

BEATTY SECONDARY SCHOOL PRELIMINARY EXAMINATION 2020



SUBJECT : Mathematics

LEVEL : Sec 4E/5N/4N

PAPER : 4048/1

DURATION : 2 hours

SETTER : Mr Lee Chau Loong

DATE : 24 August 2020

CLASS :	NAME :	REG NO :
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Write your name, class and index number in the spaces on the top of this page.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, 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.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

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 Examine	's Use
	80

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

Answer all the questions.

1 Solve the pair of simultaneous equations

2x + 3y = 44x + y = -2

2 Solve the equation 3x(x-2) = 1-8x.

3 In a regular *n*-sided polygon,

one interior angle : one exterior angle = 5 : 1.

Find the value of *n*.

4 (a) What is misleading with the survey collected below? Explain your answer.

Question posed:
What should cost less? A litre of petrol or a litre of milk?
Yes 43%
No 57%

Answer :	
	[1]

(b) What is misleading with the graph shown below? Explain your answer.

Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement

Source: https://www.buzzfeednews.com/article/katienotopoulos/graphs-that-lied-to-us

5 Danny deposits \$1000 in a bank that pays compound interest of r% per annum. At the end of 10 years, his money doubles. Calculate the value of r.

6 (a) Factorise 3ap + 10by - 5apy - 6b completely.

(a) Factorise $\frac{x^2}{2} - \frac{9y^2}{2}$ completely.

7 A map has a scale of 1 : 25000. A park on the map has an area of 30 cm². Find the area of the park on another map with scale 2 cm : 3 km.

8 (a) When x is increased by a factor of 2, y decreases by a factor of $\frac{1}{8}$. State a possible equation relating x and y.

Answer y = [1]

(b) *p* varies directly with the square root of *q*. Given that *p* = 27 when *q* = 9,
(i) find the equation relating *p* and *q*,

Answer [2]

(ii) find the value of q when p = 81.

Answer q = [1]

9 A rope 115 metres long was cut into 3 parts.Each part was then reduced by 15 metres each. The ratio of the three parts became 2 : 5 : 3.Express the original length of the longest part as a percentage of the whole rope.

10 (a) Write $x^2 - 21x + 3$ in the form $(a + x)^2 + b$.

(b) Hence solve $x^2 - 21x + 3 = 0$. Leave your answer correct to 2 decimal places.

11 The ages of customers visiting a cafe in the morning are summarised in the table below.

Ages	$0 < x \le 10$	$10 < x \le 20$	$20 < x \le 30$	$30 < x \le 40$	$40 < x \le 50$	$50 < x \le 60$
Frequency	6	15	23	14	8	6

(a) In which age group is the median found?

Answer[1]

(b) Calculate an estimate of the mean and standard deviation.

Answer mean = years old, SD = years old [2]



(b) Express the shaded region using set notation.



[2]

(c) $\xi = \{x \text{ is an integer}: 1 \le x \le 50\}$

 $A = \{ \text{ prime numbers } \}$

 $B = \{ \text{ factors of } 50 \}$

From the list below, circle all the statements that are true.

Answer:

 $9 \in A$, $1 \in A \cap B$, $B \subset A$, $n(A \cap B') = 13$, $A \cup B = \xi$, n(B) < n(A)

13 A cone is cut into three sections *X*, *Y* and *Z*, such that a : b : c = 1 : 1 : 1. The volume of *Y* is *k* times the volume of the original cone. Find the value of *k*.



14 (a) Simplify
$$\left(\frac{6q}{p^3}\right)^3 \div \left(\frac{3}{p^2q}\right)^{-1}$$
.

(b) Solve
$$a \times a^2 \times a^3 \times a^n = \frac{1}{a^{10}}$$
.

(c) Solve $8^x = \sqrt[3]{64}$.

15

 $p, -13, r, s, t, 35, \dots$

(a) Each term of the sequence is found by adding a constant *c* to the previous term. Find the value of *c*, of *p*, of *r*, of *s*, and of *t*.

(b) Find an expression, in terms of *n*, for the general term of the sequence.

(c) How many terms in the sequence are between 10 and 100?

Answer terms [1]

16 (a) On the given axes, sketch the graph of $y = 3 - (x+1)^2$. Answer:



(**b**) The graph of $y = a(b^x)$ crosses the *y*-axis at 600 and passes through $\left(4, 189\frac{27}{32}\right)$.

Find the value of *a* and of *b*.



[2]

10

Answer $a = \dots, b = \dots$ [2]

17 A bag contains letters from the words "COVID VIRUS".(a) A letter is picked at random from the bag. Find the probability of picking "V".

Answer[1]

(b) Letters from another word are to be added to the bag so that the probability of randomly picking a vowel is ⁴/₉.
Which of the following words can be used? Show your working clearly.
ITALY, MALAYSIA, SINGAPORE

Answer[2]

18 From within a solid cylindrical wood with radius 50 cm, Adam bores out a cylinder of radius *r* cm, forming a hollow.



The volume of wood remaining is 50% of the original volume. Find the value of r.

Answer r = cm [2]

19 The line $y = -\frac{4}{3}x + 4$ crosses the y-axis and x-axis at A and B respectively. Find the exact value of $\cos \theta$.



20 *P*, *Q*, *R* and *S* are points on the circumference of a circle, centre *O*. *PR* and *QS* meet at *O*.



(a) Show that triangle *OQR* is congruent to triangle *OPS*.

Answer:	 		
	 	•••••••••••••••••••••••••••••••••••••••	
	 	•••••••••••••••••••••••••••••••••••••••	

(b) The area of the circle is 1018 m² and angle $QOR = 100^{\circ}$. Find the area of the minor sector OPQ.

21 (a) The distance between A(-2, 3) and B(4, k) is 10 units. Find the negative value of k.

(b) Given P(-4, 1), Q(6, 7), *R* is on the *x*-axis such that *PQ* is perpendicular to *QR*, and (gradient of *PQ*) × (gradient of *QR*) = -1.

Find the coordinates of *R*.



Answer R (.....) [3]

22 A particle accelerates from rest at a uniform rate and reaches 8 m/s in 4 seconds. It then travels at a constant speed for 2 seconds, and finally decelerates at 1.25 m/s² until it comes to rest at t = k seconds.

The speed-time graph is shown below.



(a) Find the value of *k*.

(b) Calculate the average speed for the whole journey.



- 23 For the construction in this question, use the scale 1 cm : 500 m.
 - *B* is due north of *C* and BC = 3 km.
 - A is due west of B and AB = 4.5 km.
 - *C* is due east of *D* and CD = 6.2 km.
 - (a) Construct trapezium *ABCD* accurately. *BC* has been done for you. *Answer:*

[2]

В

С

(**b**) Measure the bearing of *D* from *B*.

Answer	[1]
(c) Construct the angle bisector of <i>DAB</i>.(d) Construct the perpendicular bisector of <i>AD</i>.	[1] [1]
(e) The region inside the trapezium that is closer to <i>AD</i> than <i>AB</i> , and that is closer to <i>A</i> than to <i>D</i> will be planted with trees.	
Shade this region clearly.	[1]

End of Paper

Answer Key

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1. x = -1, y = 2
2. x = 1/3 or x = -1
3. 12
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4(a) Either

1. Yes does not indicate response is to choose petrol or milk.

2. No scale is provided for the bars to compared against the given percentages.

4(b) The values on the *y*-axis have been inverted, causing the graph to be inverted as well. Hence the graph now shows the opposite trend.

6(a) (ap-2b)(3-5y) (b) $\frac{1}{2}(x-3y)(x+3y)$ 7. $5/6 \text{ cm}^2$ 8(a) $y = \frac{k}{x^3}$ (b)(i) $15\frac{5}{8}$ (ii) 81 9. $43\frac{11}{23}\%$ $10(a)\left(-10\frac{1}{2}+x\right)^2 -107\frac{1}{4}$ (b) 0.14 or 20.86 (2 dp) 11(a) $20 < x \le 30$ (b) 27.9 years old, 13.6 years old 12(a) ξ Q 12(b) $X' \cap Y'$ or $(X \cup Y)'$ (c) $n(A \cap B') = 13$ and n(B) < n(A)13. $\frac{7}{27}$ 14(a) $\frac{648q^2}{n^{11}}$ (b) n = -16 (c) $x = \frac{2}{3}$ 15(a) c = 12, p = -25, r = -1, s = 11, t = 23 (b) -37 + 12n (c) 8 terms 16(a) (-1, 3)2 0.732 -2.73 16(b) $a = 600, b = \frac{3}{4}$ 17(a) 1/5 (b) Choose MALAYSIA 18.35.4 cm

19. $-\frac{3}{5}$ 20(a) OQ = OP (radii of circle) (S) Angle *QOR*=angle *POS* (vertically opposite angles are equal)(A) OR = OS (radii of circle) (S) Hence by SAS, triangle OQR is congruent to triangle OPS. (also accept ASA with correct reasons) ~

20(b)
$$226\frac{2}{9} \text{ m}^2$$

21(a) $k = -5$ (b) $R\left(10\frac{1}{5}, 0\right)$
22(a) 12.4 s (b) $4\frac{20}{31}$ m/s

