CHIJ ST. THERESA'S CONVENT
PRELIMINARY EXAMINATION 2022
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS 4048/2

Paper 2

23 August 2022

2 hours 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use 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.
Calculators should be used 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 answers 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 is 100.

This document consists of **25** printed pages.

Mathematical Formulae

Compound interest

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

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

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 **(a)** Simplify $\left(\dfrac{32a^{10}}{b^{15}}\right)^{-\frac{2}{5}}$.

Answer …… [2]

(b) Express $\dfrac{y}{(3y-5)^2}+\dfrac{2}{5-3y}$ as a single fraction in its simplest form.

Answer …… [2]

(c) Simplify $\dfrac{3x^2-108}{2x^2+5x-42}$.

Answer …… [3]

(d) Solve the inequality $\frac{3x-2}{4} \leq \frac{4+5x}{3}$.

Answer …… [2]

(e) Solve the simultaneous equations.

$$4x - 3y = 5$$
$$6x + 5y = -2$$

Answer x = ……

y = …… [3]

2 A bag contains 10 red balls and 8 green balls.
Anna takes two balls from the bag, at random, without replacement.

(a) Anna says that the probability that she takes one red ball and one green ball is $\frac{40}{81}$.
Explain why Anna is wrong and provide the correct solution.

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.....

.....

.....[2]

(b) Anna puts back the two balls into the bag.
n red balls are removed from the bag.
The probability that she takes two green balls is $\frac{4}{13}$.

Write down an equation to represent this information and show that it simplifies to

$$n^2 - 35n + 124 = 0.$$ [3]

Answer

(c) Solve the equation $n^2 - 35n + 124 = 0$.

Answer n = …..…… or …..…… [3]

(d) Explain why one of the solutions in part (c) must be rejected.

……

…… [1]

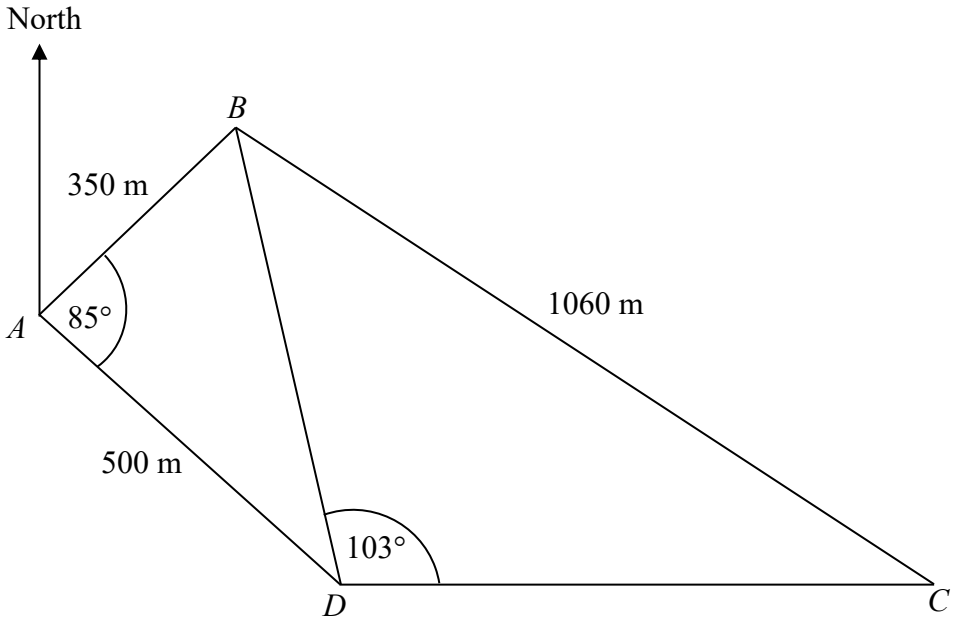
3 A, B, C and D are four points on horizontal ground.

The points are connected by straight paths AB, BC, BD, AD and DC.

C is due east of D.

$AB = 350$ m, $AD = 500$ m and $BC = 1060$ m.

Angle $BAD = 85°$ and angle $BDC = 103°$.



(a) Show that $BD = 585$ m, correct to 3 significant figures. [3]

Answer

(b) Calculate the bearing of B from C.

Answer …… ° [3]

(c) John is a Grab delivery partner. He cycles at an average speed of 12 km/h.
He starts at point C, cycles along path CB to collect food at point B then path BA to collect food at point A, and delivers the food collected to point D.
He spends 5 minutes to collect the food at each collection point.

Calculate the time it takes him to complete the food delivery.
Give your answer in minutes and seconds.

Answer …… minutes …… seconds [3]

4 $ABCD$ is a trapezium with AB parallel to CD.

A is the point $(-1, 3)$ and B is the point $(7, 9)$.

$\overrightarrow{AD} = \begin{pmatrix} 1 \\ -7 \end{pmatrix}$.

(a) Find the length of the line AB.

Answer ..... [2]

(b) Find the equation of the line CD.

Answer ..... [4]

(c) X is the point on AB such that $\dfrac{\text{area of triangle } AXD}{\text{area of traingle } BXD} = \dfrac{1}{3}$.

(i) Find $\overrightarrow{AX}$.

Answer $\overrightarrow{AX} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(ii) Find the position vector of X.

Answer $\overrightarrow{OX} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

5 The variables x and y are connected by the equation $y = 3x + \frac{8}{x} - 11$.

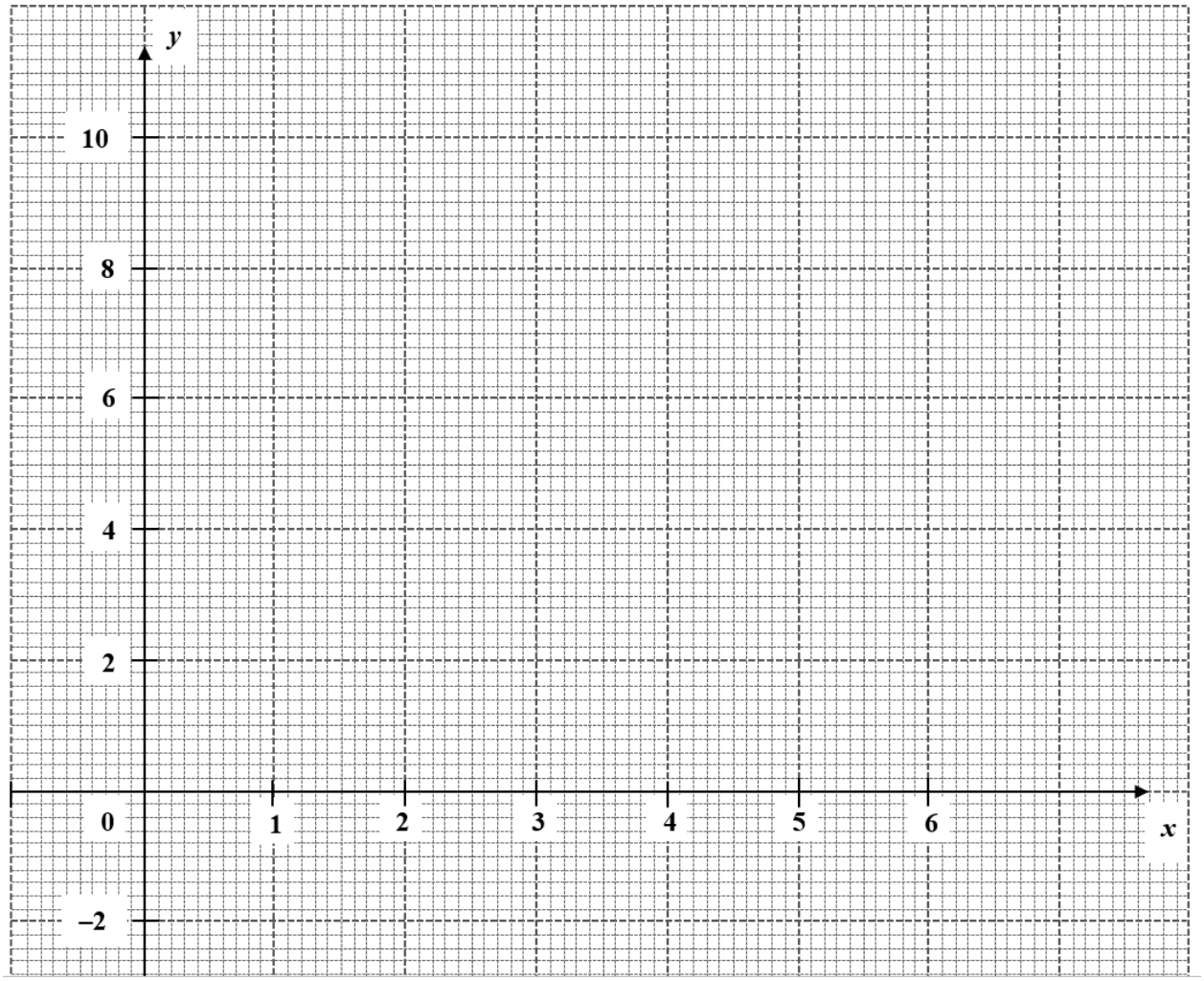
Some corresponding values of x and y, correct to 1 decimal place, are given in the table below.

x	0.5	1	1.5	2	2.5	3	4	5	6
y	6.5	0	−1.2	−1	−0.3	0.7	3	5.6	p

(a) Calculate the value of p.

Answer p = ……..…… [1]

(b) On the grid, draw the graph of $y = 3x + \frac{8}{x} - 11$ for $0.5 \le x \le 6$. [3]



(c) Use your graph to find the solutions to the equation $3x + \frac{8}{x} = 13$ in the range $0.5 \le x \le 6$.

Answer x =……..…… [2]

(d) **(i)** On the same axes, draw the graph of $2y - 1 = x$ for $0 \le x \le 6$. [2]

(ii) Write down the x-coordinates of the points where this line intersects the curve.

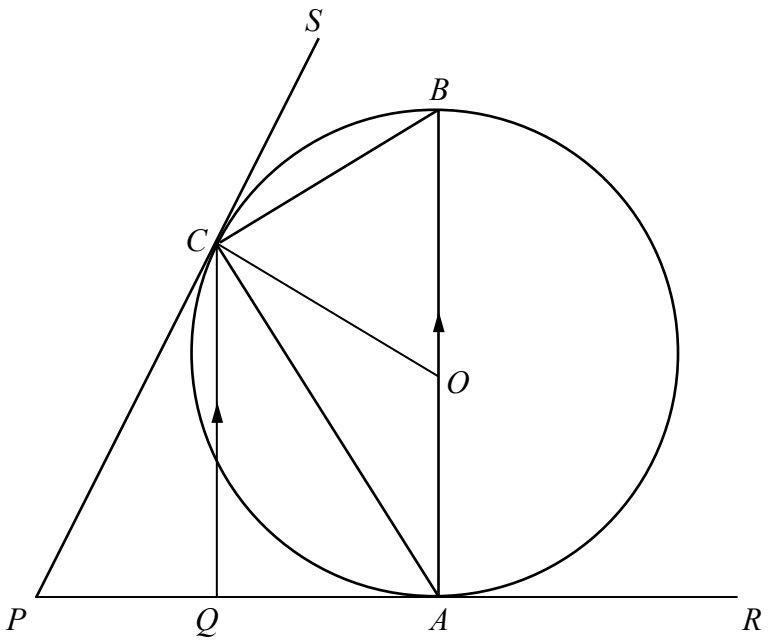
Answer x = …..…… or …..…… [2]

(iii) These values of x give the solutions of the equation $5x^2 + Ax + B = 0$.
Find the value of A and the value of B.

Answer A = ……

B = …… [3]

6 **(a)**



A, B and C are points on the circle with centre O.
AOB is a straight line.
PCS and PAR are tangents to the circle.
Q is on PAR and QC is parallel to AB.

(i) Show that triangle AQC is similar to triangle BCA.
Give a reason for each statement you make.

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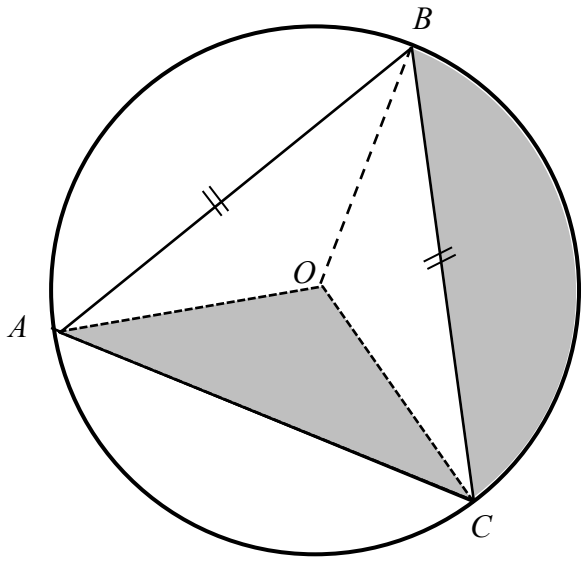
.....[2]

(ii) Angle $COB = x°$.
Find angle APC in terms of x.

Answer ..... ° [2]

6 **(b)**



A, B and C are points on a circle with centre O and radius 10 cm.
$BA = BC$ and angle AOC is 2.4 radians.

(i) Calculate angle COB, in radians, in terms of π.

Answer ……..…… radians [1]

(ii) Calculate the length of major arc AC.

Answer …… cm [2]

(iii) Calculate the total area of the shaded regions.

Answer …… cm^2 [3]

7 In Café X, an Americano (A) costs \$5.20, a Latte (L) costs \$6.60 and a Mocha (M) costs \$7.30. In Café Y, an Americano costs \$0.30 more, a Latte costs \$0.20 less and a Mocha costs \$0.10 more than Café X.

The matrix **P** shows the price of a cup of coffee in each café.

$$\mathbf{P} = \begin{array}{c} \begin{array}{ccc} \text{A} & \text{L} & \text{M} \end{array} \\ \begin{pmatrix} 5.2 & 6.6 & 7.3 \\ 5.5 & 6.4 & 7.4 \end{pmatrix} \end{array} \begin{array}{c} \\ \text{X} \\ \text{Y} \end{array}$$

(a) Belinda and Carol are project group leaders in a company.
They want to give a treat to their group members to welcome them for the first meeting in February.

Belinda intends to buy 2 cups of Americano, 4 cups of Latte and 3 cups of Mocha.
Carol intends to buy 5 cups of Latte and 4 cups of Mocha.

Represent their intended purchases using a 3×2 matrix **Q**.

Answer **Q** = [1]

(b) Evaluate the matrix $\mathbf{R} = \mathbf{PQ}$.

Answer **R** = [2]

(c) State what each element of matrix **R** represents.

……

……[1]

(d) Belinda and Carol each bought their drinks from the café that provided a better offer.

For the latest meeting in July, Belinda and Carol gave their members another treat to celebrate the completion of the project. Each of them bought the same set of drinks from the same café they patronised in February. However, the prices of the drinks have changed by the following percentages in both cafés.

The price of a cup of Americano has increased by 10%.
The price of a cup of Latte has increased by 15%.
The price of a cup of Mocha has decreased by 5%.

Calculate the percentage change in the combined total spent in February and July.

Answer …… % [3]

8 A class of 40 Secondary Four students were asked how much time they have spent on social media in the last week.
The results are shown in the table.

Time spent (x hours)	$0 < x \leq 10$	$10 < x \leq 20$	$20 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 50$
Frequency	p	11	10	q	3

The upper quartile of the time spent on social media was 30 hours.

(a) Show that $p = 9$ and hence state the value of q.

Answer

Answer $q =$ …… [3]

(b) Estimate the mean number of hours spent by the students.

Answer …… [2]

(c) Estimate the standard deviation.

Answer …… [1]

(d) A class of 40 Secondary Three students were asked how much time they have spent on social media in the last week.

The results are summarised in the table.

Mean	15.8
Standard Deviation	10.5

Make two comparisons between the number of hours spent on social media by the Secondary Three students and by the Secondary Four students.

1 ……

……

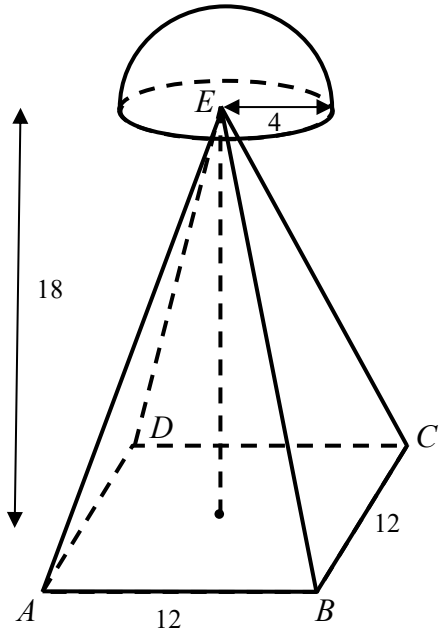
……

2 ……

……

……[2]

9 The diagram shows a metal trophy which is made up of a hemisphere and a pyramid.
The radius of the hemisphere with centre E is 4 cm.
The base $ABCD$ of the pyramid is a square of side 12 cm.
E is vertically above the centre of the square base.
The vertical height of the pyramid is 18 cm.



(a) Show that AE = 19.9 cm, correct to three significant figures. [3]

Answer

(b) Calculate angle BAE.

Answer …… ° [3]

(c) Calculate the total surface area of the trophy.

Answer …… cm^2 [4]

(d) The whole trophy is melted to make paper weights, each in the shape of a cube of side 5 cm.
What is the maximum number of paper weights that can be made from the metal trophy?

Answer …… [3]

10 Mr Tan plans to bring his wife and two children for a free-and-easy 5-day holiday in Jeju, South Korea during the school holidays in September 2022.

The tables below give information that they can use to work out their travelling costs.

Cost of Pre-departure PCR/ART Test (per person) in Singapore

Clinic	SGST	NM	Swabstation
PCR Test	$88	$98	$78
ART Test	$28	$25	$28

Cost of PCR Test (per person) in South Korea

70,000 won through the Korean National Tuberculosis Association (KNTA).

Estimated expenditure in South Korea

Hotel (Family Suite)	$ 2903
Food, Shopping & Sight-seeing	$ 400 per day
Car rental for 5 days	$ 464

Cost of return air tickets from SINGAPORE to JEJU for 2 adults and 2 children

Airlines	Scoot	Jeju Air
Adult / Child	$467.13 per person	$697.49 per person

Summary of Travel Insurance Plans (Family plan for 2 adults and 2 children)

Travel Insurance Company	**Singlife by Aviva***			**FWD#**		
Coverage/Type of Plan	Travel Lite: S$110.66	Travel Plus: S$159.65	Travel Prestige: S$222.63	Premium: $59.54	Business: S$93.89	First: S$119.08
Overseas medical expenses (per adult below 70 years old)	S$250,000	S$2,000,000	Unlimited	S$200,000	S$500,000	S$1,000,000
Travel delay (S$100 for every six hours of delay overseas and S$100 after six hours of delay in Singapore)	S$500	S$1000	S$2000	S$300	S$500	S$1000
Trip cancelled before you leave Singapore for Family Plans	S$10,000	S$20,000	S$30,000	S$7,500	S$10,000	S$15,000
Emergency Medical Cover And Repatriation Due To COVID-19 (**Free extension**) (1) Overseas Medical Expenses due to COVID-19	S$50,000	S$100,000	S$200,000	# **Extra Coverage for COVID-19 with an additional cost of $93.28** • Up to S$5,000 for trip cancellation and loss of deposit • Trip disruption: Up to S$5,000 • Overseas hospital cash: S$100 per day up to 14 days • Overseas quarantine allowance: S$50 per day up to 14 days • Emergency medical evacuation & repatriation: up to S$200,000 • Hospital cash while in Singapore: S$100 per day up to 14 days • Medical expenses: Up to S$200,000 • Extended policy cover in some situations: Up to 21 days		
(2) Emergency Medical Evacuation due to COVID-19	S$250,000	S$2,000,000	Unlimited			
(3) Repatriation due to COVID-19	S$30,000	S$500,000	Unlimited			
ii. Overseas Quarantine Allowance Due To COVID-19	Not covered	S$1,000 (S$50 for every 24 hours)	S$2,000 (S$100 for every 24 hours)			
iii. Trip Cancellation/ Postponement Due To COVID-19	S$500	S$1500	S$2000			
iv. Trip Interruption Due To COVID-19	S$500	S$1500	S$2000			

*30% discount off your travel quote if you or your immediate family member(s) has an active MINDEF & MHA Group Term Life / Group Personal Accident policy or POGIS Group Term Life policy with Singlife.

(a) The exchange rate between South Korean wons (KRW) and Singapore dollars (SGD) changes each day.

The graph shows the daily exchange rate for the period 4 June – 4 July 2022.

Lowest rate on 5 June 2022	1 SGD = 908.724 KRW
Highest rate on 23 June 2022	1 SGD = 939.752 KRW

(*Source: https://www.xe.com/currencycharts/?from=SGD&to=KRW&view=1M*)

All travellers are required to take a PCR test within three days of arriving in South Korea.

Use the information to work out the difference between the greatest and least possible cost, in Singapore dollars, for Mr Tan's family to book their appointments to take PCR tests in South Korea.

Give your answer correct to the nearest ten cents.

Answer S$ …… [2]

(b) Mr Tan intends to buy travel insurance with some coverage for COVID-19 for the whole family. The plan should have coverage of at least $300,000 per person for overseas medical expenses. Mr Tan has an active POGIS Group Term Life policy with Singlife. He wants to spend not more than $150 on the travel insurance.

The family will need to take a pre-departure PCR or ART test in Singapore before their trip.

Mr Tan adds an extra 10% to the estimated total cost of the trip to cover any extra costs.

Mr Tan finds this information about exchange rates over the past two years.

Lowest rate in Dec 2020	1 SGD = 811.551 KRW
Highest rate in Jun 2022	1 SGD = 939.752 KRW

Estimate the total cost, in Singapore dollars, for the 5-day trip for Mr Tan and his family.
Justify any decisions you make and show your calculations clearly. [8]

Answer

Additional space for working

(b)

~~ End of Paper 2 ~~