	Register No.	Class
Name :		

BENDEMEER SECONDARY SCHOOL
2021 END-OF-YEAR EXAMINATION
SECONDARY 2 EXPRESS
Mathematics Paper 1

DATE : **8 Oct 2021**
DURATION : **1 hour 15 minutes**
TOTAL : **50 marks**

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a 2B pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Answer **all** questions.
Write your answers in the spaces provided on the question paper.
All the diagrams in this paper are **not** drawn to scale.
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.

FOR EXAMINER'S USE
50

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[Turn over

MATHEMATICAL FORMULAE

Compound Interest

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

Mensuration

Curved surface area of 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 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 (a) Calculate $\sqrt[3]{3.98 + \frac{2}{5}} - 0.2^2$ and write down the first 5 digits on your calculator display.

Answer   (a) ___1·5961___ [1]

(b) Write your answer to (a) correct to
(i)   3 decimal places,
(ii) 3 significant figures.

Answer   (b)(i) ___1·596___ [1]

(b)(ii) ___1·60___ [1]

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2 A map is drawn to a scale of 1 cm to 500 m.

(a) Express the scale of the map in the form 1 : n, where n is an integer.

1 cm : 500 m
1 cm : 50 000 cm
1 : 50 000

Answer   (a) ___1 : 50 000___ [1]

(b) If the actual distance between two towns is 3.5 km, find the corresponding distance on the map.

1 cm : 0·5 km
7 cm : 3·5 km

Answer   (b) ___7___ cm [1]

(c) The actual area of a lake is 3.5 km^2. Calculate the area on the map which represents the lake, giving your answer in square centimetres.

1 cm : 0·5 km
1 cm² : 0·25 km²
14 cm² : 3·5 km²

Answer   (c) ___14___ cm² [2]

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3 (a) Expand and simplify
$5 - 3(2x - 1)$

$= 5 - 6x + 3$

$= 8 - 6x$

Answer   (a) ___8 - 6x___ [1]

(b) Factorise completely
$3p^2 + 4pq - 9pr - 12qr$

$= p(3p + 4q) - 3r(3p + 4q)$

$= (3p + 4q)(p - 3r)$

Answer   (b) ___(3p + 4q)(p - 3r)___ [2]

(c) Simplify the expression
$\dfrac{75x^3 y^2}{4x} \div \dfrac{9y^3}{16x^2}$

$= \dfrac{75x^3 y^2}{4x} \times \dfrac{16x^2}{9y^3}$

$= \dfrac{100x^4}{3y}$

Answer   (c) ___$\dfrac{100x^4}{3y}$___ [2]

4   5 workers take 35 days to build a boat. Assuming the men work at the same rate, calculate the number of workers needed to build a boat in 25 days.

$$35 \text{ days} \longrightarrow 5 \text{ workers}$$

$$1 \text{ day} \longrightarrow 35 \times 5 = 175 \text{ workers}$$

$$25 \text{ days} \longrightarrow 175 \div 25 = 7 \text{ workers}$$

Answer _____7_____ workers [2]

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5   Express as a single fraction
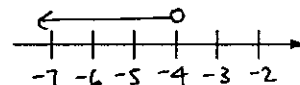$$\frac{3x+2}{(3x-1)(2x+1)} - \frac{2}{3x-1}$$

$$= \frac{3x+2}{(3x-1)(2x+1)} - \frac{2(2x+1)}{(3x-1)(2x+1)}$$

$$= \frac{3x+2-2(2x+1)}{(3x-1)(2x+1)}$$

$$= \frac{3x+2-4x-2}{(3x-1)(2x+1)}$$

$$= -\frac{x}{(3x-1)(2x+1)}$$

Answer $-\dfrac{x}{(3x-1)(2x+1)}$ [3]

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6   Solve each of the following inequalities, representing the solution on a number line.
(a) $3x + 5 < x - 3$

$$3x + 5 < x - 3$$
$$3x - x < -3 - 5$$
$$2x < -8$$
$$x < -4$$

Answer   (a)   _____$x < -4$_____ [3]

(b)   (i)   Solve the inequality $\dfrac{2x-1}{5} \leq \dfrac{5x-9}{2}$
       (ii)   Write down the least possible integer value for x.

(i)
$$\frac{2x-1}{5} \leq \frac{5x-9}{2}$$

$$\frac{2(2x-1)}{10} \leq \frac{5(5x-9)}{10}$$

$$2(2x-1) \leq 5(5x-9)$$

$$4x-2 \leq 25x-45$$

$$45-2 \leq 25x-4x$$

$$43 \leq 21x$$

$$x \geq \frac{43}{21}$$

$$x \geq 2\frac{1}{21}$$

Answer   (b)(i)   _____$x \geq 2\frac{1}{21}$_____ [3]
           (b)(ii)   _____$x = 3$_____ [1]

7   Solve the following equations.
  (a) $3x - 2 = 7$

$$3x = 9$$
$$x = 3$$

Answer   (a) $x = \underline{\quad 3 \quad}$ [1]

  (b) $2x^2 + 7x - 4 = 0$

$$2x^2 + 7x - 4 = 0$$
$$(2x - 1)(x + 4) = 0$$
$$2x - 1 = 0 \quad \text{or} \quad x + 4 = 0$$
$$2x = 1 \qquad\qquad x = -4$$
$$x = \tfrac{1}{2}$$

Answer   (b) $x = \underline{\tfrac{1}{2} \text{ or } x = -4}$ [2]

  (c) $\tfrac{1}{4}x^2 = 9$

$$x^2 = 36$$
$$x = \pm\sqrt{36}$$
$$x = \pm 6$$

Answer   (c) $x = \underline{6 \text{ or } x = -6}$ [2]

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8   Given that $x^2 + y^2 = 170$ and $xy = 77$, find the value of $x - y$, given that $x > y$.

$$(x - y)^2 = x^2 - 2xy + y^2$$
$$= 170 - 2(77)$$
$$= 16$$
$$x - y = \pm\sqrt{16}$$
$$= 4 \text{ or } -4 \ (\text{rej. since } x > y)$$

Answer $x - y = \underline{\quad 4 \quad}$ [2]

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9   (a)   The total surface area of a cone is $24\pi \text{ cm}^2$. Given that the radius of the base of the cone is $3\,cm$, find the volume of the cone.

$$\pi(3^2) + \pi(3)(l) = 24\pi$$
$$9\pi + 3\pi l = 24\pi$$
$$3\pi l = 15\pi$$
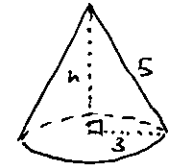$$l = \frac{15\pi}{3\pi}$$
$$= 5$$

Using Pythagoras' Theorem,
$$h^2 + 3^2 = 5^2$$
$$h^2 = 5^2 - 3^2$$
$$h = \sqrt{5^2 - 3^2}$$
$$= 4$$

Vol of cone
$$= \tfrac{1}{3}\pi(3^2)(4)$$
$$= 12\pi$$
$$= 37.7 \text{ cm}^3 \ (3 \text{ s.f.})$$

Answer   (a) $\underline{37.7}$ cm³   [4]

  (b)   In the diagram, $\triangle ABE$ is similar to $\triangle ACD$, $AB = 4\ cm$, $BE = 3\ cm$, $CD = 24\ cm$ and $\angle ABE = 90°$
  (i)   Find the length of BC.
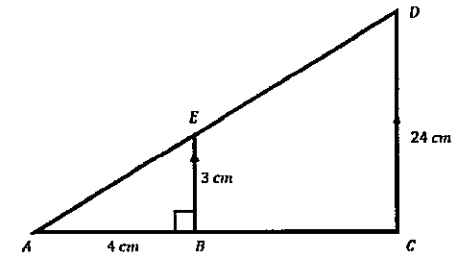
$$\frac{AC}{4} = \frac{24}{3}$$
$$AC = \frac{24}{3} \times 4$$
$$= 32$$
$$BC = 32 - 4$$
$$= 28$$

Answer   (b)(i) $\underline{28}$ cm   [2]

  (ii)   Find the angle EAB.

$$\tan \angle EAB = \frac{3}{4}$$
$$\angle EAB = \tan^{-1}\frac{3}{4}$$
$$= 36.9° \ (1 \text{ dp})$$

Answer   (b)(ii) $\underline{36.9}$ °   [1]

10 (a) Given that $s = ut + \frac{1}{2}at^2$, express a in terms of u, s and t.

$$s = ut + \tfrac{1}{2}at^2$$
$$s - ut = \tfrac{1}{2}at^2$$
$$2(s-ut) = at^2$$
$$a = \frac{2(s-ut)}{t^2}$$

Answer (a) $a = \dfrac{2(s-ut)}{t^2}$ [2]

(b) Hence, find the value of a when $s = 5$, $t = 8$ and $u = -15$.

$$a = \frac{2(5-(-15)(8))}{8^2}$$
$$= \frac{2(5+120)}{64}$$
$$= \frac{250}{64}$$
$$= 3\frac{29}{32} \text{ or } 3.90625$$

Answer (b) $a = 3\frac{29}{32}$ [2]

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11 Solve the simultaneous equations.
$$2x + 3y = -9 \quad\text{——— (1)}$$
$$3x - y = 14 \quad\text{——— (2)}$$

$(2) \times 3$

$9x - 3y = 42$ ——— (3)

$(1) + (3)$

$2x + 3y + 9x - 3y = -9 + 42$

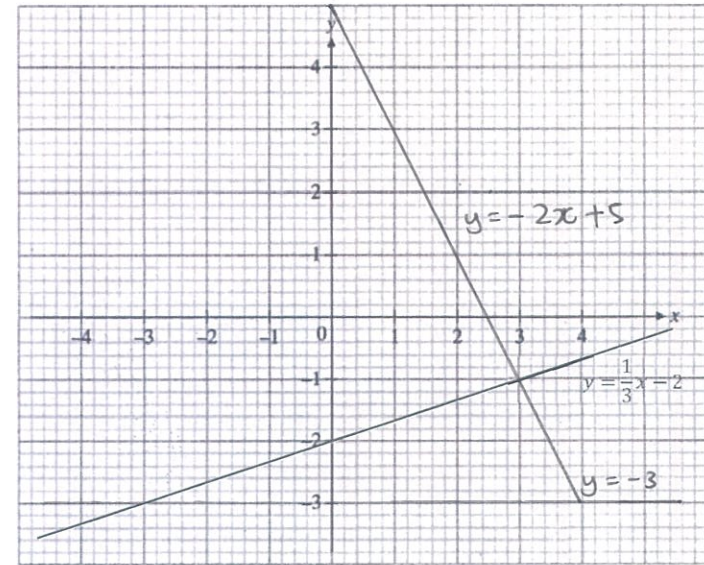$11x = 33$

$x = 3$

sub $x = 3$ into (2)

$3(3) - y = 14$

$9 - y = 14$

$y = 9 - 14$

$= -5$

Answer $\quad x = 3$

$\qquad\qquad y = -5$ [3]

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12 The graph of $y = \frac{1}{3}x - 2$ is drawn on the grid below.

(a) (i) On the grid above, draw and label the graph of $y = -3$.

(ii) Write down the coordinates of the point of intersection between the 2 lines $y = \frac{1}{3}x - 2$ and $y = -3$.

Answer (a)(i) Shown on grid [1]

(ii) $(-3, -3)$ [1]

(b) (i) On the grid above, draw and label the graph of $y = -2x + 5$.

(ii) **Hence**, write down the solutions of these simultaneous equations
$$y = \frac{1}{3}x - 2$$
$$y = -2x + 5.$$

Answer (b)(i) Shown on grid. [1]

(ii) $x = 3$
$y = -1$ [2]

~ End of Paper ~

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