GREENRIDGE SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
SECONDARY 4 NORMAL (ACADEMIC)

original

CANDIDATE NAME	

CLASS	☐ - ☐	INDEX NUMBER	☐☐

MATHEMATICS SYLLABUS A   **4045/01**

Paper 1   5 August 2024

Setter: Mrs Goh-Kok Mei Leng   2 hours

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** the questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

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 total of the marks for this paper is 70.

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.

[Turn over

This paper consists of **14** printed pages, including this cover page.

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

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

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

Answer **all** the questions.

1 It is given that $m = \dfrac{78.9}{\sqrt{24.05 - 7.85}}$.

(a) Without the use of a calculator, estimate the value of m. Show your working clearly.

$$m = \frac{80}{\sqrt{24 - 8}}$$

$$= \frac{80}{\sqrt{16}}$$

$$= \frac{80}{4} = 20$$

Answer ....20............ [1]

(b) Use your calculator to find the value of m, leaving your answer to 2 decimal places.

$= 19.6029$

$= 19.60 \ (2 \, dp)$

Answer ....19.60............ [1]

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2 The weight of a golf ball is 0.0459368 kg.

(a) Write this weight correct to 3 significant figures.

Answer ....0.0459............ [1]

(b) Write your answer in part (a) in standard form.

Answer ....4.59 $\times 10^{-2}$............ [1]

---

3 Find the least integer x satisfying $5x > -21$.

$5x > -21$

$x > -\dfrac{21}{5}$

$x > -4\dfrac{1}{5}$ (1m)

Least integer $x = -4$ (1m)

Answer ....-4............ [2]

[Turn over

4   3, 8, 13, 18, 23, ...

(a)   Find an algebraic expression for the nth term in the sequence.

$$T_n = 3 + (n-1)5$$
$$= 3 + 5n - 5$$
$$= 5n - 2$$

Answer $5n - 2$ [1]

(b)   Show that 403 is a term in the sequence.

Answer

Let $5n - 2 = 403$ Since n is a whole
      $5n = 403 + 2$ number, 403 is a term
         $= 405$ in the sequence. (1m)
      $n = \dfrac{405}{5}$
         $= 81$ (1m)   [2]

---

5   (a)   Find the obtuse angle of A such that sin $A° = 0.8667$.

Acute $\angle A = 60.077°$
$\therefore$ Obtuse $\angle A = 180 - 60.077°$
$= 119.92°$
$= 119.9°$ (1dp)

Answer $119.9°$ [1]

(b)   Write the following in order of size, starting with the smallest.

$$32.5\% \qquad 0.3255 \qquad 0.3\dot{2} \qquad \sqrt{\dfrac{64}{625}}$$

$32.5\% = 0.325$
$0.3\dot{2} = 0.3222...$
$\sqrt{\dfrac{64}{625}} = 0.32$

[1 error → $-$1m]

Answer $\sqrt{\dfrac{64}{625}}$, $0.3\dot{2}$, 32.5% , 0.3255 [2]

6 (a) Write $\dfrac{5^4 \times 5^2}{\sqrt{5}}$ as a single power of 5.

$$= \frac{5^6}{5^{\frac{1}{2}}} \quad (1m)$$

$$= 5^{5\frac{1}{2}} \quad (1m)$$

Answer .... $5^{5\frac{1}{2}}$ .... [2]

(b) Given that $\dfrac{1}{32} = 2^m$, find the value of m.

$$\frac{1}{2^5} = 2^m \quad (1m)$$

$$2^{-5} = 2^m$$

Comparing power

$$\therefore m = -5 \quad (1m)$$

Answer $m =$ .... -5 .... [2]

---

7 Factorise

(a) $2ap - 6bp + aq - 3bq$,

$$= 2p(a - 3b) + q(a - 3b)$$

$$= (2p + q)(a - 3b)$$

Answer .... $(2p+q)(a-3b)$ .... [1]

(b) $2x^2 + x - 10$.

$$
\begin{array}{c|c|c}
2x & 5 & 5x \\
\times & & \\
x & -2 & -4x \\
\hline
2x^2 & -10 & x
\end{array}
$$

Answer .... $(2x+5)(x-2)$ .... [1]

[Turn over

8 In a sale, the price of a watch was reduced by 30% of its original price to $385. Find the original price of the watch.

$$70\% \longrightarrow \$385 \quad (1m)$$
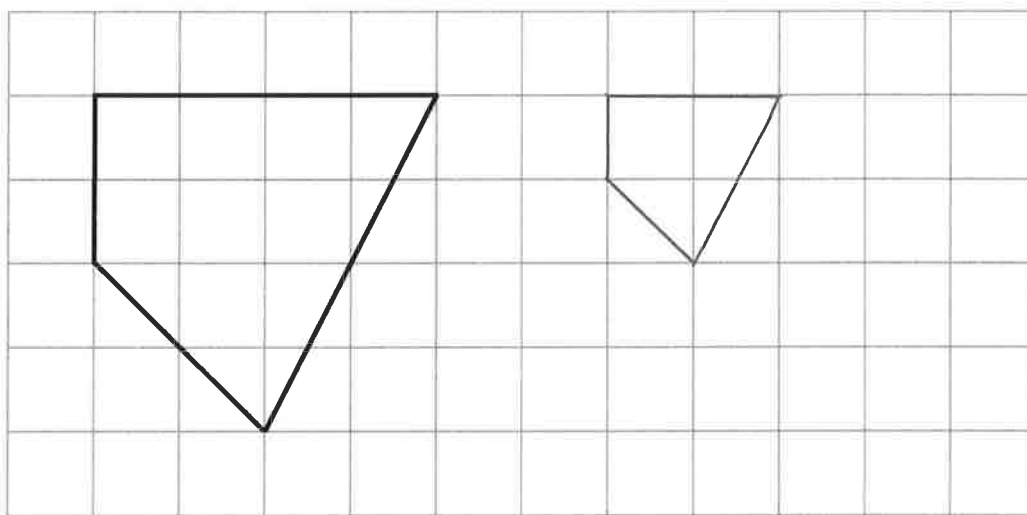
$$\text{Original price} = \frac{385}{70} \times 100$$

$$= \$550 \quad (1m)$$

Answer $ ....550.................... [2]

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9 Draw a reduction of this quadrilateral using the scale factor of $\frac{1}{2}$.

$$[1 \text{ error} \longrightarrow -1m]$$

[2]

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10 If Jenny buys x kg of sugar at the price of 99 cents, how much will y kg of sugar cost in dollars? Express your answer in terms of x and y.
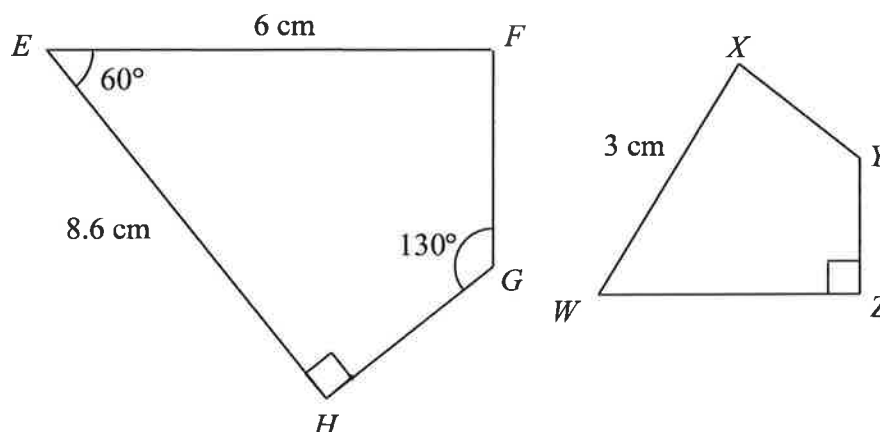
$$x \text{ kg} \longrightarrow \$0.99$$

$$1 \text{ kg} \longrightarrow \frac{\$0.99}{x} \quad (1m)$$

$$\therefore y \text{ kg} \longrightarrow \frac{\$0.99}{x} \times y$$

$$= \$\frac{0.99y}{x} \quad (1m)$$

Answer $ ....$\frac{0.99y}{x}$.... or ....$\frac{99y}{100x}$.... [2]

11 Quadrilateral *WXYZ* is a reduction of quadrilateral *EFGH*.
    XW = 3 cm, *EF* = 6 cm and *EH* = 8.6 cm.
    $\angle FEH = 60°$, $\angle FGH = 130°$ and $\angle EHG = \angle WZY = 90°$.

E 6 cm F
60°
8.6 cm
130°
G
H

X
3 cm
Y
W
Z

Find

(a) the scale factor,

SF = $\frac{XW}{FE}$

= $\frac{3}{6}$ = $\frac{1}{2}$

Answer ....$\frac{1}{2}$.......... [1]

(b) *WZ*,

WZ = $\frac{1}{2}$ EH

= $\frac{1}{2}$ (8.6)

= 4.3 cm

Answer ....4.3..........cm [1]

(c) $\angle WXY$.

$\angle WXY = \angle EFG$

= $360° - 130° - 90° - 60°$

= $80°$

Answer ....$80°$.......... [1]

12 Tim scored 16 out of 20 marks in Test A and 49 out of 56 marks in Test B. In which test
    did Tim do better? Justify your answer.

Answer

Test A : $\frac{16}{20}$ × 100 = 80%

Test B : $\frac{49}{56}$ × 100 = 87.5%

1m - any 1 test %
correct

Tim did better in Test B because he scored
a higher % in Test B. (1m)

[2]

[Turn over

13 Solve these simultaneous equations.

$$5x - 2y = 16 \quad — \quad (1)$$
$$x + 3y = -7 \quad — \quad (2)$$

Method 1

From (2)

$x = -7 - 3y$ (1m)

Subst $x = -7 - 3y$ into (1)

$5(-7 - 3y) - 2y = 16$

$-35 - 15y - 2y = 16$

$-17y = 51$

$y = -3$ (1m)

∴ $x = -7 - 3(-3)$

$= -7 + 9$

$= 2$ (1m)

Method 2

(2) × 5

$5x + 15y = -35 \quad — \quad (3)$ (1m)

(1) - (3)

$-17y = 51$

$y = -3$ (1m)

Subst $y = -3$ into (2)

$x + 3(-3) = -7$

$x = -7 + 9$

$= 2$ (1m)

Answer $x = \underset{}{2}$, $y = \underset{}{-3}$ [3]

---

14 Three bells ring every 15 minutes, 21 minutes and 25 minutes respectively.

(a) Given that they rang together at 08 30, when will they next ring together again?

3	15, 21, 25
5	5, 7, 25
5	1, 7, 5
7	1, 7, 1
	1, 1, 1

LCM = $3 \times 5^2 \times 7$

$= 525$ (1m)

525 min = 8.75h

∴ Rang together again at

$= 08\ 30 + 08\ 45$

$= 17\ 15h$ (1m)

Answer ......17 15h...... [2]

(b) How many times will they ring together over a period of 19 hours?

No. of times $= 19 \div 8.75$

$= 2.171$

Answer ......2...... [1]

15 **(a)** Express $x^2 + 6x + 2$ in the form $(x+a)^2 - b$.

$$= x^2 + 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 + 2$$

$$= (x+3)^2 - 9 + 2$$

$$= (x+3)^2 - 7$$

Answer $(x+3)^2 - 7$ [1]

(b) Hence solve $x^2 + 6x + 2 = 0$.

$$(x+3)^2 - 7 = 0$$

$$x+3 = \sqrt{7} \qquad (1m)$$

$$x = \sqrt{7} - 3 \qquad\qquad or \ x = -\sqrt{7} - 3$$

$$= -0.3542 \qquad\qquad\qquad = -5.646$$

$$= -0.354 \ (3sf) \qquad\qquad = -5.65 \ (3sf)$$
$$(1m) \qquad\qquad\qquad\qquad (1m)$$

Answer -0.354 or -5.65 [3]

---

16 p is inversely proportional to the square of x.
When $x = 3$, $p = 20$.

(a) Show that $P = \dfrac{180}{x^2}$.

Answer $\qquad p = \dfrac{k}{x^2} \qquad (1m) \qquad \therefore p = \dfrac{180}{x^2} \ (shown) \ (1m)$

When $x = 3$, $p = 20$

$$20 = \frac{k}{3^2}$$

$$k = 20 \times 9$$
$$= 180$$

[2]

(b) Find the values of x when $p = 7.2$.

$$7.2 = \frac{180}{x^2}$$

$$x^2 = \frac{180}{7.2} \qquad (1m)$$

$$x = \sqrt{\frac{180}{7.2}}$$

$$= \pm 5 \qquad (1m)$$

Answer ± 5 [2]

[Turn over

17 (a) Show that the point (1, 2) lies on the line $3y = 2x + 4$.

Answer

For pt $(1,2)$, when $x = 1$,

$3y = 2(1) + 4$
$= 6$
$y = 2$

∴ Pt $(1, 2)$ lies on the line [1]

(b) Find the coordinates of the y-intercept of the line $3y = 2x + 4$

For y Intercept, $x = 0$

∴ $3y = 2(0) + 4$
$y = \frac{4}{3}$

∴ y intercept is $(0, \frac{4}{3})$

Answer (....0...., ...$\frac{4}{3}$...) [1]

---

18 (a) The ratio of Peter's age to his father's age is 2 : 7.
Peter is 14 years old now. How old is his father?

Father's age $= \frac{7}{2} \times 14$
$= 49$ yrs

Answer ....49 yrs.... [1]

(b) The ratio of George's age to his mother's age is 3 : 8.
The total of their ages is 66 years.

(i) How old is George?

11 parts → 66
1 part → 6 yrs (1m)
∴ George's age $= 6 \times 3$
$= 18$ yrs (1m)

Answer ....18 yrs.... [2]

(ii) Find the ratio of George's mother's age to his age 3 years from now.

3 yrs from now, George age $= 18 + 3$
$= 21$ yrs (1m)

mother's age $= 8(6) + 3$
$= 51$ yrs (1m)

Answer ....51 yrs.... [2]

19 (a) In a regular polygon, the interior angle is $120°$.
Calculate the number of sides of the polygon.

$$1 \text{ interior } \angle = \frac{(n-2)180}{n} = 120 \quad (1m)$$

$$180n - 360 = 120n$$

$$60n = 360$$

$$n = 6 \quad (1m)$$

Answer ....6............... [2]

(b) Explain why the exterior angle of a regular polygon cannot be $23°$.

Answer

If exterior $\angle = 23°$

No of sides $= \frac{360}{23}$

$= 15.65 \quad (1m)$

Exterior $\angle$ cannot be $23°$ because the number of sides
is not a whole number. $(1m)$ [2]

20 Detergent powder is being sold in packet of 2 different sizes.
The small packet costs $8.70 and weighs 600 g.
The larger packet costs $19.50 and weighs 1.5 kg.

(a) Which packet gives a better value? Show your working clearly.

Small packet : 600g → $8.70
                1g → $0.0145 $(1m)$

Larger packet : 1500g → $19.50
                1g → $0.013 $(1m)$
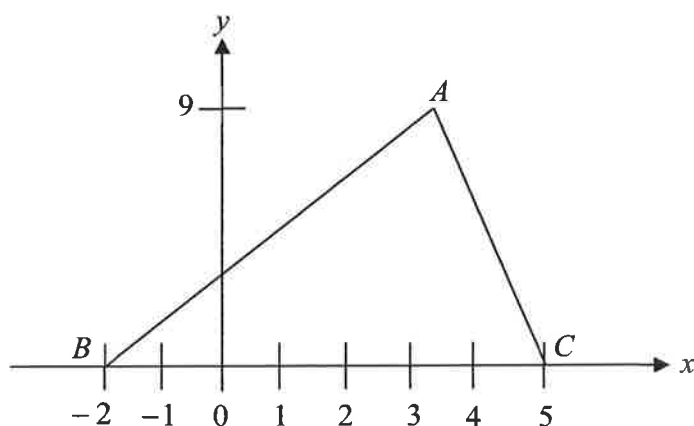
Larger packet gives a better value $(1m)$

Answer ....Larger packet..... [3]

(b) The manufacturer decides to change the price of the small packet so that both packets
cost the same unit price. Find the new price of the small packet.

New price of small packet = 600 × $0.013

$= 7.80

Answer $ ......7.80...... [1]

21 The diagram below shows the points $A(3, 9)$, $B(-2, 0)$ and $C(5, 0)$.

Find

(a) the gradient of AC,

$$m_{AC} = \frac{9 - 0}{3 - 5}$$

$$= \frac{9}{-2}$$

$$or\ -4\frac{1}{2}$$

Answer .... $-\frac{9}{2}$ or $-4\frac{1}{2}$ .... [1]

(b) the equation of AC,

Consider $A(3, 9)$

$$9 = -\frac{9}{2}(3) + c \qquad (1m)$$

$$c = 9 + \frac{27}{2}$$

$$= \frac{45}{2}$$

∴ Equation of AC $y = -\frac{9}{2}x + \frac{45}{2}$ $(1m)$

Answer .... $y = -\frac{9}{2}x + \frac{45}{2}$ .... [2]

(c) the equation of the line parallel to BC which passes through A.

Answer .... $y = 9$ .... [1]

22   The following dot diagram shows the quiz scores of some students.

Quiz scores
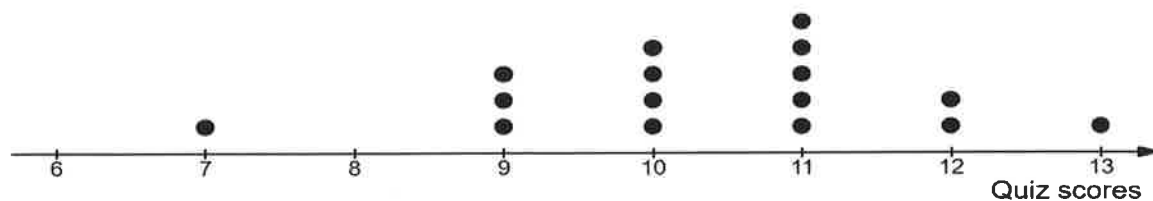
(a)   Find the total number of students who took the quiz.

Total = 1 + 3 + 4 + 5 + 2 + 1

= 16

Answer ....16..................... [1]

(b)   State the modal score.

Answer ....11................... [1]

(c)   Explain why finding the mean of the above data may not be a good representation of how the students scored in the quiz

Answer   Most of the scores are centred around 9 to 12 marks. (1m)

The outlier of 7 marks will affect the mean. (1m)

or other acceptable answer

[2]

[Turn over

23   A spinner in the form of a regular hexagon is constructed as shown below.
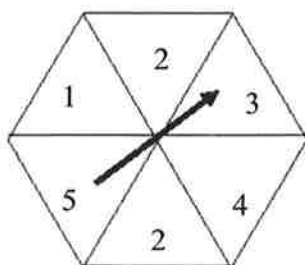
When the pointer is spun, find the probability that the pointer will stop at

(a)   5,

Answer   .... $\frac{1}{6}$ .... [1]

(b)   6,

Answer   .... 0 .... [1]

(c)   either 1 or 2,

$$P(1 \text{ or } 2) = \frac{3}{6}$$
$$= \frac{1}{2}$$

Answer   .... $\frac{1}{2}$ .... [1]

(d)   a prime number.

Prime numbers = $\{2, 3, 5\}$

$$P(\text{prime}) = \frac{4}{6}$$
$$= \frac{2}{3}$$

Answer   .... $\frac{2}{3}$ .... [1]

End of Paper