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CHIJ ST. THERESA'S CONVENT

PRELIMINARY EXAMINATION 2019

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS **4048/1**

Paper 1 **05 September 2019**

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number, and name 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 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 for this paper is 80.

ANSWERS TO QUESTIONS 1 TO 15 MUST BE HANDED IN SEPARATELY FROM ANSWERS TO QUESTIONS 16 TO 24.

This document consists of **17** printed pages.

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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

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

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

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Answer **all** the questions.

1 Solve $\frac{x}{4}+13=6$.

Answer $x =$ …… [1]

---

2 Peter boards a bus at bus stop A at 6.50 am. The bus travels to bus stop B at an average speed of 60 km/h to school. He reaches bus stop B at 7.15 am.

What is the distance between the 2 bus stops?

Answer ……..… km [2]

---

3 John wrote down five numbers.
The mean of these numbers is 8, the median is 6 and the mode is 5.
The largest number is three times the smallest number.

Find the five numbers.

Answer ……..… , ….…… , ……..… , ……..… , ……..… [2]

---

4 A field which has an area of 1800 m^2, is used to plant sunflowers.
It is known that an acre of land, which is about 4047 m^2, can grow an average of 20 000 sunflower plants.
Each sunflower plant has an average seeding rate of 1500 seeds.

Calculate an estimate of the total number of seeds that can be harvested from the field, leaving your answer in standard form, correct to 3 significant figures.

Answer ……..… seeds [2]

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5 Simplify $\frac{3x}{5} - \frac{4(2-3x)}{7}$.

Answer ……...……. [2]

---

6 $\xi = \{x : x \text{ is a positive integer and } x < 25\}$

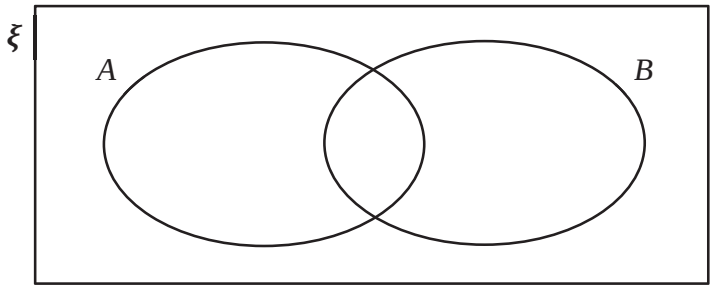
$A = \{x : x \text{ is a perfect square}\}$

$B = \{x : x \text{ is an odd number}\}$

(a) Find $n(A \cap B)$.

Answer …… [1]

(b) On the Venn diagram, shade the region which represents $(A \cap B')'$.



[1]

---

7 Factorise fully $6ac + 9ad - 12bd - 8bc$.

Answer ……...……. [2]

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8 A is the point $(-2,\ 5)$ and $\overrightarrow{BA} = \begin{pmatrix} -4 \\ 8 \end{pmatrix}$.

(a) Find the coordinates of point B.

Answer B (……..…, ……..…) [1]

(b) Calculate $\left|\overrightarrow{BA}\right|$.

Answer …… [1]

---

9 Andrew weighed ten large watermelons from his farm.

The mean mass of the watermelons was 9070 grams.
The standard deviation of the masses of the watermelons was 362.8 grams.

The scales used by Andrew were found to be inaccurate.
The correct mass of each watermelon turns out to be 1650 grams more than Andrew recorded.

Write down the correct values for the mean and standard deviation (SD).

Answer Mean = ..…….. g

SD = ……... g [2]

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10 A man purchased a painting in 2016.
The value of the painting increased by 8% in 2017.
In 2018, the value of the painting was \$73288.80, an increase of 20% as compared to 2017.
Express the cost of the painting in 2016 as a percentage of the cost of the painting in 2018.

Answer ..…….…… % [3]

---

11 **(a)** David makes a mocktail drink for his kids.
He uses apple juice, lime juice and sparkling water in the ratio 3 : 2 : 7 respectively.
He uses 2.1 litres of sparkling water.

(i) How much apple juice does he use?

Answer ……... litres [1]

(ii) How much mocktail drink does he make altogether?

Answer ……... litres [1]

(b) Wen Ni makes a mocktail drink using lemon juice, syrup and coconut water.
The ratio lemon juice : syrup is $\frac{1}{2} : \frac{1}{3}$.
The ratio syrup : coconut water is 1 : 8.

Find the ratio lemon juice : syrup : coconut water.

Answer ……..… : …… : ……....… [2]

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12 Jane draws a triangle.
The first angle is 20º bigger than the second angle
The third angle is three times the size of the first angle.

Form an equation and solve it to find the angles of the triangle.

Answer ……..... º, …… º, ……..….. º [3]

---

13 It is given that x and y are in direct proportion.
The difference in the value of y, when x is 5 and when x is 17, is 54.

(a) Find an equation connecting x and y.

Answer …… [3]

(b) Find the value of x when $y = 84$.

Answer …… [1]

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14 When written as the product of their prime factors,

m is $2^2 \times 5^2 \times 11$
n is $2^3 \times 3 \times 5 \times 7$

Find

(a) the largest integer which is a factor of m and n,

Answer ..... [1]

(c) the smallest integer p such that mp is a perfect cube,

Answer ..... [1]

(d) the smallest positive integer value of q such that $\sqrt[3]{\frac{mn}{q}}$ is an integer.

Answer ..... [1]

---

15 **(a)** Solve the inequalities $-15 \le 8 - 3x < 2$.

Answer ..... [2]

(b) Write down all the integers that satisfy $-15 \le 8 - 3x < 2$.

Answer ..... [1]

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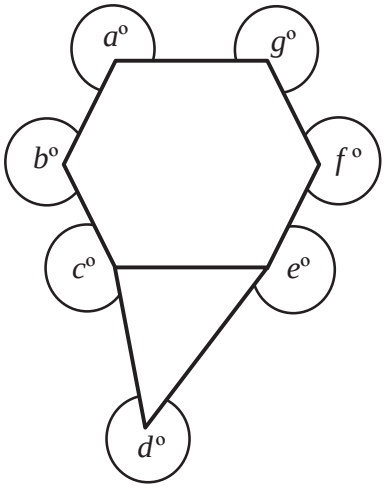
Name: _____( ) Class: _____

16 The diagram shows a regular hexagon and a triangle.



(a) Calculate the sum of the interior angles of the regular hexagon.

Answer ……...° [1]

(b) Calculate the sum of the angles a, b, c, d, e, f and g.

Answer ……...° [2]

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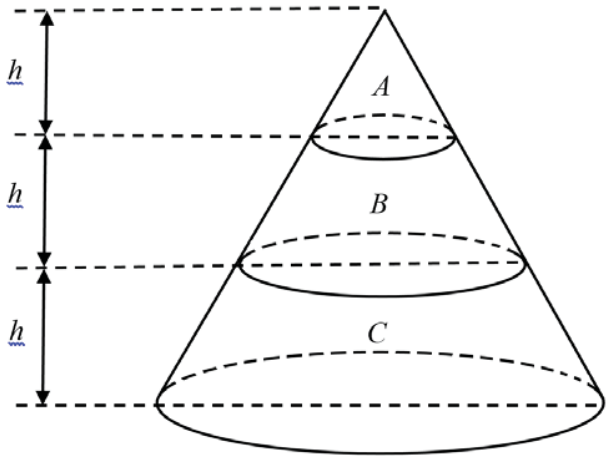
17 The diagram shows a right circular cone which is divided into 3 parts *A*, *B* and *C* by planes parallel to the base as shown. *B* and *C* are frustums of a cone. The height of each part is *h* cm.



The curved surface area of *A* is 200 cm^2

(a) Show that $A_A : A_{A+B}$ is 1 : 4, where A_A is the curved surface area of *A* and A_{A+B} is the combined curved surface areas of *A* and *B*.

[1]

(b) Find A_B, the curved surface area of *B*.

Answer …….… cm^2 [1]

(c) Find the ratio of the volume of *B* to the volume of *C*.

Answer …….…….. [3]

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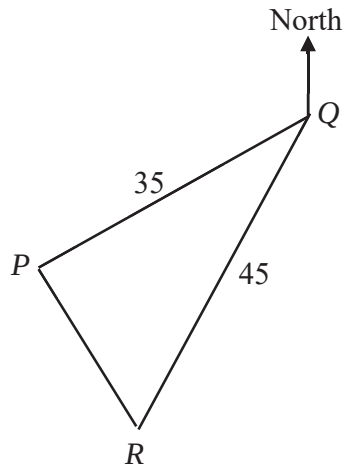
18 The diagram shows the positions of three towns P, Q and R.
$PQ = 35$ km and $QR = 45$ km.
The bearing of P from Q is 235º and the bearing of R from Q is 205º.



Calculate the distance between towns P and R.

Answer ……..… km [3]

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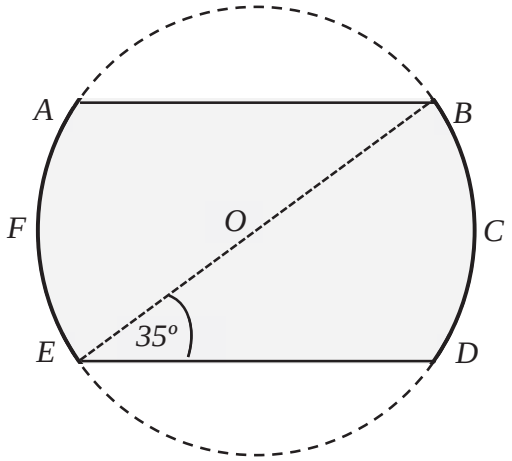
19 The diagram shows six points A, B, C, D, E and F on the circumference of a circle with centre at O.
It is given that the diameter BE of the circle is 14 cm, $\angle BED = 35^\circ$ and $AB = ED$.



Calculate the area of the shaded region.

Answer …… cm^2 [5]

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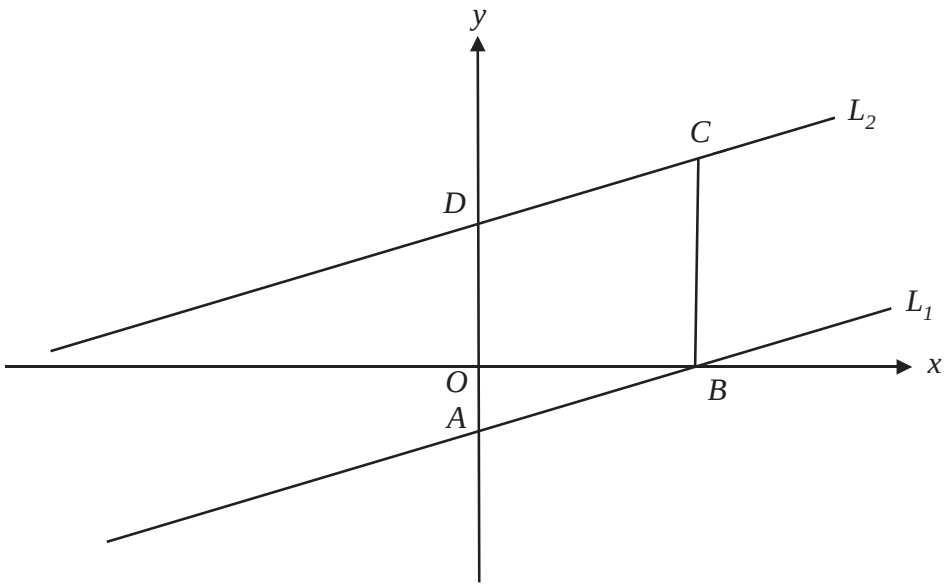
20 In the diagram, the equation of the line L_1 is $2y = 3x - 5$.
The line L_2 has the same gradient as the line L_1.
A and D lie on the y-axis. BC is parallel to the y-axis and $BC = 8$ units.



(a) Find the equation of the line L_2.

Answer …… [2]

(b) What is the area of quadrilateral $ABCD$?

Answer ……..… units^2 [1]

(c) Find the value of tan $\angle ABO$.

Answer …… [1]

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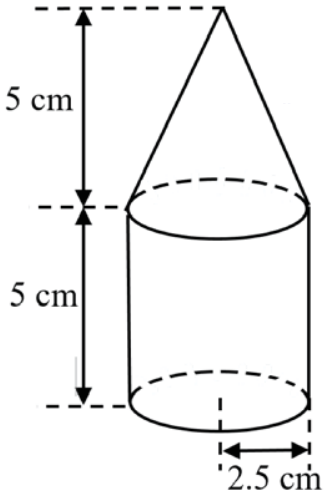
21 **(a)** The period of oscillation of a pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$.

Rearrange the formula to make l the subject.

Answer …… [2]

(b) A solid is made from a cylinder and a cone.
Both the cylinder and cone have radius 2.5 cm and height 5 cm.



Calculate the total surface area of the solid.

Answer …….… cm^2 [3]

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22 A gift company sells three hamper packages containing packets of biscuits, bars of chocolates and bottles of wine.
The cost of one packet of biscuit, one bar of chocolate and one bottle of wine are \$7.20, \$10.80 and \$32.00 respectively.

	Biscuit	Chocolate	Wine
Hamper *A*	6 packets	5 bars	3 bottles
Hamper *B*	9 packets	7 bars	4 bottles
Hamper *C*	10 packets	8 bars	2 bottles

The quantity of the items packed into each of the three types of hamper packages is shown in the table above.

These information can be represented by the matrices $\mathbf{H} = \begin{pmatrix} 6 & 5 & 3 \\ 9 & 7 & 4 \\ 10 & 8 & 2 \end{pmatrix}$ and $\mathbf{P} = \begin{pmatrix} 7.20 \\ 10.80 \\ 32.00 \end{pmatrix}$.

(a) Evaluate the matrix **R = HP**.

Answer **R** = …… [2]

(b) State what the elements of **R** represent.

…… [1]

(c) A total of 20 Hamper *A*, 25 Hamper *B* and 30 Hamper *C* are sold.
Represent the total number of hamper packages sold in a 1×3 matrix **T**.

Answer T = …… [1]

(d) Using matrix multiplication, find the total amount of money obtained by the gift company from the sales of the hamper packages *A*, *B* and *C*.

Answer \$ …… [2]

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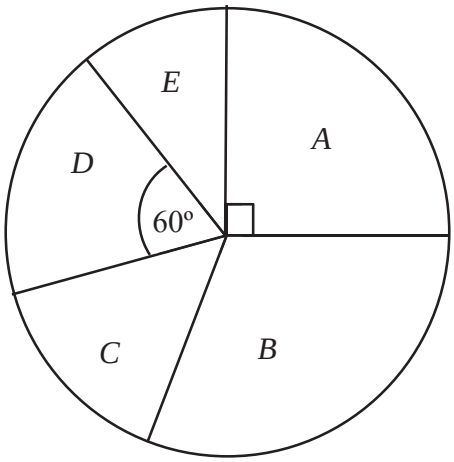
23 Some boys are placed into five groups, *A*, *B*, *C*, *D* and *E*, based on their heights.
The pie chart shows the proportion of boys in each group.
Group *A* comprises $\frac{1}{4}$ of the boys, Group *B* 30% of the boys and Group *C* has 18 boys.
Group *D* is represented by a $60°$ sector.



(a) Find the percentage of the boys who are in Group *D*.

Answer …….. % [1]

(b) Given that the number of boys in group *B* is 36, find the total number of boys.

Answer ……..… boys [2]

(c) Calculate the number of boys in group *E*.

Answer ……..… boys [2]

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24 A bag contains 20 marbles, n of which are red and the rest are yellow.
A marble is chosen at random and not replaced.

(a) Write down, in terms of n, the probability that the marble is yellow.

Answer ..... [1]

A second marble is chosen at random.

(b) Find, in terms of n, the probability that both marbles are yellow.

Answer ..... [1]

(c) **(i)** The probability that both marbles are yellow is $\frac{39}{95}$.

Show that $n^2 - 39n + 224 = 0$

[2]

(ii) Solve the equation $n^2 - 39n + 224 = 0$ to find the number of yellow marbles in the bag.

Answer ..... [3]

~~ End of Paper 1 ~~~

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PRELIMINARY EXAMINATION 2019

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

CANDIDATE NAME	

CLASS		INDEX NUMBER	

MATHEMATICS **4048/02**

Paper 2 **29 Aug 2019**

Additional Material: Graph paper (1 sheet) **2 hours 30 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your 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 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 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 number of marks for this paper is 100.
Answers to Questions 1 to 6 must be handed in separately from answers to Questions 7 to 10.

This document consists of **23** printed pages.

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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

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

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

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Answer **all** the questions.

1 **(a)** Factorise $27a^4 - 3$.

Answer ……..... [2]

(b) Express as a single fraction in its simplest form

(i) $\dfrac{2(x-1)^2}{4y^3} \div \dfrac{6y(x-1)}{8y^2}$,

Answer ……..... [1]

(ii) $\dfrac{3}{m-2} - \dfrac{2}{3m-1}$.

Answer ……..... [2]

(c) Solve the equation $2^{2-x} = \dfrac{1}{\sqrt[3]{2^{5x+1}}}$.

Answer ……..... [2]

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(d) **(i)** Express $x^2 - 8x - 6$ in the form $(x-b)^2 - c$.

Answer ……..... [1]

(ii) **Hence** solve the equation $x^2 - 8x - 6 = 0$, giving your answers correct to one decimal place.

Answer $x =$ ..... or .....[3]

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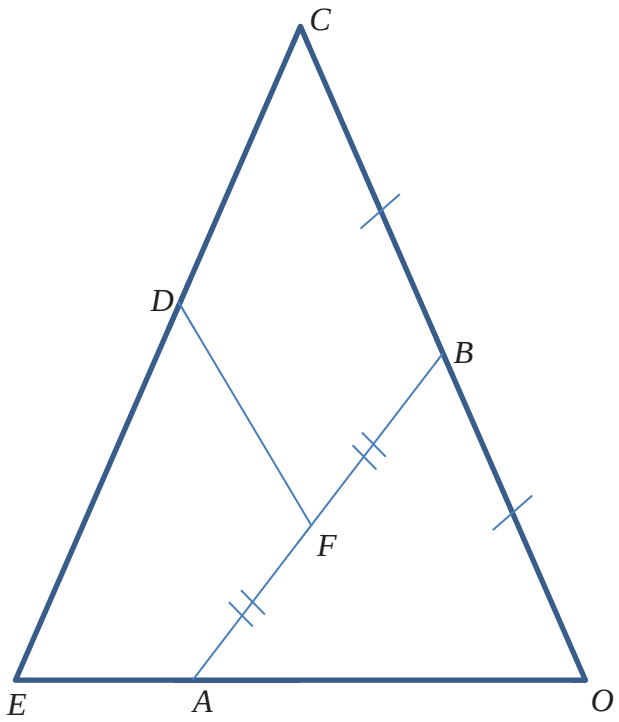
2 In the diagram below, $OB = BC$ and $AF = FB$. It is given that $OA : AE = 2 : 1$ and $ED : DC = 4 : 3$. $\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.



(a) Express, as simply as possible, in terms of **a** and/or **b**,

(i) $\overrightarrow{CE}$,

Answer ..... [1]

(ii) $\overrightarrow{CD}$,

Answer ..... [1]

(iii) $\overrightarrow{BA}$,

Answer ..... [1]

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(iv) $\overrightarrow{OF}$,

Answer ……..... [2]

(v) $\overrightarrow{FD}$.

Answer ……..... [2]

(b) Find

(i) $\dfrac{\text{Area of } \Delta OBA}{\text{Area of } \Delta OBE}$,

Answer ……..... [1]

(ii) $\dfrac{\text{Area of } \Delta OBA}{\text{Area of } \Delta OCE}$.

Answer ……..... [2]

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3 **(a)** Celine wishes to buy a new car. The price of the car is $98 000.

(i) The car dealer requires Celine to make a downpayment of $19 600. Express this amount as a percentage of the price of the car.

Answer .....% [1]

(ii) After making the downpayment, Celine decides to take a bank loan for the rest of the money to be paid to the car dealer.
Bank OCC charges an interest rate of 2.78% per annum compounded half yearly.
Bank DBB charges a simple interest rate of 2.99% per annum.
If Celine decides to take a seven year loan, which bank should she loan from? Justify your answer.

Answer…….

……... [4]

(b) Celine visits the petrol station weekly to refill petrol, refilling 51 litres of petrol each and every time. In order to save on petrol costs, she decides to drive to Johor Bahru, Malaysia, weekly to refill the petrol.

(i) How much does she need to pay weekly to refill petrol in Singapore if the price of petrol is $2.25 per litre?

Answer S$..... [1]

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(ii) How much does she need to pay to refill petrol weekly in Johor Bahru if the price of petrol is RM 2.08 per litre?

Answer RM..... [1]

(iii) (a) How much is Celine able to save weekly if she refills the petrol in Malaysia? Give your answer in terms of Singapore dollars. (Given the exchange rate is S$1 = RM 3.05)

Answer S$..... [2]

(b) Express the amount of savings as a percentage of the cost of refilling petrol weekly in Singapore.

Answer .....% [1]

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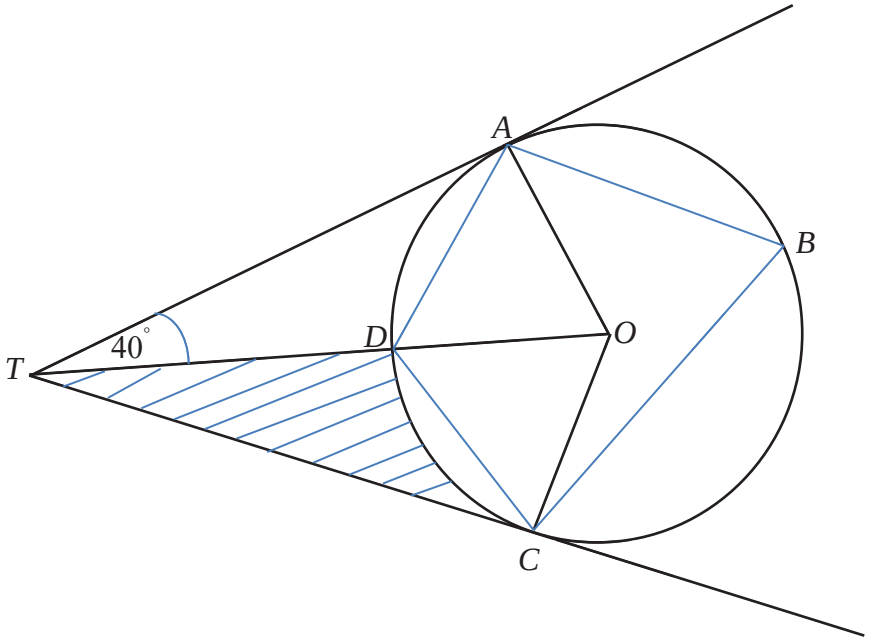
4 The diagram below shows a circle *ABCD* with centre *O*. *AT* and *CT* are tangents to the circle and angle $ATO = 40^\circ$.



(a) Find, giving reasons for each answer,

(i) angle *AOD*,

Answer ……° [2]

(ii) angle *ABC*,

Answer ……° [2]

(iii) angle *ADC*,

Answer ……° [1]

(iv) angle *OCD*.

Answer ……° [1]

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(b) Calculate the area of the shaded region, given that the radius of the circle is 5 cm.

Answer …….....cm^2 [4]

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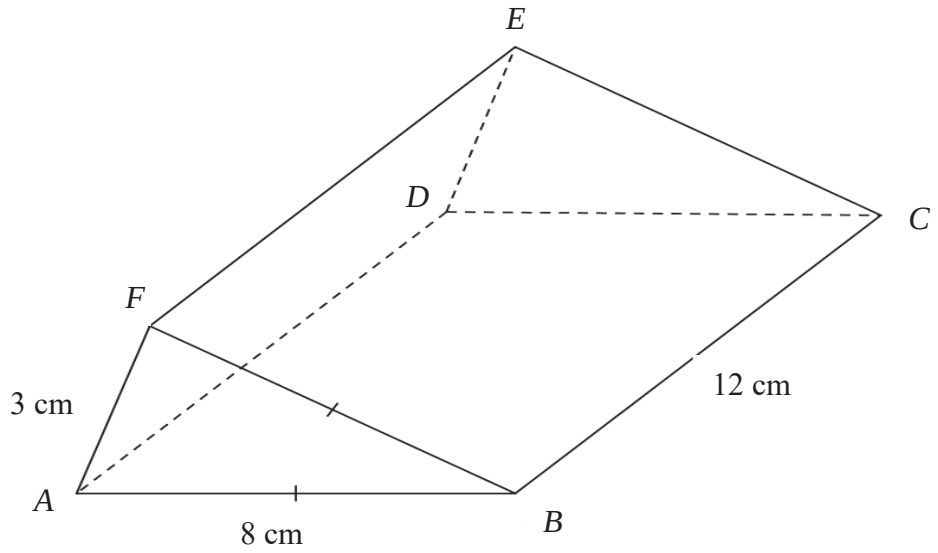
5



The diagram above shows a prism *ABCDEF* whose cross section is an isosceles triangle.

It is given that AB = 8 cm, BC = 12 cm, and AF = 3 cm.

(a) Show that $\angle ABF = 21.6^\circ$, correct to 1 decimal place. [3]

(b) Find the angle of elevation of E from B.

Answer …….....° [3]

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(c) **(i)** Calculate the volume of the prism *ABCDEF*.

Answer ……..cm^3 [2]

(ii) The prism is melted and moulded into a hemisphere. Calculate the radius of the hemisphere.

Answer ……..cm [2]

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6 **Answer the whole of this question on the sheet of graph paper.**

The variables x and y are connected by the equation

$$y = \frac{x^2}{3} + \frac{2}{x} - 3.$$

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

x	0.5	1	1.5	2	2.5	3	4	5
y	p	–0.67	–0.92	–0.67	–0.12	0.67	2.83	q

(a) Find the values of p and q.

Answer p =…….....

q=……..... [2]

(b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x-axis for $0 \le x \le 5$ and a vertical y-axis for $-2 \le y \le 6$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find the solutions to the equation $\frac{x^2}{3} + \frac{2}{x} = 3$.

Answer x =…… or ….....[2]

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(d) By drawing a tangent, find the gradient of the curve at $(3,\ 0.67)$.

Answer ..... [2]

(e) By drawing a suitable line on the graph, solve the equation

$$\frac{x^2}{3}+\frac{2}{x}+2x-6=0$$

Answer Equation of line $y =$ .....[1]

$x =$……..... [1]

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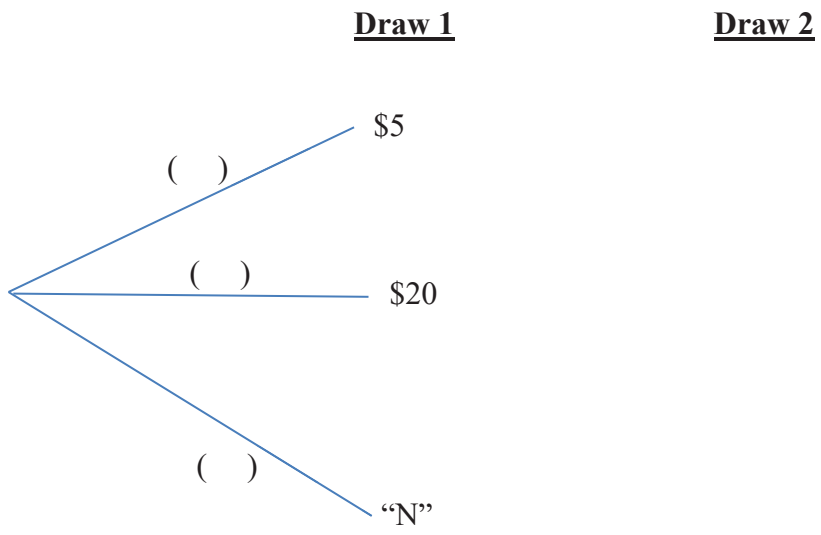
Name: ……..( ) Class: ……..

7 **(a)** In the lucky draw, there are 3 types of tickets to be drawn from a box: \$5 tickets, \$20 tickets and "N" tickets. If a customer draws a \$5 or a \$20 ticket, the ticket will be exchanged for a \$5 or \$20 shopping voucher respectively. However, if the customer draws an "N" ticket in the first draw, the "N" ticket will be placed back into the box and the customer will draw a ticket a second time. The second draw is the final one.

Given $\frac{3}{5}$ of the tickets are \$5 tickets, $\frac{1}{10}$ of the tickets are \$20 tickets and the rest are "N" tickets, complete the tree diagram below.



[2]

(i) Find the probability that a customer will draw an "N" ticket.

Answer …..... [1]

(ii) Find the probability that a customer will win a cash voucher.

Answer …..... [2]

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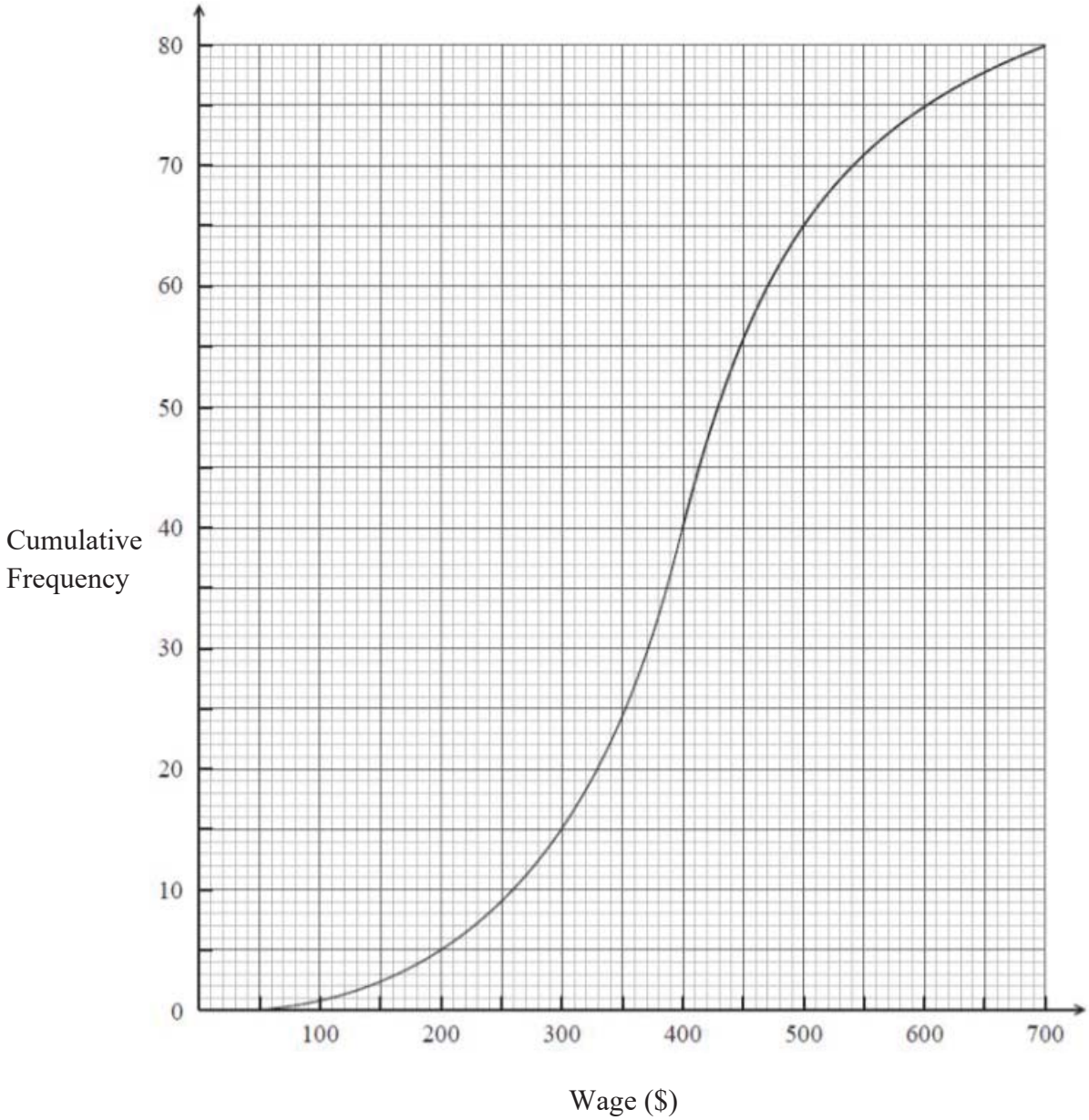
(iii) If both Mary and Peter take part in the lucky draw, what is the probability that at least one of them will win a cash voucher?

Answer ……..... [2]

(b) The cumulative frequency curve below shows the distribution of the weekly wages of 80 employees.



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Use the curve to estimate

(i) the median wage,

Answer $…..... [1]

(ii) the interquartile range of the wages,

Answer $…..... [1]

(iii) the percentage of the employees who earned at least $500.

Answer …..... % [2]

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8 **(a)** The first four terms in a sequence are $\frac{1}{3}, -\frac{1}{6}, \frac{1}{12}, -\frac{1}{24}$

Find the 5th term .

Answer ..... [1]

(b) The *n*th term of a sequence is given by $T_n = \frac{1}{n^2+1}$. Find the sum of the 4th and 5th terms.

Answer ..... [3]

(c) The first four terms in a sequence of numbers are given below

$$T_1 = 1^3 + 5 = 6$$
$$T_2 = 2^3 + 7 = 15$$
$$T_3 = 3^3 + 9 = 36$$
$$T_4 = 4^3 + 11 = 75$$

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(i) Find T_5.

Answer ..... [1]

(ii) Express T_n in the form of $an^3 + bn^2 + cn + d$, where a, b, c and d are integers to be determined.

Answer $a =$ .....

$b =$ .....

$c =$ .....

$d =$ .....[2]

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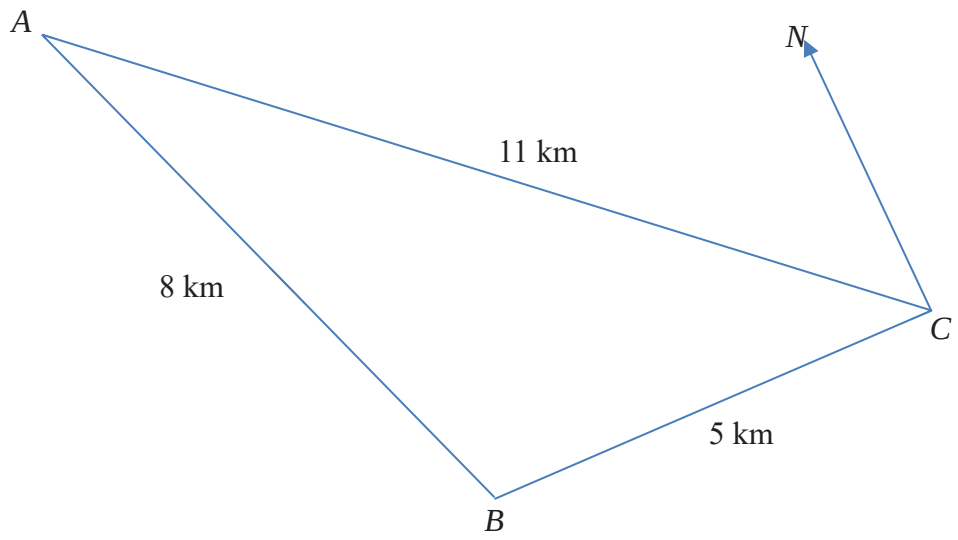
9 *ABC* represents a triangular plot of land on horizontal ground.
AB = 8 km, *BC* = 5 km, *AC* = 11 km and *B* is due west of *C*.



(a) Calculate

(i) the bearing of *A* from *C*,

Answer .....° [3]

(ii) the bearing of *C* from *A*,

Answer .....° [2]

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(iii) the reflex angle *ABC*,

Answer ..... ° [2]

(iv) the area of the triangular plot of land *ABC*.

Answer ..... km^2 [2]

(b) A vertical lamp post is erected at point *A*. State with a reason, whether the angle of depression of *B* or of *C* is larger from the top of the lamp post.

Answer……..

…….[2]

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10 Mr Wong is thinking of applying for a credit card that gives the most savings in terms of dining, grocery and petrol. His gross monthly expenses (before any discounts) are listed in the table below:

Type of Expenses	Amount ($)
Petrol	350
Grocery	100
Dining	400

After doing some research, he decided to narrow his options to the three cards listed below:

Credit Card	Savings on Petrol	Savings on Dining	Savings on Grocery
CBSH Card	• 14% upfront discount plus 5% cash rebate (on monthly petrol expenses) with monthly minimum spending of $600 on the CBSH card	• 5% cash rebate on dining expenses with monthly minimum spending of $600 on the CBSH card	• 5% cash rebate on grocery expenses with monthly minimum spending of $600 on the CBSH card
BSOP Card	• 15% upfront discount plus 6% cash rebate (on monthly petrol expenses) with minimum spending of $1000 on BSOP Card	• 5% cash rebate on all dining expenses with minimum monthly spending of $1000 on the BSOP Card	• 5% cash rebate on grocery expenses
CBCO Card	• 14% upfront discount plus 4.3% cash rebate (on monthly petrol expenses) with monthly minimum spending of $800 on the CBCO Card plus 2.1% cash rebate (on monthly petrol expenses) with monthly minimum spending of $400 on petrol	• 5% cash rebate on all dining expenses with monthly minimum spending of $800 on the CBCO Card	• 5% cash rebate on grocery expenses with monthly minimum spending of $800 on the CBCO Card

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Which credit card should Mr Wong apply for so as to maximise his savings, given that he can only apply for one card and this card is to be used only for these three types of expenses? Show your working clearly. [9]

~ End of Paper 2~

Remember to check your work carefully

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