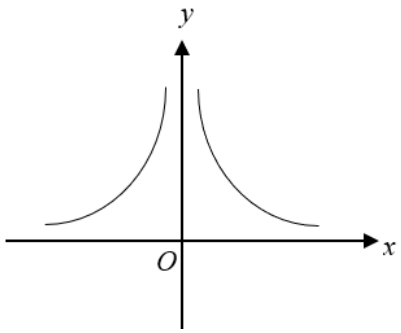
$$\text{Mean} = \frac{\sum fx}{\sum f}$$

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

Answer **all** the questions.

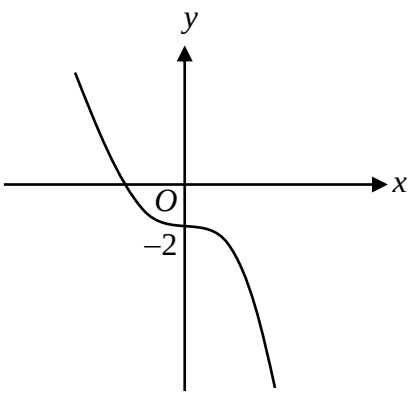
1 Write down a possible equation for each of the following graphs.

(a)



Answer ..... [1]

(b)



Answer ..... [1]

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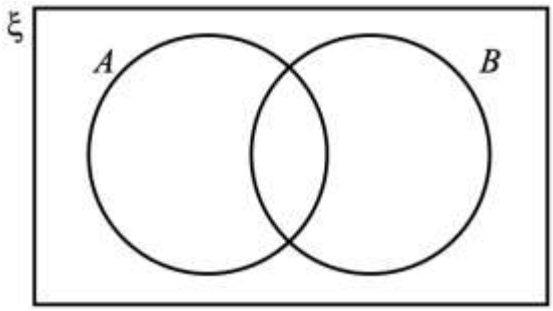
2 Simplify $\left(\frac{p^6}{r^9}\right)^{-\frac{2}{3}}$.

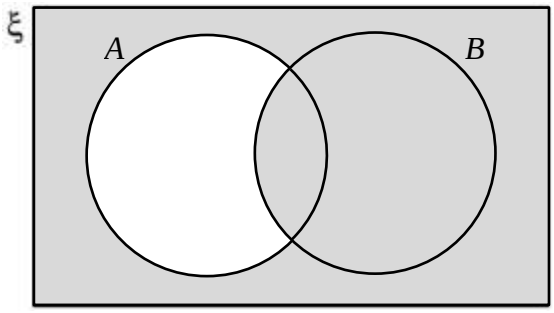
Answer ..... [2]

3 **(a)** On the Venn diagram, shade the region which represents $A \cap B'$.



[1]

(b) Use set notation to describe the shaded region.



Answer ..... [1]

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4 The highest common factor and lowest common multiple of two numbers, *m* and *n*, are 117 and $2 \times 3^2 \times 13^2$ respectively.
Given than *m* is an even number and *m* < *n*, find the values of *m* and *n*.

Answer *m* = ...

n = ... [2]

5 Two jugs are geometrically similar.
The bigger jug has a capacity of 3.2 litres and the smaller jug has a capacity of 1.35 litres.
Given that the height of the larger jug is 27 cm, calculate the height of the smaller jug.

Answer …… cm [2]

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6 y is inversely proportional to x^n and y is $\frac{1}{16}$ of its original value when x is increased by 100%.
Calculate the value of n.

Answer n = …… [3]

7 The first 4 terms of a sequence are 33, 25, 17 and 9.

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

Answer …… [1]

(b) Explain whether −101 is a term in the sequence

Answer

……

…… [2]

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8 A map of Singapore is drawn to the scale of 1 : n.
The 12-km long Kallang-Paya Lebar Expressway (KPE) is represented by a line of length 6 cm on the map.

(a) Find the value of n.

Answer $n =$ …… [1]

(b) The area on the map that represents the Jurong Bird Park is 0.05 cm^2.
Calculate the actual area, in square kilometres, of the park.

Answer …… km^2 [2]

9 The table shows the heights of a group of 25 boys.

Height h (cm)	Frequency
$140 \leq h < 150$	1
$150 \leq h < 160$	3
$160 \leq h < 170$	5
$170 \leq h < 180$	14
$180 \leq h < 190$	2

(a) Calculate an estimate for

(i) the mean height of the boys,

Answer …… cm [1]

(ii) the standard deviation of their heights.

Answer …… cm [1]

(b) Find the probability of selecting a boy whose height is below 170 cm.

Answer …… [1]

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10 DEF is a triangle.

$\overrightarrow{DE} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$, $\overrightarrow{DF} = \begin{pmatrix} -3 \\ 7 \end{pmatrix}$.

Calculate the length of EF.

Answer …… units [3]

11 **(a)** Simplify $3(2b+d)-5(b-2d)$.

Answer ..... [1]

(b) Write as a single fraction in its simplest form $\frac{4}{(5-3x)^2}-\frac{1}{5-3x}$.

Answer ..... [2]

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12 **(a)** Express x^2-6x+7 in the form $(x+p)^2+q$.

Answer ..... [2]

(b) Write down the coordinates of the minimum point of the graph of $y=x^2-6x+7$.

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

13 The times taken, in minutes, for 30 students to complete a Mathematics assignment were recorded.
The results are shown in the stem-and-leaf diagram.

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

Key: 1|2 represents 12 minutes

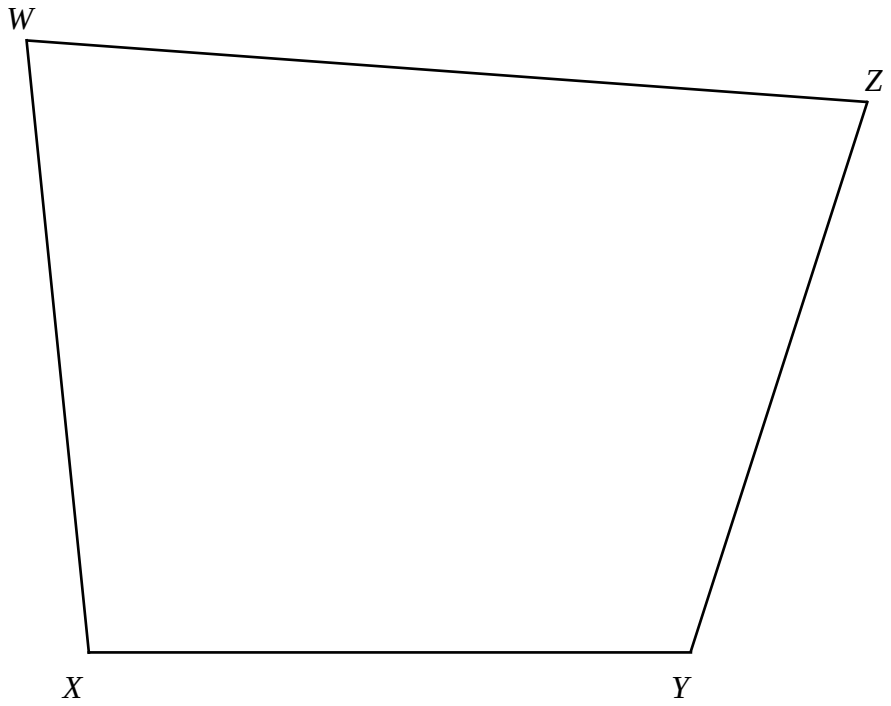
(a) Write down the median time taken.

Answer …… minutes [1]

(b) The interquartile range of the times is 22 minutes.
Find p.

Answer p = …… [2]

14 The diagram represents a plot of land, *WXYZ*, which is used for a garden.



(a) Construct the perpendicular bisector of WX. [1]

(b) Construct the angle bisector of $\angle XYZ$. [1]

(c) A fountain F is to be built in the garden, nearer to W than to X and nearer to YZ than to XY. Shade the region where the fountain is to be built. [1]

15 A factory produced 3.99 million masks for adults and children in 2021.

639 000 of them were produced for children.

(a) Calculate the percentage of the masks produced for children.

Answer ..... % [2]

(b) Find the number of masks produced for adults.
Give your answer in standard form.

Answer ..... [2]

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16 **(a)** Factorise $(x-3)^2-25$ completely.

Answer ..... [2]

(b) Hence, find two factors of 9191 other than 1 and 9191.

Answer ..... and ..... [2]

17 Hamad deposited $5000 in a bank which pays 1.25% simple interest per annum.

(a) The total amount of money will exceed $5200 at the end of n years.
Find the smallest value of n given that n is an integer.

Answer $n =$ …… [2]

(b) Hamad withdrew $3200 and exchanged into Korean Won (KRW).
The exchange rate for the day was KRW 1000 = $1.08.
Calculate the amount of KRW he would receive, rounding off the answer to the nearest thousand won.

Answer KRW …… [2]

18 The table below shows the number of books read by a group of youths in a month.

Number of books	0	1	2	3	4	20
Number of youths	2	11	$2x+2$	5	$13-x$	1

(a) Explain whether the mean or the median is a better measure of the average number of books read by the youths.

Answer

……

…… [1]

(b) **(i)** Given that the modal number of books read is 1, write down two inequalities involving x.

Answer ……

…… [1]

(ii) Hence, find all possible values of x.

Answer $x =$ …… [2]

19 Companies *A* and *B* use envelopes to send items to their customers.
The envelopes used are of three different sizes.
The number of envelopes used in a particular month is given in the table below.

	Standard Regular	Standard Large	Non-standard
Company *A*	30	25	8
Company *B*	42	35	4

This information can be represented by the matrix $\mathbf{E} = \begin{pmatrix} 30 & 25 & 8 \\ 42 & 35 & 4 \end{pmatrix}$.

(a) The postage fees for each standard regular envelope is \$0.37.
The postage fees for each standard large envelope is \$0.90.
The postage fees for each non-standard envelope is \$1.15.
Represent these fees in a 3×1 column matrix **F**.

Answer $\mathbf{F} = \begin{pmatrix} \\ \\ \end{pmatrix}$ [1]

(b) Evaluate the matrix $\mathbf{O} = \mathbf{EF}$.

Answer $\mathbf{O} =$ [2]

(c) State what each of the elements of **O** represents.

Answer

……..
…….. [1]

20 A box contained 8 chocolates with nuts and 10 chocolates with caramel.
Nadiah took a chocolate, selected at random, from the box and ate it.
Peter then took a chocolate, selected at random, from the box and ate it.

Find, as a fraction in its simplest form, the probability that

(a) both Nadiah and Peter ate a chocolate with caramel,

Answer …….. [1]

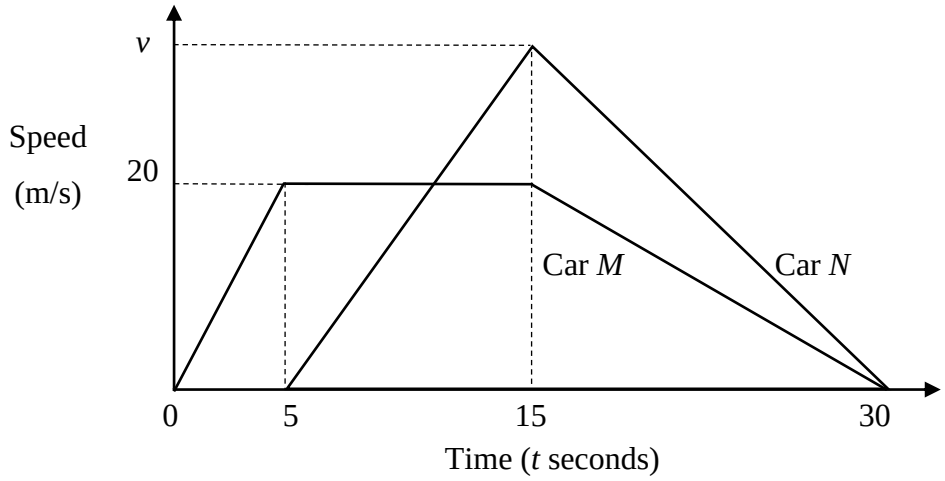
(b) Peter ate a chocolate with nuts,

Answer …….. [2]

(c) one of them ate a chocolate with nuts and the other ate a chocolate with caramel.

Answer …….. [2]

21 The diagram shows the speed-time graphs of two cars *M* and *N* travelling between two traffic junctions.
Car *N* started 5 seconds after Car *M*.
Both cars stopped at the same time.



(a) Calculate the retardation of Car *M* when $t = 20$.

Answer …….. m/s^2 [1]

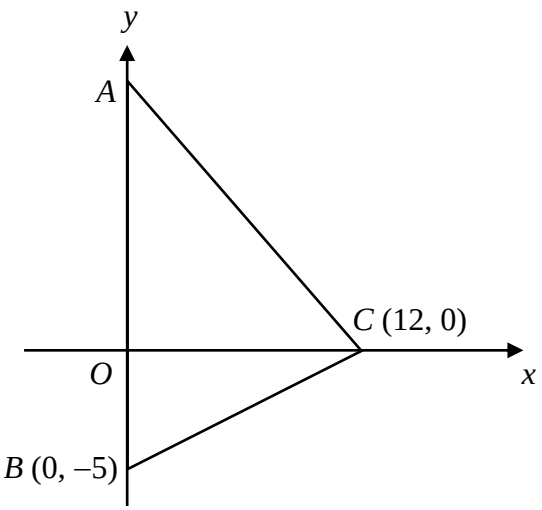
(b) Given that the two cars travelled the same distance, calculate the value of *v*.

Answer $v =$ …… [2]

(c) Find the time when the two cars were travelling at the same speed.

Answer …….. seconds [3]

22 In the diagram, the coordinates of points B and C are (0, –5) and (12, 0) respectively. The equation of the line AC is $y = px + q$.



Given that the area of triangle ABC is 120 units^2, find

(a) the coordinates of A,

Answer A = (…… , ……) [2]

(b) the values of p and q,

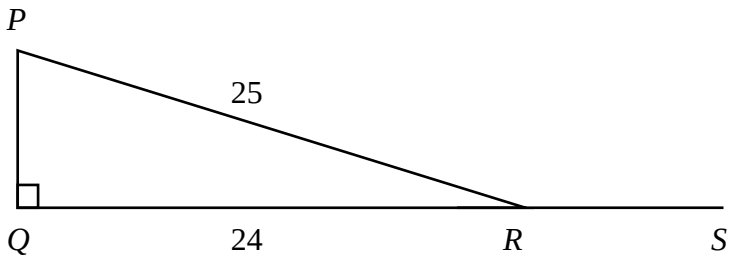
Answer p = ……

q = …… [2]

(c) the shortest distance from A to BC.

Answer ..…… units [3]

23 In the diagram, QRS is a straight line.
$PR = 25\,\text{cm}$, $QR = 24\,\text{cm}$ and angle $PQR = 90°$.



(a) Without using a calculator, find

(i) $\cos \angle PRQ$,

Answer ..... [1]

(ii) $\sin \angle PRS$.

Answer ..... [2]

(b) Find $\angle PRS$.

Answer ..... [2]

End of Paper