Class Register No.

Candidate Name

PEIRCE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY 4 NORMAL ACADEMIC

MATHEMATICS **4045/02**
Paper 2 **2 August 2024**
2 hours

Additional Materials:
Plain Paper (for rough work)

INSTRUCTIONS TO CANDIDATES
Candidates answer on the Question Paper. Write your name, class and register number on all the work you hand in. Write in dark blue or black pen. You may use a pencil for any diagrams or graphs. Do not use staples, paper clips, highlighters, glue or correction fluid.
Answer **all** questions from Section A and **only one** question from Section B. 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 70.

	For Examiner's Use	
PARENT'S SIGNATURE	**Total**	

This paper consists of **23** printed pages and **1** blank page.
Setter: Mr Goh

[TURN OVER

Mathematical Formulae

Compound interest

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

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

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

Statistics

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

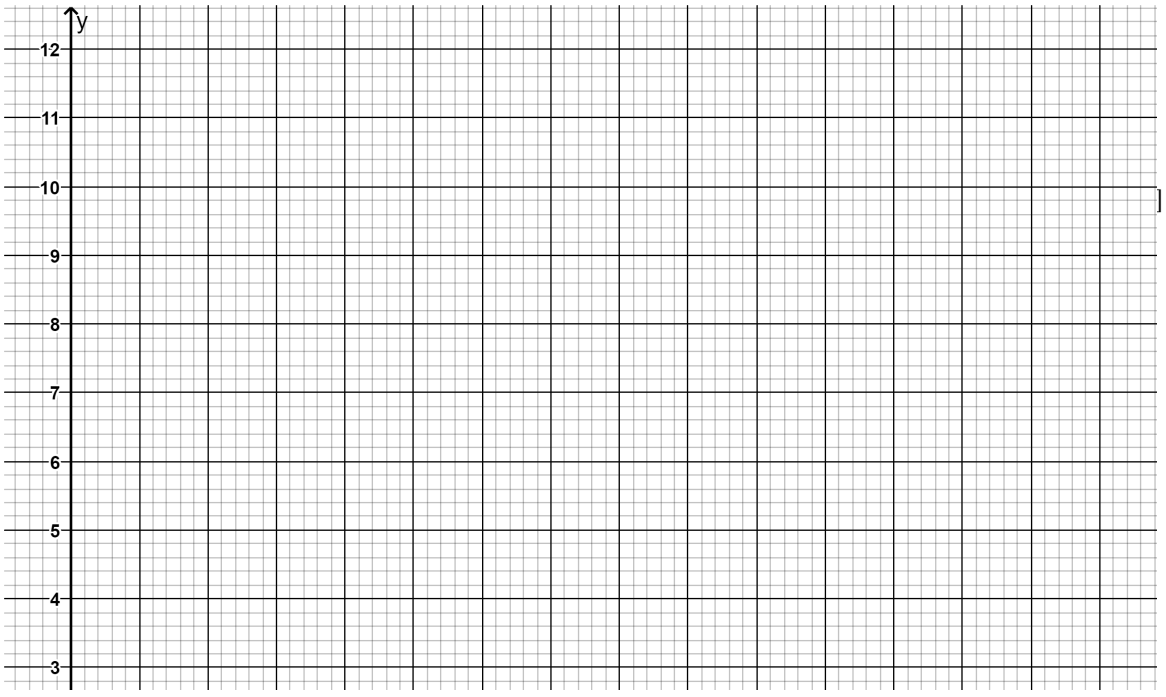
Standard deviation = $\sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$

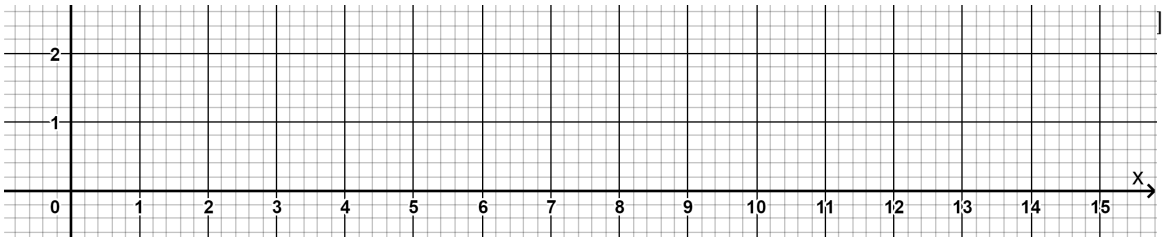
Section A (62 marks)

Answer **all** the questions in this section.

1 Factorise the following completely.

(a) $2r^2 + 5r - 3$





]

Answer …… [1]

2 Mdm Lee wants to invest $150 000 with an investment company over a duration of **15 years**.
There are 2 options, A and B.

Option A
Mdm Lee will immediately receive a one-time payout of $40000. Subsequently, for the next 15 years, Mdm Lee will receive a yearly payout of $12000.

Option B
The investment company will invest $150 000 based on 3.8% per annum compounded yearly. Mdm Lee will receive the total investment after 15 years.

Which option should Mdm Lee choose ? Show all workings clearly.

Answer

[
3]

3 **(a)** Johnny took the 1400 hrs train from Alpha city to Oasis.
Johnny arrived in Oasis at 1840 hrs and the average speed of the train is 200 km/h.
Calculate the distance of the train

ride.

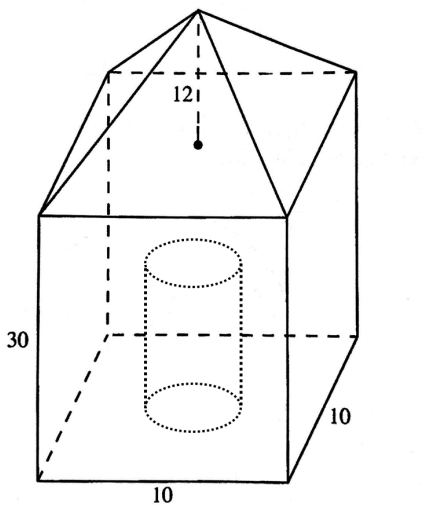
Answer …… km [2]

(b) Janelle cycled for 40 km for 6 hours. She rested for 30 minutes before continuing her journey at an average speed of 50 km/h for 9 km. Calculate the average speed of Janelle.

Answer …… km/h [3]

4 A solid object is made up of a right-pyramid and a cuboid.

The sides of the base of the cuboid are 10 cm each and the height of the cuboid is 25 cm.
The vertical height of the right-pyramid is 12 cm.
For design purpose, a cylindrical hole of radius 3 cm and height 10 cm is being removed the object below.



Calculate the volume of the remaining object.

Answer …… cm^3 [3]

5 **(a)** Simplify $\dfrac{(3y)^2 \times 2xy^5}{16x^2}$.

Answer ……[2]

(b) Simplify $(g^6)^{-\frac{4}{3}}$.

Answer ……[2]

6 The table below is for the graph $y = x + \dfrac{6}{x}$.

x	1	2	3	4	5	6	8	10	12
y	7	q	5	5.5	6.2	7	8.8	10.6	12.5

(a) Find the value of q.

Answer $q =$ …… [1]

(b) On the grid next page, plot the graph of $y = x + \frac{6}{x}$

. [2]

(c) By drawing a suitable tangent, find the gradient of the graph at $x = 1.5$.

Answer ……[2]

(d) By drawing the line $6y = x + 36$ on the same graph paper, find the y-coordinate of the point of intersections of the graphs $y = x + \frac{6}{x}$ and $6y = x + 36$.

25

Answer $y =$ …… or $y =$ ……
[3]

□

7 **(a)** Write $\frac{3}{x+2} - \frac{1}{x-3}$ as a single fraction, simplifying the numerator.

A *C* *D*

B

E 130°

Answer ……[2]

(b) Solve the equation $3x^2 - 2x - 14 = 0$

Answer
……[3]

8 (a) Anson intends to buy a laptop which costs 13500 Chinese Yuan (CNY) from an online seller.

The details of the deal is as follows.

- Discount by online seller is 20%
- Goods and Service Tax (GST) is 9%
- Shipping fee is $ 30 SGD (GST not applicable)
- Currency conversion is $1 SGD : 5.36 Chinese Yuan (CNY)

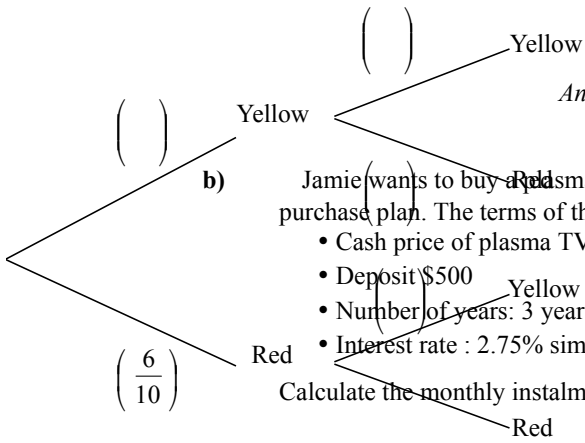
Calculate the total amount paid by Anson for the purchase of the laptop.

Answer ……SGD [2]

b) Jamie wants to buy a plasma TV from an electronics shop in Singapore on hire purchase plan. The terms of the hire purchase plan are as follows.

- Cash price of plasma TV : $3000
- Deposit $500
- Number of years: 3 years
- Interest rate : 2.75% simple interest per annum

Calculate the monthly instalment paid by Jamie.



Answer $……SGD [3]

9 2520 expressed as the product of its prime factors is $2^3 \times 3^2 \times 5 \times 7$.

(a) 2520k is a perfect cube. Find the smallest positive value of k.

Answer …… [1]

(b) Write 756 as a product of its prime factors.

Answer ……..…… [1]

(c) Find the highest common factor (HCF) of 756 and 2520. Leave your answer in prime factorisation form.

Answer ..... [1]

(d) Find the smallest positive integer value of m such that the lowest common multiple (LCM) of 2520, 756 and m is 52920.

Answer ..... [2]

10 The populations of the world's poorest countries in the world are shown in the table below.

Country	**Population (millions)**	***GDP-PPP per capita (USD $)**
South Sudan	15	455
Burundi	13.563	916
Central African Republic	5.579	1123
Democratic Republic of the Congo	99.01	1552
Mozambique	32.97	1649

***** Gross domestic product (GDP) per captia is often used as the standard metric for measuring level of poverty.

To better compensate for differences in living costs and rates of inflation, economists also factored power parity (PPP) to assess an individual's buying power in any given country.

(https://gfmag.com/data/economic-data/poorest-country-in-the-world/)

(a) Calculate the total population of the 5 countries. Give your answer in standard form.

Answer ..... [2]

(b) Luxembourg is the richest country in the world with a population of 670 000 and GDP-PPP per capita (USD $) of 143743.

Express the GDP-PPP per capita of Luxembourg as a percentage of the GDP-PPP per capita of South Sudan.

Answer ……% [1]

(c) Interpret the meaning of the value found in **(b)**.

Answer

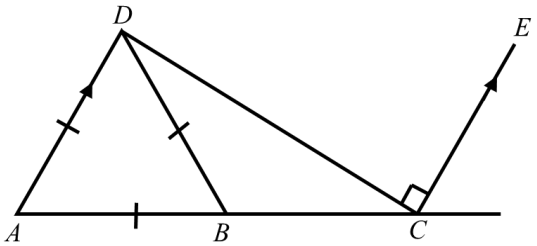
……

……

……

……[1]

11 In the diagram below, ABC is a straight line and ABD is an equilateral triangle. AD is parallel to CE.



(a) Find $\angle DBC$. State the reason(s) clearly.

Answer $\angle DBC$ =

……^{o} [1]

Reason (s)
……..

……
[1]

(b) Find $\angle ACD$. State the reason(s) clearly.

Answer $\angle ACD$ =
……^{o} [1]

Reason (s)
……..

……
[1]

12 **(a)** Name the special quadrilateral with 4 equal sides and 2 equal diagonals.

Answer ……..…….[1]

(b) Find the interior angle of a regular octagon.

Answer ……..…….[2]

13 Solve the simultaneous equations.

$$2x - 2y = 5$$
$$8x = 11 - y$$

Answer x =……, y = ……..……[3]

14 The Boeing 737-800 and the Airbus A380 are two of the most popular passenger aircrafts in the world.

Some details of both aircrafts are shown in the table below.

General		
	Airbus A380	**Boeing 737-800**
Typical Seating (excluding pilots and cabin crew)	555 passengers	124 passengers
Price (average)	USD375.3 million	USD106.1 million
Mass		
Maximum Zero Fuel Mass - **Total mass of the airplane and all its contents, minus the total weight of the usable fuel on board.**	361 000 kg	111 000 pounds
Maximum Fuel Capacity	320 000 litres	4270 gallons
Empty mass of aircraft	276 800 kg	41 145 kg
Performance		
Maximum flight range with passenger	15 000 km	42 000 km

(a) Given that the mass of the fuel in the **Airbus A380** when filled to maximum capacity of 320 000 litres is 251.2 tonnes, calculate the mass of fuel in kilogram per litre.

Note : 1 tonne (t) = 1000 kilograms (kg)

Answer …… kg/ litre [1]

(b) Calculate the rate of fuel consumption of the **Boeing 737-800** aircraft in litre per kilometre.

Note : 1 gallon = 3.78541 litres

Answer …… litre/ km [1]

(c) According to an aviation website (*https://simpleflying.com/airbus-a320-variants-hourly-operating-costs/*), airlines spend an average of $13233.41 per block hour on operating cost for passenger air carriers. It can be taken that operating hours of a flight = flight duration + 6 hours.

Zeus Airline plans to arrange a flight itinerary on **Airbus A380** from Singapore to Hanoi where the duration of the flight is 3 hours 30 minutes.

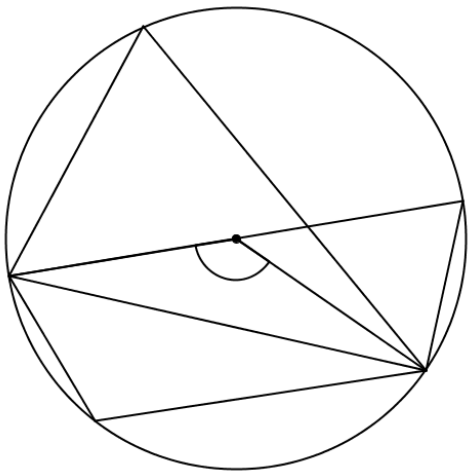
Zeus airline wants to make a profit of at **least 20%** and plans to charge each paying passenger at least **$300** based on full seating capacity. Does this amount meet Zeus airline's profit objective ? Show all workings clearly.

Answer

[3]

Section B – Answer only 1 question

15 **(a)** In the diagram below, O is the centre of the circle. AOD is a straight line and angle $AOC = 130^{o}$. The points A, B, C, D and E lie on the circle.



(i) State the reason that angle ACD is 90^{o}.

Answer

Reason……[1]

(ii) Find angle AEC.

Answer ……[1]

(ii) Find angle ABC.

Answer ……[1]

(b) In the diagram below, P, Q and R are three points on level ground.
$PQ = 7.7$ m, $PR = 4$ m and $RQ = 8$ m.

R *P* North

7.7

4

Q

8

(i) Find angle RPQ.

Answer ……[3]

(ii) Find the bearing of P from Q.

Answer …….. [2]

16 **(a)** In class Alpha, the Math test scores of 40 students are tabulated in the table below.

Marks	**Frequency**
$45 \le x < 55$	6
$55 \le x < 65$	11
$65 \le x < 75$	24
$75 \le x < 85$	45
$85 \le x < 95$	14

‘

(i) Calculate the estimated mean and standard deviation of the test scores.

Answer Mean = ……, Standard deviation =……
[3]

(ii) In class Beta, where the number of students is the same as class Alpha, the students took the same Math test. The mean and standard deviation of the score are 77 and 9.8 respectively.

Make two comparisons in the performance of class Alpha and class Beta respectively.

Answer

Comparison 1
……

……
[1]

Comparison 2
……

……
[1]

(b) A bag contains 5 yellow balls and 8 red balls. Two balls are drawn at random, one after another without replacement.

(i) Complete the probability tree shown below. [1]

( )

( )

(ii) Calculate the probability that both balls drawn are of different colours.

Answer ……..[2]

End of Paper

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