2E

Session 1

END-OF-YEAR EXAMINATIONS 2021

MATHEMATICS 4052

PAPER 1

Level	: Secondary Two	**Date**	: 1 October 2021
Stream	: Express	**Duration**	: 1 hour 30 minutes
Name	: _____ ( )	**Marks**	:
Class	: Secondary 2 _____		/60

READ THESE INSTRUCTIONS FIRST:

Write your name, class and register number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use 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 60.

Set by: Ms Madeleine Chew

This question paper consists of 15 printed pages, including the cover page.
[Turn over

Mathematical Formulae

Compound Interest

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

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

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

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

1   Write the following numbers in order of size, starting with the smallest.

$$\frac{1}{15} \ , \ 0.06\ddot{1} \ , \ \sqrt{0.078} \ , \ 0.279$$

Answer $\underline{0.06\ddot{1}}$, $\underline{\frac{1}{15}}$, $\underline{0.279}$, $\underline{\sqrt{0.078}}$ [2]

2   (a)   Calculate

$$\frac{-2^2 - (-1)^2}{2.75 - 6.84} \ .$$

Write down the first five digits on your calculator display.

Answer $\underline{1.2224}$ [1]

(b)   Write down your answer to part (a) correct to 2 significant figures.

Answer $\underline{1.2}$ [1]

3   (a)   State the gradient and y-intercept of the line $y = -3x + 5$.

Answer gradient = $\underline{-3}$

y-intercept = $\underline{5}$ [2]

(b)   State the gradient of the line $y = 5$.

Answer gradient = $\underline{0}$ [1]

4   A survey was conducted on a group of visitors to the Gardens by the Bay.
They were asked how they travelled to the Gardens by the Bay.
The information they gave is represented in the pie chart below.
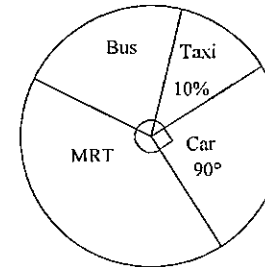
It is given that 375 visitors travelled by car.

(a)   Calculate the total number of visitors who took part in the survey.

$$\frac{375}{90} \times 360 = 1500$$
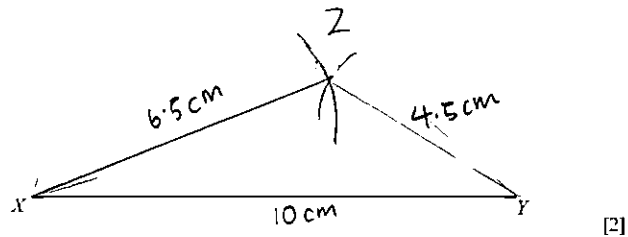
Answer $\underline{1500}$ visitors   [1]

(b)   675 visitors travelled by MRT. Calculate the angle representing the number of visitors who travelled by MRT in the pie chart.

$$\frac{90}{375} \times 675 = 162$$

Answer $\underline{162°}$ [1]

5. In triangle XYZ, $XY = 10$ cm, $YZ = 4.5$ cm and $XZ = 6.5$ cm.
The side XY is drawn in the answer space.
Using ruler and compasses only, draw the triangle XYZ.

Answer

[2]

6. (a) When written as the product of their prime factors,

$$X = 3 \times 5 \times 7$$
$$Y = 2 \times 3 \times 5^4$$
$$Z = 2^5 \times 3^3 \times 5$$

(i) Find, giving your answer as the product of its prime factors, the lowest common multiple (LCM) and highest common factor (HCF) of X and Y.

Answer LCM = $2 \times 3^2 \times 5^4 \times 7$ .... [1]

HCF = 3×5 .... [1]

(ii) Find the smallest possible integer value of K such that the product KZ is a perfect cube.

$Z = 2^5 \times 3^3 \times 5$ $\therefore K = 2 \times 5^2$
$K = 2 \times 5^2$ $= 50$
$ZK = 2^6 \times 3^3 \times 5^3$ *Answer* $K =$ ...... 50 .... [1]

(b) Amir wants to pack 80 boxes of axe oil, 360 packets of coffee and 480 packets of biscuits into gift packs for elderly.

It is given that each gift pack has the same number of axe oil, coffee and biscuits and there are no leftover items.

How many packets of biscuits does each gift pack has?

$80 = 2^4 \times 5$

$360 = 2^3 \times 3^2 \times 5$

$480 = 2^5 \times 3 \times 5$

$HCF = 2^3 \times 5 = 40$

$\dfrac{480}{40} = 12 \text{ packets}$

Answer ...... 12 ...... packets [2]

7   In the Olympics triathlon event, participants are required to complete a 1.5 km swim followed by a 40 km bicycle ride and a 10 km run.

In the 2021 Olympics, gold medalist Flora Duffy took 1 hour 55 minutes to complete the triathlon.

(a)   Flora Duffy completed the 1.5 km swim segment in 18 minutes.
Calculate the speed of her swim in metres per seconds.
Give your answer correct to 1 decimal place.

$$\text{Speed} = \frac{1.5 \times 1000}{18 \times 60}$$

$$= 1.4 \text{ m/s} \quad (1 \text{ d.p.})$$

Answer ....1.4.......... m/s   [2]

(b)   Calculate Flora Duffy's average speed for the triathlon in kilometers per hour.
Give your answer to 1 decimal place.

$$\frac{1.5 + 40 + 10}{1 + \left(\frac{55}{60}\right)} = 26.9 \ (1 \text{ d.p.})$$

Answer ....26.9.......... km/h   [2]

8   Kelly bought a smart phone at a retail price of $800.
This retail price included a tax of 7%.

(a)   Calculate the amount of tax that Kelly paid.
Give your answer to the nearest cent.

$$\text{Amt of tax} = \frac{800}{107} \times 7$$

$$= \$52.34 \ (\text{nearest cent})$$

Answer $..........52.34.......... [2]

(b)   A year after purchasing the smart phone at the retail price, Kelly sold the smart phone at a profit of 15%.
Calculate the selling price of the smart phone.

$$\frac{800}{100} \times 115 = \$920$$

Answer $..........920.......... [2]

9   The scale of a map at a park is 1 : 17 500.

(a)   The actual distance between two rest points is 4025 m.
Calculate the distance, in centimetres, between the two rest points on the map.

$$\text{Dist. on map} = \frac{4025}{175}$$

$$= 23 \text{ cm}$$

Answer .... 23 .... cm   [2]

(b)   A lake is represented by an area of 640 cm² on the map.
Calculate the actual area of the lake in square kilometres.

$$\text{Actual area} = 0.175^2 \times 640$$

$$= 19.6 \text{ km}^2$$

Answer .... 19.6 .... km²   [2]

10   A spherical solid has a volume of 220π cm³.

(a)   Calculate the radius of the solid.

$$\frac{4}{3} \times \pi \times r^3 = 220\pi$$

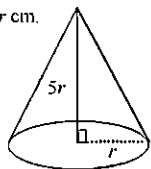$$r = 5.48 \text{ cm} \ (3 \text{ s.f.})$$

Answer .... 5.48 .... cm   [2]

(b)   The spherical solid is melted and recasted into a prism of height 12 cm.
Calculate the base area of the prism.

$$\text{Base area} \times 12 = 220\pi$$

$$\text{Base area} = \frac{220\pi}{12}$$

$$= 57.6 \text{ cm}^2 \ (3 \text{ s.f.})$$

Answer .... 57.6 .... cm²   [2]
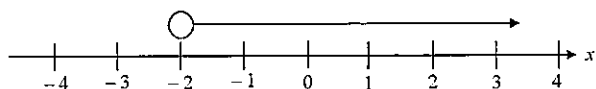
11 A circular cone has a base radius of r cm and a height of $5r$ cm.

Find and simplify, an expression in terms of r and π, for the volume of the cone.

$$\text{Vol. of cone} = \frac{1}{3}\pi r^2 (5r)$$
$$= \frac{5}{3}\pi r^3 \text{ cm}^3$$

Answer ....$\dfrac{5}{3}\pi r^3$.......... cm³ [2]

12 (a) State the inequality that is represented by the number line below.

Answer ....$x > -2$.......... [1]

(b) Solve the inequality $3x + 4(5 - 2x) \leq 55$.

$$3x + 4(5 - 2x) \leq 55$$
$$3x + 20 - 8x \leq 55$$
$$-5x \leq 35$$
$$x \geq -7$$

Answer ....$x \geq -7$.......... [3]

13 (a) Factorise $49p^2 - 121$.

$$49p^2 - 121 = (7p)^2 - 11^2$$
$$= (7p + 11)(7p - 11)$$

Answer ....$(7p+11)(7p-11)$.......... [1]

(b) Factorise completely $6x^2 - 14x - 12$.

$$6x^2 - 14x - 12 = 2(3x^2 - 7x - 6)$$
$$= 2(3x + 2)(x - 3)$$

Answer ....$2(3x+2)(x-3)$.......... [2]

(c) Factorise completely $2b - 6 + ab - 3a$.

$$2b - 6 + ab - 3a = 2(b - 3) + a(b - 3)$$
$$= (b - 3)(2 + a)$$

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

14 The OCBC Skyway is an attraction at Gardens by the Bay.
1 adult ticket costs $x and 1 child ticket costs $y.

(a) It is given that

4 adults and 6 children have to pay $62,
9 adults and 3 children have to pay $87.

Write down two simultaneous equations, in terms of x and y, to represent this information.

Answer $4x + 6y = 62$

$9x + 3y = 87$ [2]

(b) By solving the simultaneous equations in (a), find the total cost of visiting the OCBC Skyway for a family consisting of 3 adults and 5 children.

$4x + 6y = 62$ ——(1)

$9x + 3y = 87$ —— (2)

(1) ÷ 2

$2x + 3y = 31$ ——(3)

(2) − (3)

$(9x + 3y) - (2x + 3y) = 87 - 31$

$\vdots$

$x = 8$

Sub $x = 8$ into (1.)

$4(8) + 6y = 62$

$\vdots$

$y = 5$

Cost of 2A and 5C

$= 3(8) + 5(5)$

$= \$49$

Answer $ 49 [4]

15 In the figure, the curve $y = (2x - 1)(x + 1)$ cuts the x-axis at the points, P and Q.
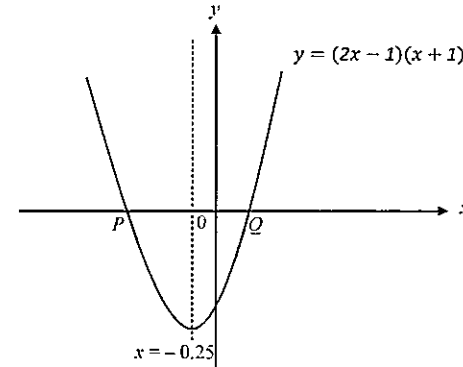
$y = (2x - 1)(x + 1)$

$x = -0.25$

(a) Find the coordinates of P and Q.

$(2x - 1)(x + 1) = 0$

$x = 0.5$ or $x = -1$

Answer P (-1 , 0)

Q (0.5 , 0) [2]

(b) The equation of the line of symmetry is $x = -0.25$.
Find the coordinates of the minimum point.

Sub $x = -0.25$

$y = [2(-0.25 - 1)](-0.25 + 1)$

$= -1.125$

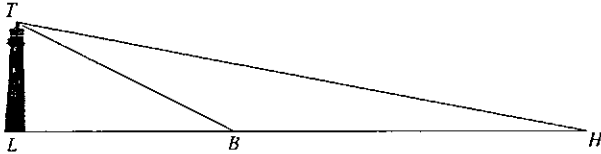Answer (-0.25 , -1.125) [2]

(c) Explain whether the point A (2, 8) lie on the curve.

Answer When $x = 2$, $y = [2(2) - 1](2 + 1) = 9 \neq 8$

$\therefore$ (2, 8) does not lie on the curve.

[2]

16 In the diagram, *TL* is a 85 m lighthouse standing vertically at sea level.
A boat at point *B* is 132 m away from the base of the lighthouse.
It is also given that the distance between the top of the lighthouse and the boat,
TB is 157 m.

(a) Explain why angle *TLB* is a right angle.

Answer $TL^2 + LB^2 = 85^2 + 132^2 = 24649$,

and $TB^2 = 157^2 = 24649$. Since $TL^2 + LB^2 = TB^2$,

by the converse of the Pythagoras'

Theorem, triangle TLB is a right-angled

triangle where angle TLB is the right

angle.   [2]

(b) A ship is at a point *H* such that angle *THL* = 14°.
Calculate the distance between the boat and the ship.

$$\tan 14° = \frac{85}{HL}$$

$$HL = \frac{85}{\tan 14°}$$

$$= 340.9163794$$

Dist. between boat and ship

$= BH$

$= HL - 132$

$= \frac{85}{\tan 14°} - 132$

$= 209 m \; (3 \; s.f.)$

Answer .... 209 m .... m [3]

End of paper