

GREENRIDGE SECONDARY SCHOOL 2023 END-OF-YEAR EXAMINATION SECONDARY 3 EXPRESS

| NAME | | |
|-------|----------------|--|
| CLASS | - INDEX NUMBER | |

MATHEMATICS

Paper 1

Setter: Mr Lim Yeun Chen

Candidates answer on the Question Paper.

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name 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 of the marks for this paper is 90.

| For Examiner's Use | | | | |
|--------------------|----|--|--|--|
| Total | 90 | | | |

This paper consists of **20** printed pages, including this cover page.

4052/01

3 October 2023

2 hours 15 minutes

4002/0

Mathematical Formulae

Compound interest

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

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$a^{2} = b^{2} + c^{2} - 2bc \cos A$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

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.

3

1 Write these numbers in order of size, starting from **largest**.

Aden needs a loan of \$99 800 to buy a new car. Bank *ABC* charges a simple interest of 2.58% per annum.If Aden plans to take a five year loan, what is the total amount he has to pay for the loan?

Answer \$ [2]

3 By rounding off each number to 1 significant figure, estimate $\frac{46 \times 0.07035}{22.34 - 3.1\sqrt{4.45}}$. Show your workings clearly.

[Turn over

4 (a) Change 330 degrees to radians.

..... rad [1] *Answer*

(**b**) Change $\frac{5\pi}{8}$ radians to degrees.

Answer° [1]

5 *A* is the point (3, 6) and *B* is the point (8, *n*). The length of the line segment *AB* is $\sqrt{34}$. Find the possible values of *n*.

6 The sine of an angle is 0.6231. Give two possible values for the angle.

Answer° or° [2]

7 Given that $7^p = \frac{1}{49} \times \sqrt{7}$, find the value of *p*.

Answer \$

8 Janelle invests \$6850 in a bank that pays compound interest at a rate of 3.13% per annum. Find the total interest she will earn from the investment after 7 years. Give your answer correct to the nearest cent.

[Turn over

[3]

$$y = \frac{2}{x^2}$$

$$y = x^2 - 2$$

$$y = \frac{1}{x}$$

$$y = x^3$$

$$y = 5^x$$

$$y = x^3$$

Write down a possible equation for each of the sketch graphs below. In each case select one of the equations from the box above.

9



10 If x = -5 is a solution of the equation $2x^2 + 9x - a = 0$, find the other solution of the equation.

Answer $x = \dots$ [3]

11 (a) Solve the inequality $2x - 15 \le 19$.

(b) Randy says there are a total of 8 prime numbers which satisfy the inequality $2x-15 \le 19$. Explain whether Randy's claim is correct.

Answer

.....[2]

12 In the right-angled triangle below, angle $BAC = 90^{\circ}$, AC = 16 cm, BC = 20 cm. *AB* is produced to *P* and *AC* is produced to *Q*.



(a) Express $\cos x$ as a fraction, in its simplest form.

Answer [1]

(**b**) Calculate angle *ABC*.

Answer° [2]

13 Simplify (a) $6(a^2b^0)^3 \div a^{-6}$,

Answer [2]

(b)
$$\left(\frac{a^{15}}{125}\right)^{-\frac{1}{3}}$$
.

Answer [2]

14 In the diagram, AS = 12 cm, BS = 3 cm and AR = 9 cm.



Show that triangle *ABC* is congruent to triangle *ARS*. Give a reason for each statement you made.

Answer

.....[3]

15 Given that $x^2 + y^2 = 23$ and xy = 17, find the value of $(3x - 3y)^2$ without solving for values of x and y.

16 The curve y = -(x-5)(2x+b) cuts the x-axis at the point A and the y-axis at the point (0, 10).



(a) Find the value of *b*.

Answer $b = \dots$ [1]

(b) State the coordinates of *A*.

Answer (.....) [1]

(c) Find the maximum value of y.

[Turn over

17 The distance-time graph shows the entire journey of an object.



(a) State the time interval in which the object is stationary.

Answer s to s [1]

(b) Find the speed of the object at 40 seconds.

Answer m/s [2]

(c) Calculate the average speed for the entire journey.

Answer m/s [2]

18 (a) Sketch the graph of $y = (x-2)^2 + 3$ on the axes below.



[2]

(b) Explain, by drawing a suitable line on your sketch, why the equation $(x-2)^2 = -1$ has no real solution.

Answer

......[2]

19 (a) Express $x^2 - 13x + 9$ in the form $(x - p)^2 + q$.

(b) Hence solve $x^2 - 13x + 9 = 0$.

Answer $x = \dots$ [3]

- **20** As of 2021, India has a population of 1.41 billion people. India's capital, New Delhi, was estimated to be home for 31.2 million people.
 - (a) Calculate the number of people living outside of New Delhi. Give your answer in standard form.

(b) Given that the land area of India is 3287263 square kilometres, calculate the average number of people per square kilometre in India.

| Line Number, n | T_n | S_n |
|----------------|-------------|-------|
| Line 1 | $1^2 + 2^2$ | = 5 |
| Line 2 | $2^2 + 3^2$ | = 13 |
| Line 3 | $3^2 + 4^2$ | = 25 |
| Line 4 | $4^2 + 5^2$ | = 41 |
| | | |

21 The first four lines in a sequence of numbers are given below.

(a) Write down Line 11 of the sequence.

(b) Write down an expression, in terms of *n*, for the *n*th term of the sequence, T_n .

(c) One term in the sequence is 8321. Find the value of n for this term.

Answer $n = \dots$ [1]

(d) Explain why S_n is always odd.

Answer

| 22 | (a) | Construct quadrilateral <i>ABCD</i> , given that $AB = 6$ cm, $BC = 7$ cm, $CD = 9$ cm, $AD = 7.5$ cm and angle $ABC = 130^{\circ}$. The line segment <i>AB</i> has been drawn for you. | [2] |
|--------------|------------|---|-----|
| | (b) | On the same diagram, construct | |
| | | (i) the perpendicular bisector of AB , | [1] |
| | | (ii) the bisector of angle <i>BCD</i> . | [1] |
| (c) | | A point P is inside quadrilateral $ABCD$, nearer to BC than CD and nearer to A than to B . | |
| | | Shade the region that point <i>P</i> lies in. | [1] |
| | | Answer | |

A

В

23 The diagram shows two lines, l_1 and l_2 . The equation of line l_1 is 5y-4x-20=0. Line l_1 cuts the y-axis at C(0, 4). The lines l_1 and l_2 intersect at the point A. The coordinates of A and B are (p, 8) and (0, -2) respectively.



(a) Show that p = 5

Answer

(b) Find the gradient of AB.

(c) Calculate the perpendicular distance from *C* to the line *AB*.

[Turn over

[1]



Find

24

(a) the height of the vertical pole, *TP*.

Answer m [1]

(b) the angle of depression of R from T.

25 In the diagram, OQR and OPS are sectors with centre O. The length of PQ is 12 cm, angle POS = 2.2 rad and the length of arc PS is 11 cm.



(b) the perimeter of the shaded region *PQRS*.

(c) the area of the shaded region *PQRS*.

[Turn over

26 The diagram shows the speed-time graphs of a van and a bike. The van, which is initially at rest accelerates uniformly for 24 seconds until it reaches a speed of 14 m/s. It then continues to travel at this constant speed.



(a) Find the acceleration of the van during the first 24 seconds.

Answer m/s² [1]

(b) Find the distance travelled by the van in 30 seconds.

Answer m [2]

(c) The bike starts from the same place as the van 12 seconds later. It accelerates uniformly until it overtakes the van 30 seconds later. Shasa claims that the speed of the bike required at this instant is 26 m/s. Do you agree? Justify your answer.

Answer