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HUA YI SECONDARY SCHOOL

4E/5N

Preliminary Examination 2022

4E/5N

MATHEMATICS

4048/1

Paper 1

26 August 2022

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Name, Class and Index Number in the spaces provided at the top of this page.
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 in the space below 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 80.

For Examiner's Use
80

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[Turn Over]

Setter: Ms Lee Hui Ling

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

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

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

1. Given that $2^{1003} + 2^{1000} = 2^m \times 3^n$, find the value of m and of n .

Ans: $m =$ _____,

$n =$ _____ [3]

2. The first four terms of a sequence are 27, 24, 21 and 18.

(a) Write down the 8th term of the sequence.

Ans: _____ [1]

(b) Find an expression, in terms of n , for the n^{th} term of the sequence.

Ans: _____ [1]

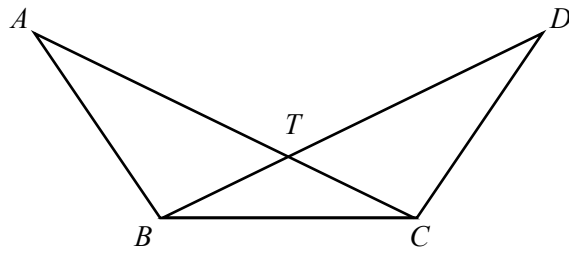
(c) Will -31 be a term in the sequence? Explain.

Answer

.....

..... [1]

3. In the diagram, $AB = DC$ and $AC = DB$. The line BD intersect the line AC at T .



- (a) Prove that $\triangle ABC$ is congruent to $\triangle DCB$.

Answer

Ans: _____ [2]

- (b) Explain why $\triangle TBC$ is an isosceles triangle.

Answer

.....

.....

[1]

4. Written as a product of its prime factors, $p = 3^3 \times 5 \times 7^2$.

(a) Express 450 as a product of its prime factors.

Ans: _____ [1]

(b) Find the highest common factor of p and 450.

Ans: _____ [1]

(b) Find the smallest integer m such that $450m$ is a multiple of p .

Ans: m = _____ [1]

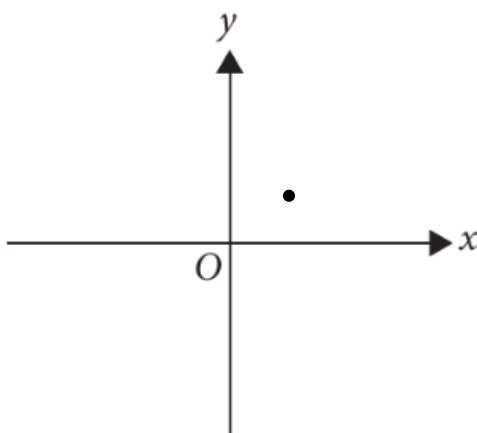
(c) Find the value of a and b such that $p \times \frac{a}{b}$ is a perfect cube where a and b are prime numbers.

Ans: a = _____

b = _____ [2]

5. The point $\left(\frac{1}{2}, \frac{1}{2}\right)$ is shown on the axes. Sketch the graph of $y = 2x^3$.

[2]



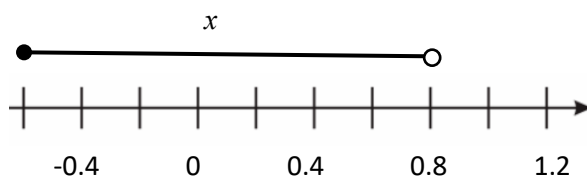
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6. Given that $\left(\frac{1}{7}\right)^{3y} = 7^{\frac{3}{5}}$, find the value of y .

Ans: $y =$ _____ [2]

-
7. Simplify $\left(\frac{2p^3}{5q}\right)^{-2} \times \frac{4}{p^{-7}q}$, leaving your answer in positive indices.

Ans: _____ [2]

8. Write an inequality to represent the range of values of x shown on the number line below.



Ans: _____ [1]

9. Solve the inequality $\frac{4x+3}{-2} \leq 5$.

Ans: _____ [2]

10. Given that $3v = \sqrt{25 - x^2}$,
 (a) find the value of v when $x = -3$,

Ans: _____ [1]

- (b) make x the subject of $3v = \sqrt{25 - x^2}$.

Ans: _____ [3]

11. Show that $(3n + 1)^2 + 2$ is always divisible by 3 for all integer values of n .

[2]

Answer

-
12. The probabilities of Andrew, Ben and Caleb passing the driving test are $\frac{3}{5}$, $\frac{2}{3}$ and $\frac{3}{4}$ respectively.

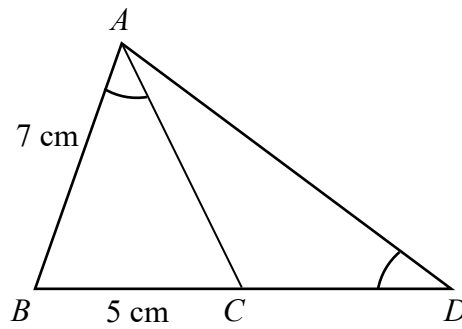
- (a) Find the probability that only Andrew passes the driving test.

Ans: _____ [1]

- (b) Find the probability that at least one of them passes the driving test.

Ans: _____ [2]

13. The diagram shows triangle ABD and BCD is a straight line.
It is also known that $AB = 7\text{ cm}$, $BC = 5\text{ cm}$ and $\angle BAC = \angle ADC$.



- (a) Prove that triangle ABC is similar to triangle DBA .

[2]

Answer

- (b) Find the length of CD .

Ans: _____ cm [2]

14. Two empty paper cups are geometrically similar.

The thickness of the paper used is negligible.

The big cup can be filled by 8 small cups.

The height of the smaller cup is 5 cm and the base area of the big cup is 26 cm^2 .

- (a) Find the height of the big cup.

Ans: _____ cm [2]

- (b) Find the base area of the small cup.

Ans: _____ cm^2 [1]

- (c) Julie said that the mass of one big cup is 8 times that of the small cups. Do you agree? Explain.

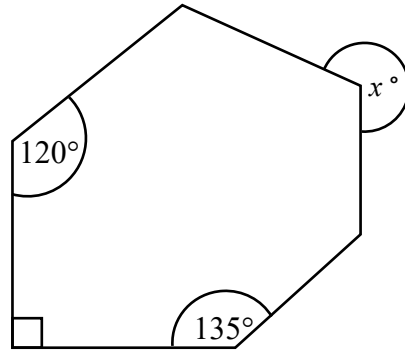
Answer

[1]

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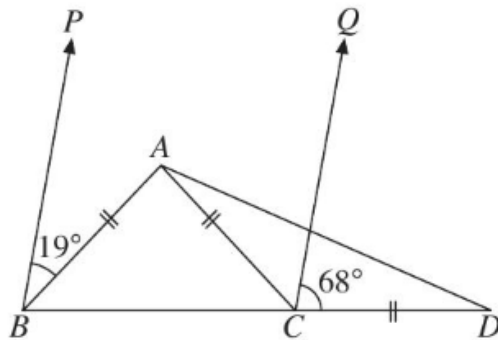
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15. The diagram shows a hexagon. Three interior angles are as shown. The remaining three interior angles are equal. Find x .



Ans $x =$ _____ $^\circ$ [3]

16. In the diagram, BP is parallel to CQ . $AB = AC = CD$, $\angle ABP = 19^\circ$ and $\angle QCD = 68^\circ$. Calculate $\angle CDA$. Show workings clearly and give reasons for your workings.



Ans: _____ $^\circ$ [3]

17. Aladdin invested \$20 000 in a savings account which pays compound interest at the rate of r % per year. The interest is compounded quarterly. The formula below shows the total amount of the investment at the end of n years.

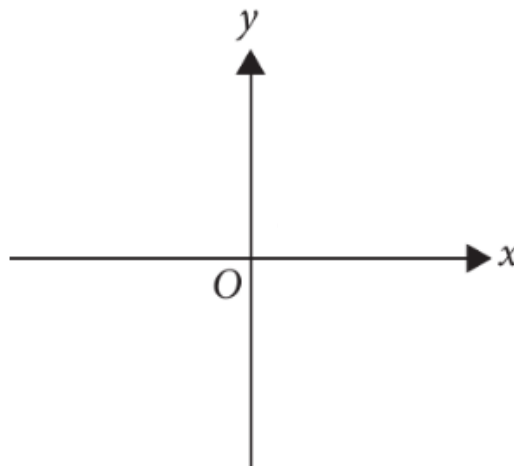
$$\text{Total amount} = 20\,000 \left(1 + \frac{r}{1000} \right)^{20}$$

Find the value of r and n .

Ans: $r =$ _____

$n =$ _____ [2]

18. (a) Sketch the graph of $y = 5 - (x - 2)^2$, showing clearly the turning point and the y - intercept. [2]



- (b) Using your graph, explain why $5 - (x - 2)^2 = 7$ will not have a solution.

Answer

.....

..... [1]

19. (a) Factorise $27x^2 - 12$ completely.

Ans: _____ [2]

- (b) Hence, simplify $\frac{5}{27x^2 - 12} + \frac{2}{2 - 3x}$.

Ans: _____ [3]

-
20. A fraction is such that its denominator is 3 more than its numerator. When 1 is added to both the numerator and denominator, the result is $\frac{7}{8}$. Find the original fraction.

Ans: _____ [3]

21. PQR is a triangle. $\overrightarrow{PQ} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$, $\overrightarrow{PR} = \begin{pmatrix} -3 \\ 9 \end{pmatrix}$ and Q is the point $(0, 5)$.

(a) Find the coordinates of P .

Ans: P (_____, _____) [1]

(b) Calculate the length of QR .

Ans: _____ units [2]

22.

$$\xi = \{x : x \text{ is a positive integer and } x < 10\}$$

$$A = \{2, 3, 5, 7\}$$

$$B = \{1, 4, 9\}$$

$$C = \{2, 4, 7\}$$

(a) Circle the correct statements from the list below.

[2]

$$\{7\} \in C \quad B \cup C = \{4\} \quad \{9\} \subset B \quad A \cap B = \{\phi\} \quad 5 \notin A'$$

(b) Find $A' \cap C$.

Ans: _____ [1]

(c) Describe in words, the elements in set B .

Answer

[1]

.....

- 23. (a)** There are five numbers. Some information of the numbers are as shown.

$$\text{Range} = 6 \quad \text{mean} = 7 \quad \text{median} = 8 \quad \text{mode} = 9$$

Find the numbers.

Ans: _____, _____, _____, _____, _____ [2]

- (b)** The average mass of 5 boys is 68 kg and that of 8 girls is 55 kg. To find the average mass of all the children, Caleb takes the average of 68 kg and 55 kg. Explain why Caleb is wrong and find the correct answer.

Answer

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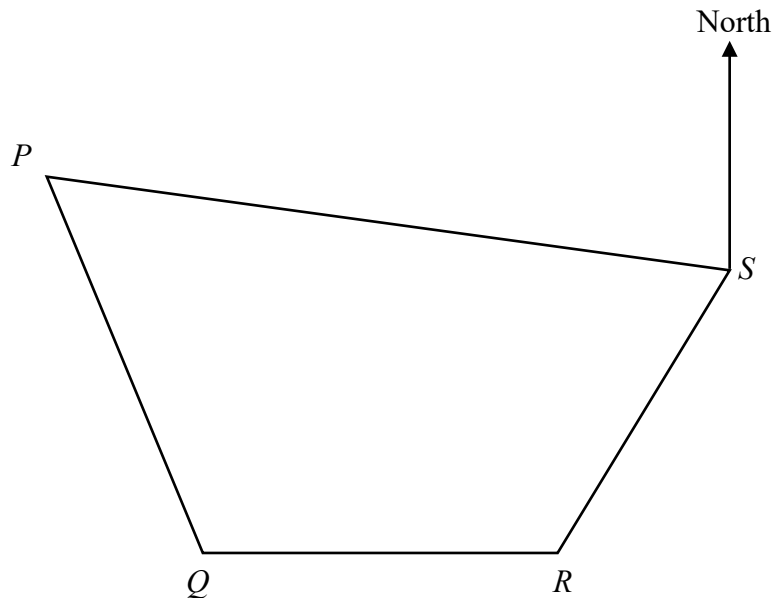
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[2]

24. In the scale drawing, $PQRS$ represents a plot of land, which is to be used for a park.

Scale 1 cm to 0.5 km



- (a) Find the actual distance between P and Q .

Ans: _____ km [2]

- (b) Measure the bearing of P from S .

Ans: _____ ° [1]

- (c) Construct the angle bisector of $\angle PQR$.

[1]

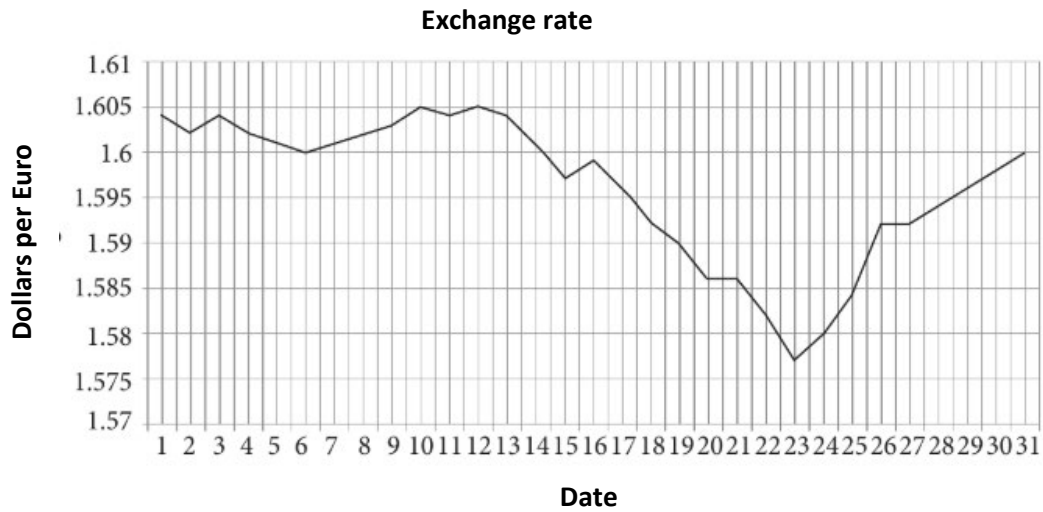
- (d) Construct the perpendicular bisector of RS .

[1]

- (e) A water fountain is to be built in the park, nearer to R than to S and equidistant to PQ and QR . Mark a possible location for the water fountain to be built and label it as F .

[1]

25. Emmett is going to Europe for a study exchange. The exchange rate between the Euro and Singapore dollar changes each day. The graph shows the daily exchange rate in a particular month.



- (a) Emmett went to the money changer on the 6th to change \$1200 to Euros. How much Euros will he get?

Ans: _____ Euros [1]

- (b) The accommodation per night at Europe is 120 Euros. Emmett wanted to convert the accommodation cost to dollars. Use the graph to work out the difference between the greatest and least possible accommodation costs per night in dollars.

Answer

[3]

-End of Paper-