5

SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR
O-LEVEL PROGRAMME

CANDIDATE NAME

CLASS 4

CENTRE NUMBER S

REGISTER NUMBER

INDEX NUMBER

MATHEMATICS 4052/01
PAPER 1

Monday **19 August 2024** **2 hours 15 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class, register number, centre number and index number 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 staples, paper clips, glue or correction fluid/tape.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

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 total of the marks for this paper is 90.

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.

For Examiner's Use

2

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

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

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

Answer **all** the questions.

1 Calculate $\sqrt[7]{\dfrac{13.5^2}{8.64^3+29}}$.

Answer ..... [1]

---

2 The number of butterflies in an enclosure is given as 1 000, correct to the nearest hundred.
Write down the greatest number of butterflies that could be in the enclosure at this time.

Answer ..... [1]

---

3 Write 25^3 as a power of 5.

Answer ..... [1]

---

4 Simplify $\dfrac{7t^3}{n} \div \dfrac{21t}{n^2}$.

Answer ..... [1]

---

5 Solve $4f = 5f^2$.

Answer $f =$ ..... [2]

---

6 The area of a field is 16 km^2.

(a) Express the area of the field in cm^2.
Give your answer in standard form.

Answer ..... cm^2 [2]

(b) The field has an area of 25 cm^2 on a map.
The map has a scale of 1 : n.
Find n.

Answer n = ... [1]

---

7 **(a)** Express 792 as a product of its prime factors.

Answer ..... [1]

(b) m and n are prime numbers and $m > n$.

Find the values of m and n so that $792 \times \frac{m}{n}$ is a perfect square.

Answer m = ...

n = ... [1]

---

8 Simplify $\left(\frac{c^6}{64d}\right)^{-\frac{2}{3}}$.

Answer ..... [2]

---

9 **(a)** Solve the inequalities $5 < 9 - 12k \leq 21$.

Answer ..... [2]

(b) p grams of potatoes cost q cents.
Express the cost, in dollars, of buying 3 kilograms of potatoes.
Leave your answer in terms of p and q.

Answer ..... [1]

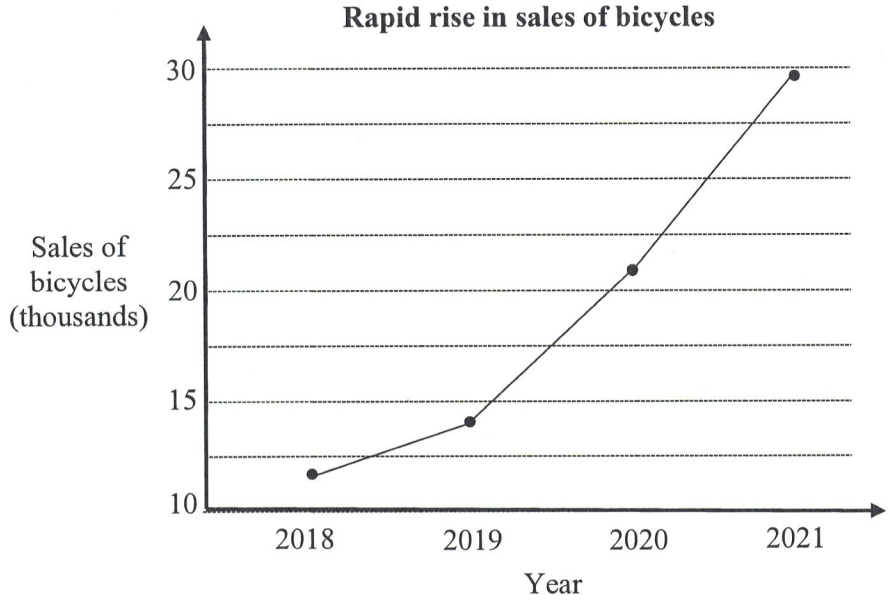
---

10 Li, Mun and Ning share a sum of money.
The ratio of the amount that Mun receives to the **total** amount that Li and Ning receive is 5 : 2.
Ning receives $ 46 more than Li and $ 405 less than Mun.
Find the sum of money.

Answer $ ..... [3]

---

11 The graph shows the total sales of bicycles at the end of each of the given years.



(a) State one misleading feature of the graph.

Answer .....

.....

..... [1]

(b) Explain how this feature affects the reader's interpretation of the graph.

Answer .....

.....

..... [1]

---

12 $3 + 9 \times 81^{v} = 30$

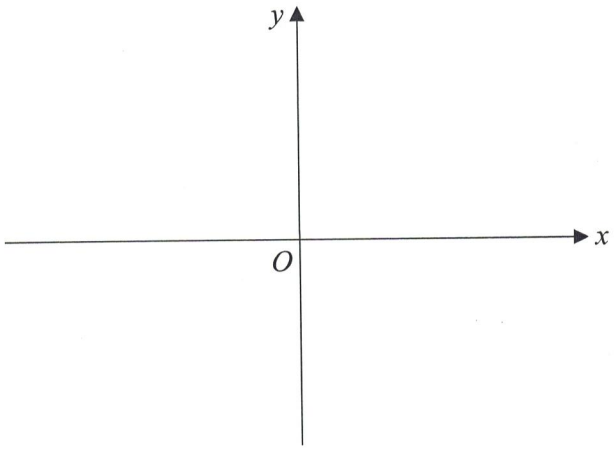
Use the laws of indices to find the value of v.
Show your working.

Answer $v =$ ..... [2]

---

13 Sketch the graph of $y = -(x+1)(x+5)$.
Indicate clearly the points where the graph crosses the axes.

Answer



[2]

---

14 In a sequence, the same number is added each time to obtain the next term.
The first five terms of the sequence are

97 a b 118 c.

(a) Find the values of a, b and c.

Answer a = ...

b = ...

c = ... [2]

(b) Write down an expression for the n^{th} term of this sequence.

Answer ..... [1]

(c) Explain clearly why there are odd and even numbers in the sequence.

Answer .....

.....

.....

..... [2]

[Turn Over

15 Express as a single fraction in its simplest form $\frac{4}{a+2b}+\frac{2}{9a-b}$.

Answer ..... [2]

---

16 **(a)** In May, a shop sold 4320 donuts.
This is an increase of 25 % of the sales of donuts in April.
Find the number of donuts sold in April.

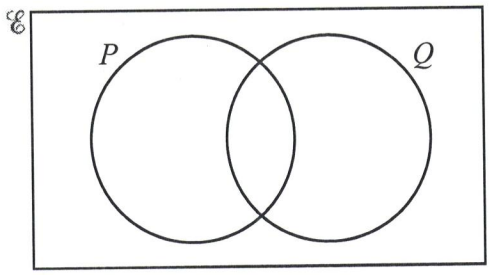
Answer ..... [2]

(b) In June, 45 % of the donuts sold were chocolate-flavoured.
$\frac{1}{3}$ of the remaining donuts sold were strawberry-flavoured.
The other 1716 donuts sold were vanilla-flavoured.
Calculate the total number of donuts sold in June.

Answer ..... [3]

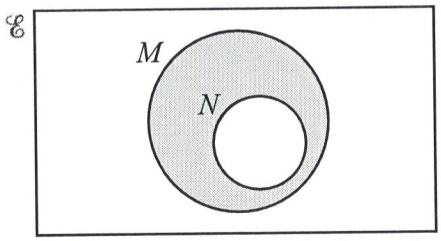
17 (a) (i) On the Venn diagram, shade the region that represents $(P \cap Q') \cup P'$.

Answer



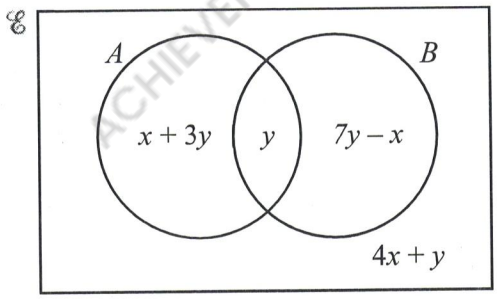
[1]

(ii) Use set notation to describe the shaded region.



Answer ..... [1]

(b) The Venn diagram shows set A and set B.



$n(A) = 60$, $n(B) = 8y - x$ and $n(\mathscr{E}) = 188$.

Form and solve two simultaneous equations to find x and y.

Answer $x =$ .....

$y =$ ..... [3]

18 Simplify $\dfrac{(p+2)^2-(3-4p)^2}{10-p-3p^2}$.

Answer ..... [3]

---

19 A group of students took part in a challenge.
The table shows the distribution of the times taken to complete the challenge.

Time (t minutes)	$30 < t \leq 35$	$35 < t \leq 40$	$40 < t \leq 45$	$45 < t \leq 50$	$50 < t \leq 55$
Number of students	18	34	62	59	27

(a) Calculate an estimate of the mean time.

Answer ..... min [1]

(b) Calculate an estimate of the standard deviation of these times.

Answer ..... min [1]

---

20 X is the point $(10, -1)$ and $\overrightarrow{WX} = \begin{pmatrix} -8 \\ 5 \end{pmatrix}$.

(a) Find the equation of the line WX.

Answer ..... [2]

(b) Y is the point $(8, -4)$.

$\overrightarrow{ZY} = \frac{1}{2}\overrightarrow{WX}$

Find the position vector of Z.

Answer ..... [2]

(c) Explain clearly why quadrilateral $WXYZ$ is a trapezium.

Answer .....

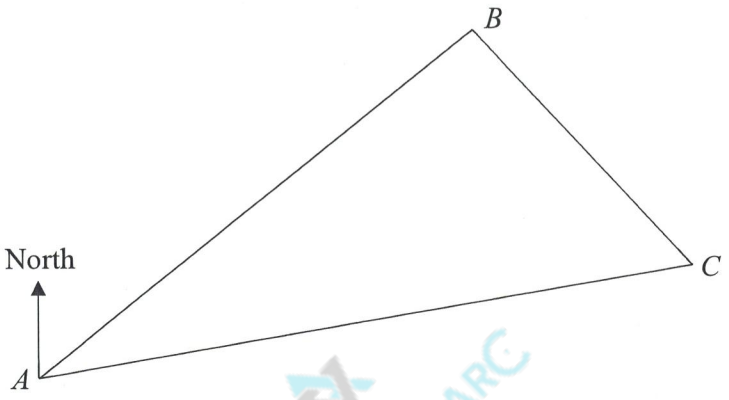
.....

.....

..... [1]

21 In this scale drawing, A, B and C are three ports.

Scale: 1 cm to 15 km



(a) A boat leaves C and sails towards A to a point, P, where its distance from A is the same as its distance from B.
Mark and label on the drawing the point P. [1]

(b) A second boat leaves B and sails on a bearing of 250° to a point, Q, which is north of A.
Mark and label on the drawing the point Q. [1]

(c) Find the actual distance between P and Q.

Answer ..... km [2]

22 $6p = \dfrac{2+5rq}{2r} + 7$

Rearrange the formula to make r the subject.

Answer ..... [3]

---

23 The line L_1 is parallel to $6y - 4x + 1 = 0$.

The line L_2 is a reflection of the line L_1 in the y-axis and cuts the x-axis at -12.

Explain clearly whether the area bounded by the line L_1, the line L_2 and the x-axis is greater or less than 100 square units.

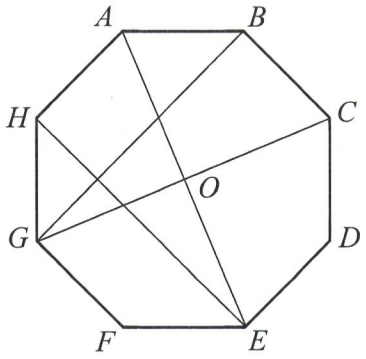
Answer

.....

..... [5]

---

24 *ABCDEFGH* is a regular octagon with centre *O*.
AE intersects *CG* at *O*.



(a) Show that triangle *AEH* is congruent to triangle *CGB*.

Answer

[3]

(b) Find angle *ACB*.

Answer ..... ° [2]

(c) The area of triangle *AEH* is 28 cm^2.
Find the area of the trapezium *EFGH*.

Answer ..... cm^2 [1]

25 The masses of some apples and oranges were recorded.
The results are shown in the stem-and-leaf diagram.

Apples							Oranges						
					9	8							
		6	5	2	0	10	0	1	1	2	*y*		
8	6	4	3	3	1	11	0	4	5	9			
	7	5	2	1	0	12	1	1	2	4	5	7	8
				8	0	13	0	2	3				
					2	14	3	4					

Key (Apples)
0 | 10 means 100 grams

Key (Oranges)
9 | 8 means 98 grams

(a) Find the range of the masses of the apples.

Answer ..... g [1]

(b) The interquartile range of the masses for the oranges is 19 grams.
Find *y*.

Answer $y =$ ..... [2]

(c) Calculate the percentage of apples with masses greater than 135 grams.

Answer ..... % [1]

(d) Fruits with masses greater than 135 grams are classified as Grade A.
Fruits with masses greater than 120 grams are classified as Grade B.
Use this information to make two comments comparing the grade classification of the apples and oranges.
Support your answer with relevant figures.

Answer .....

.....

.....

..... [3]

26 Aimee jogged twice a day on Monday, Tuesday and Wednesday.

On Monday, she jogged for 50 minutes in the morning and 15 minutes less in the evening.
On Tuesday, she jogged for 45 minutes in the morning and 10 minutes more in the evening.
On Wednesday, she jogged for x minutes in the morning and for another x minutes in the evening.

This information can be represented by the matrix $\mathbf{C} = \begin{matrix} \text{morning} & \text{evening} \\ \begin{pmatrix} 50 & -15 \\ 45 & 10 \\ x & 0 \end{pmatrix} & \begin{matrix} \text{M} \\ \text{T} \\ \text{W} \end{matrix} \end{matrix}$.

(a) On Monday, Aimee jogged at an average speed of 48 metres per minute.
On Tuesday, she jogged at an average speed of 49 metres per minute.
On Wednesday, she jogged at an average speed of 52 metres per minute.

Represent her average speeds in a 1×3 matrix **D**.

Answer $\mathbf{D} = \begin{pmatrix} & & \end{pmatrix}$ [1]

(b) Find, in terms of x, the matrix $\mathbf{E} = \mathbf{DC}$.

Answer $\mathbf{E} =$ [2]

(c) State what the first element of matrix **E** represents.

Answer .....

.....

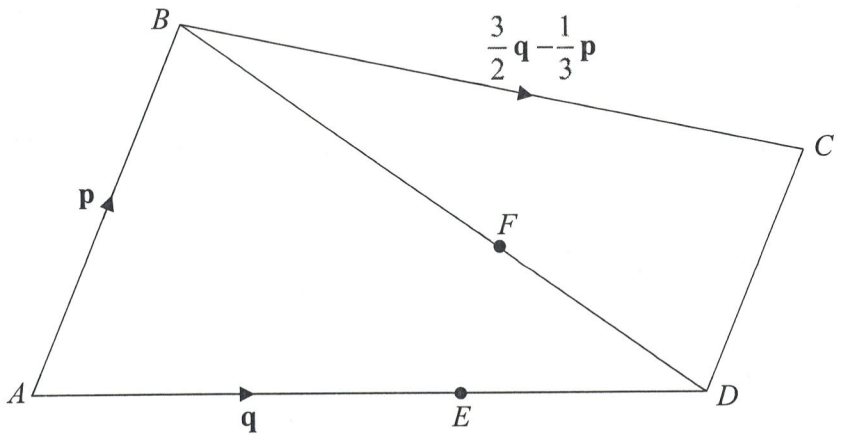
.....

..... [1]

(d) Aimee jogged for a total of 13.14 kilometres over the three days.
Calculate x.

Answer $x =$ ..... [2]

27



$ABCD$ is a quadrilateral.
E is a point on AD and F is a point on BD.
$\overrightarrow{AB} = \mathbf{p}$, $\overrightarrow{AE} = \mathbf{q}$ and $\overrightarrow{BC} = \frac{3}{2}\mathbf{q} - \frac{1}{3}\mathbf{p}$.
$AE : ED = 2 : 1$ and $5BF = 3BD$.

(a) Express $\overrightarrow{BD}$, as simply as possible, in terms of **p** and **q**.

Answer ..... [1]

(b) Express $\overrightarrow{AC}$, as simply as possible, in terms of **p** and **q**.

Answer ..... [1]

(c) Explain clearly why A, F and C lie on a straight line.

Answer

.....

.....

.....

..... [3]

(d) Find

(i) $\frac{AB}{CD}$,

Answer ..... [1]

(ii) area of triangle BFC : area of triangle AFD.

Answer ..... : ..... [1]

20

BLANK PAGE

SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR
O-LEVEL PROGRAMME

CANDIDATE NAME

CLASS 4

CENTRE NUMBER S

REGISTER NUMBER

INDEX NUMBER

MATHEMATICS 4052/02

Paper 2

Monday **26 August 2024** **2 hours 15 minutes**

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class, register number, centre number and index number 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 staples, paper clips, glue or correction fluid/tape.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

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 total of the marks for this paper is 90.

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.

For Examiner's Use

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

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

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

1 **(a)** Factorise $30n+10m-12n^2-4mn$ completely.

Answer ..... [2]

(b) **(i)** Express $7+4x+x^2$ in the form $p+(x+q)^2$.

Answer ..... [2]

(ii) Write down the equation of the line of symmetry of the graph of $y=7+4x+x^2$.

Answer ..... [1]

(c) Solve the equation $\frac{y}{y+5} = 1 - \frac{2y+1}{3}$.

Give your solutions correct to two decimal places.

Answer $y =$ ..... or ..... [4]

2 n families were surveyed to find out the number of children that they have.
The greatest number of children in each family is three.

A family is selected at random.

The table shows the probabilities of selecting a family with no children, 1 child or 2 children.

No. of children	0	1	2	3
Probability	0.25	0.1	0.35	

(a) Complete the table above to find out the probability of selecting a family with 3 children. [1]

(b) The number of families surveyed was a minimum.

(i) Explain clearly why $n = 20$.

.....

.....

.....

..... [2]

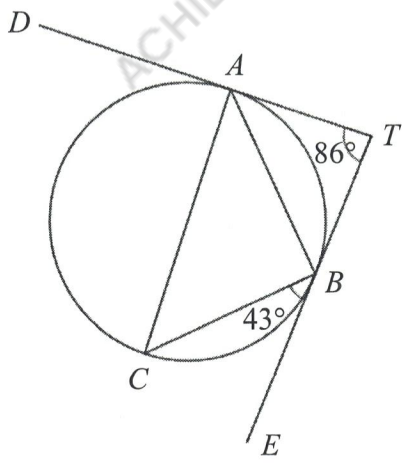
(ii) Two families are selected at random from the n families.
Find the probability that one family has no children and the other has 2 children.

Answer ..... [2]

(iii) A child is selected at random from the n families.
Find the probability that the child selected comes from the family with 2 children.

Answer ..... [2]

3



In the diagram, A, B and C are points on a circle.
DAT and EBT are tangents to the circle.
Angle $CBE = 43°$ and angle $ATB = 86°$.

(a) Show that AC is the diameter of the circle.
Give reasons for each step of your answers.

Answer

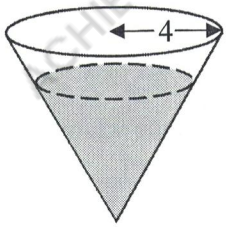
.....

..... [3]

(b) $AB = 10$ cm.
Calculate the circumference of the circle.

Answer ..... cm [3]

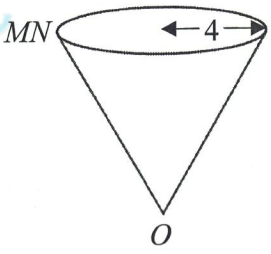
4

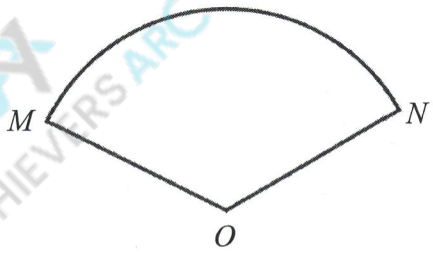


A conical paper cup of radius 4 cm has a capacity of 64π cm^3.
It is filled with water to a depth of $\frac{3}{4}$ the height of the cone.

(a) Find, in terms of π, the volume of the water in the cup.

Answer ..... cm^3 [2]





The water in the cup is emptied.
The cup is cut along its slant height from *MN* to *O* to form a sector *OMN* of a circle with centre *O*.

(b) Calculate angle *MON* in radians.

Answer ..... radians [5]

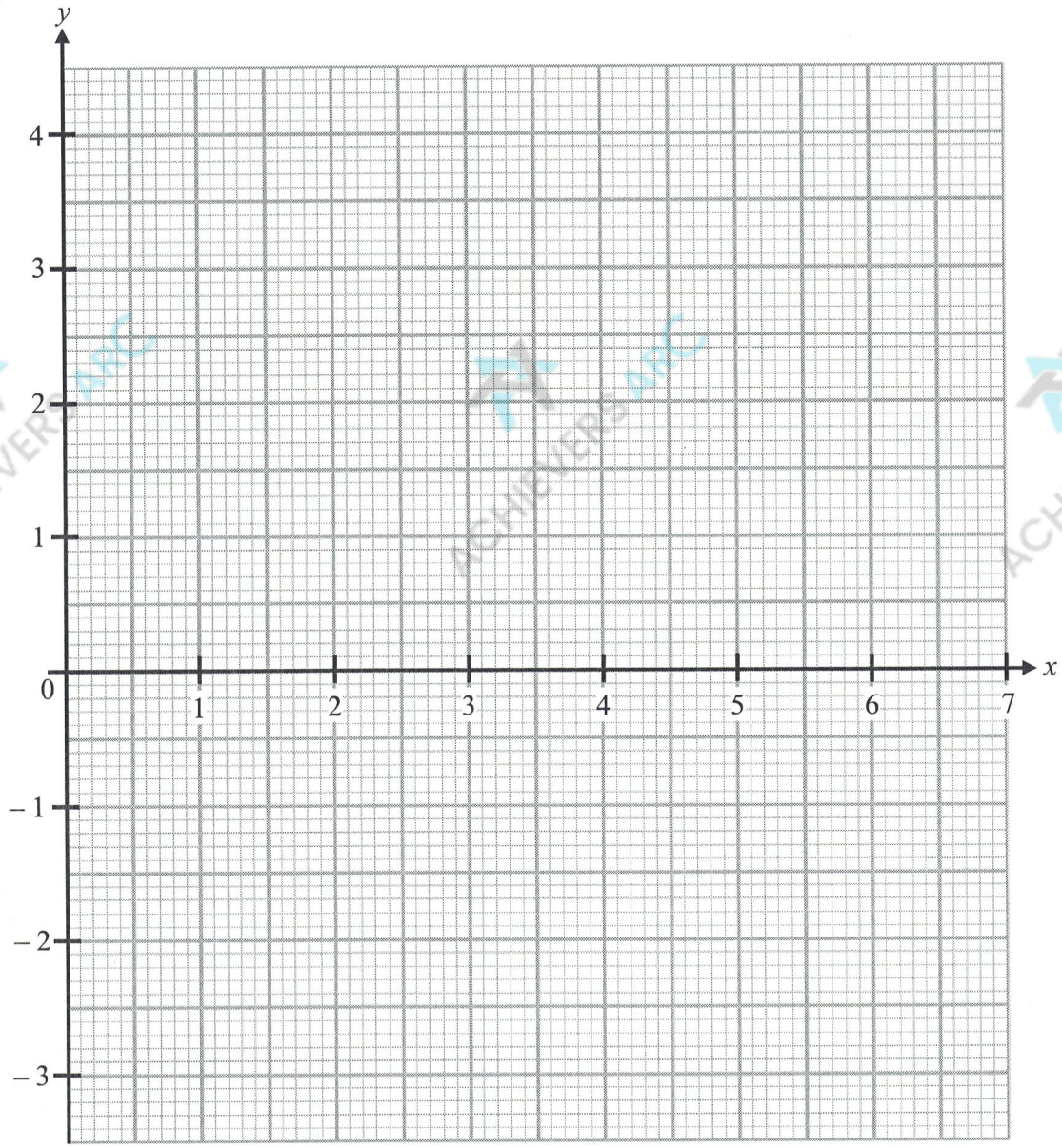
5 **(a)** Complete the table of values for $y = \frac{2}{x} + x - 5$.

Values are given to one decimal place where appropriate.

x	0.25	0.5	1	2	3	4	5	6	7
y	3.3	− 0.5	− 2	− 2		− 0.5	0.4	1.3	2.3

[1]

(b) On the grid, draw the graph of $y = \frac{2}{x} + x - 5$ for $0.25 \leq x \leq 7$. [3]



(c) Using the equation $y = \frac{2}{x} + x - 5$, explain clearly why the curve does not cross the y-axis.

.....

.....

..... [1]

(d) By drawing a tangent, find the gradient of the curve at $(1, -2)$.

Answer ..... [2]

(e) The equation $Ax^2 + Bx + 20 = 0$ can be solved by finding the points of intersection of the straight line $y = \frac{1}{5}x + \frac{1}{2}$ and the curve $y = \frac{2}{x} + x - 5$.

(i) Find the value of A and the value of B.

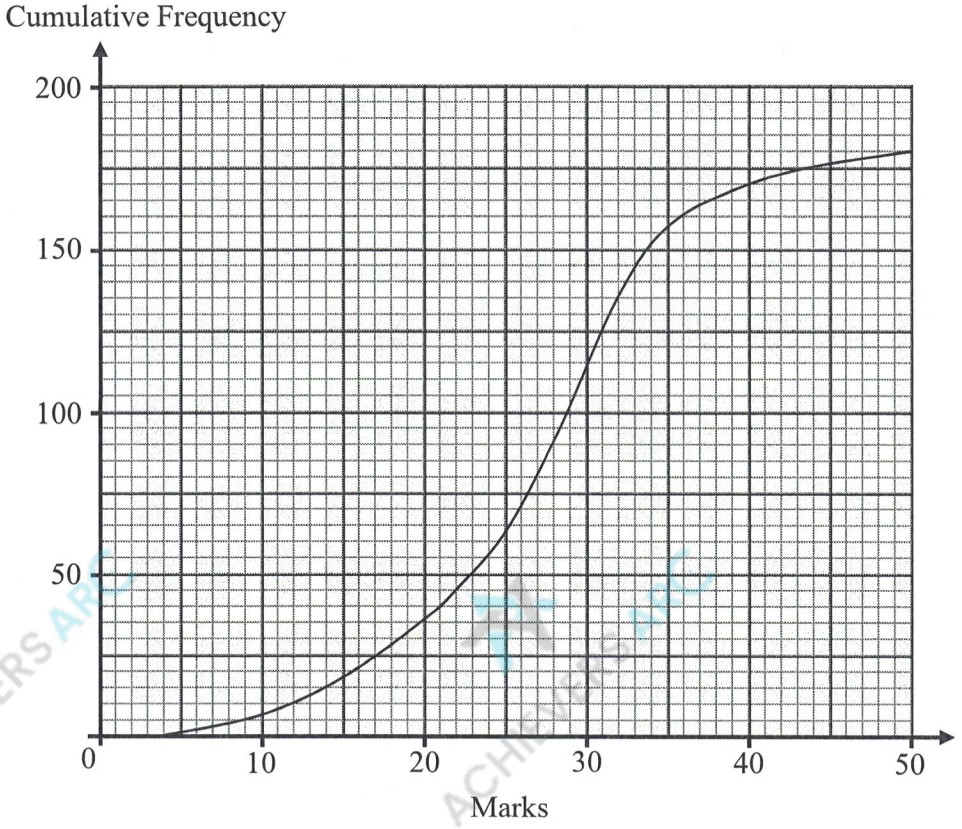
Answer $A =$ ....., $B =$ ..... [2]

(ii) By drawing the line $y = \frac{1}{5}x + \frac{1}{2}$, solve the equation $Ax^2 + Bx + 20 = 0$ for $0.25 \leq x \leq 7$.

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

6 In an Economics test, 180 students each took two papers, Paper 1 and Paper 2.
Both papers were marked out of 50.

The cumulative frequency curve shows the distribution of the marks for Paper 1.



(a) Use the curve to estimate, for Paper 1,

(i) the median mark,

Answer ..... [1]

(ii) the interquartile range.

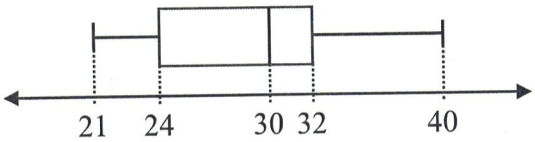
Answer ..... [2]

(b) Two students were chosen at random.
Find the probability that both of them scored 36 marks and below for Paper 1.

(c) Estimate the number of students who scored more than 80% of the maximum mark for Paper 1.

Answer ..... students [1]

The box-and-whisker plot below shows the distribution of the marks for Paper 2 for the same group of students.



Marks

(d) Estimate the number of students who scored between 30 and 32 marks for Paper 2.

Answer ..... students [1]

(e) Make two comparisons between the performance for Paper 1 and Paper 2.
Use figures to support your answer.

1. .....

.....

.....

.....

2. .....

.....

.....

..... [3]

7 **(a)** The population, P, of a colony of ants at the end of q months is given by the formula

$$P = 275\left(3^q\right).$$

(i) State the initial population of ants.

Answer ..... ants [1]

(ii) Explain the significance of the value 3 in the formula.

.....

..... [1]

(b) The cash price of a watch is \$6000.
Ling buys the watch on hire purchase.
She pays a deposit of 20% of the cash price.
She then pays the remaining amount in equal monthly payments for 30 months at a simple interest rate of 8% per year.

Calculate each monthly payment.

Answer \$ ..... [3]

(c) Mei invests \$6000 in an account paying compound interest at r% per year.
After 3 years, the money earns a **total interest** of \$320.

Calculate the value of r.

Answer $r =$ ..... [3]

(d) In January, the exchange rate between Thai baht (THB) and Singapore dollars ($) is THB 100 = $3.69.
Nur changed some Singapore dollars into Thai baht in January.
She received a total of THB 125 000.

In March, she brought all her Thai baht to Thailand to spend.
She saw a bag that costs THB 125 000 in Thailand.
Nur has the option to pay for the bag using her credit card which charges a conversion fee of 1.5% on the amount spent.
The credit card company uses an exchange rate of $100 = THB 2732.24.

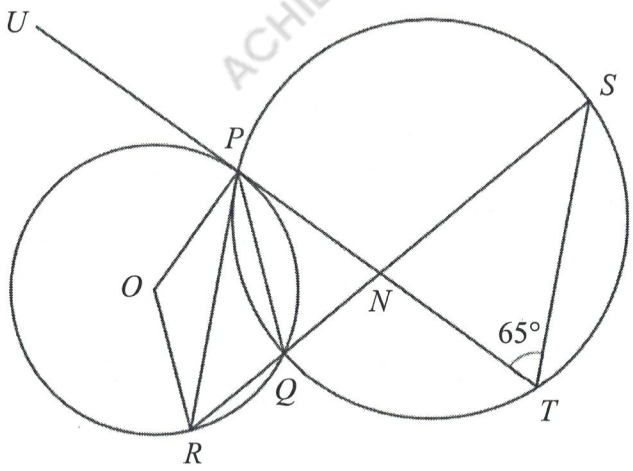
Is it more worthwhile for Nur to pay for the bag using cash or credit card?
You must show your calculations.

.....

.....

..... [3]

8



In the diagram, two circles intersect at points P and Q.
P, Q and R are points on the smaller circle, centre O.
P, S, T and Q are points on the larger circle.
$TNPU$ is a tangent to the smaller circle.
$RQNS$ is a straight line.
Angle $STU = 65°$.

(a) Find, giving reasons for each step of your working,

(i) angle PQR,

Answer ..... [2]

(ii) angle ORP.

Answer ..... [3]

(b) (i) Prove that triangle *STN* is similar to triangle *RPN*.

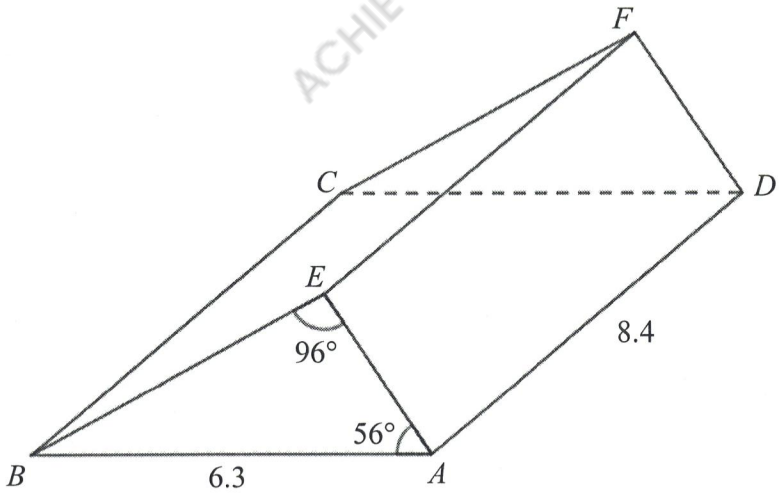
Answer

[3]

(ii) The ratio area of triangle *STN* : area of triangle *RPN* = 6 : 5.
RS = 17 cm.
Calculate the length of *NS*.

Answer ..... cm [2]

9



The diagram shows a prism $ABCDFE$.
Angle $AEB = 96°$ and angle $BAE = 56°$.
$AB = 6.3$ cm and $AD = 8.4$ cm.

(a) Calculate AE.

Answer ..... cm [2]

X is the point of intersection of AC and BD.
The angle of elevation of F from X is 29°.

(b) Show that $FX = 5.09$ cm, correct to 2 decimal places.

Answer

[3]

(c) Calculate angle *FDX*.

Answer ..... [3]

10 Due to the Earth's rotation, time zones were created to allow an area to observe a uniform standard time.
Each time zone is defined by a standard offset from Coordinated Universal Time (UTC).

Table 1 shows a list of cities in their UTC offset.

Table 1: Time zones in selected cities

City	Country	*UTC Offset
Dubai	United Arab Emirates	UTC +3
London	United Kingdom	UTC (0)
Melbourne	Australia	UTC +9
New York City	United States	UTC −5
Paris	France	UTC +1
Singapore	Singapore	UTC +7
Tokyo	Japan	UTC +8

**The UTC offset indicates the number of hours by which an area is ahead of or behind Coordinated Universal Time.*

(a) A live football match was screened at 0345 in Singapore on a particular Monday.
State the time and day that the same match was screened in London.

Answer Time: .....

Day: ..... [2]

Max needs to travel from his home in Singapore to Kobe, Japan, for a meeting scheduled on 8 October 2024 at the local time of 1400.
He does not want to incur overnight accommodation costs.

Information that Max needs to help him work out his transport expenses to Kobe can be found on pages 19 and 20.

Table 2: Daily flights from Singapore to Tokyo.

Departure City	Departure Time (Local)	Flight Duration	Arrival City	Arrival Time (Local)	Cost ($)
Singapore	0325	7 h 5 min	Tokyo	1130	1016.80
Singapore	0800	6 h 55 min	Tokyo	1555	1139.80
Singapore	0925	7 h 5 min	Tokyo		1139.80
Singapore	2250	6 h 55 min	Tokyo	0645	1189.80

(b) (i) Complete Table 2 to show the arrival time (local) of the flight that departs Singapore at 0925. [1]

Travel options from Tokyo to Kobe.

Train

First: 0600 Last: 1830 Frequency: every 30 minutes

Cost: $120 – $140

Distance: 344 miles

Average speed: 216 km/h

Useful information

1 mile = 1.60934 km

100 yen = $0.85

Driving

Distance: 331 miles Average speed: 85 km/h

Type of Car	Economy Car	Compact Car
Maximum no. of passengers	4	4
Rental Cost (per day)	$57	$67
Amount of fuel used (litres/100 km)	6	8
Average cost of fuel (per litre)	180 yen	

Max intends to take a taxi from his home to the airport in Singapore.
The estimated taxi fare is $20.

He then travels by plane to Tokyo.

To complete his journey, Max can choose to take a train or rent a car to drive to Kobe.

Max wants to plan his journey such that he has sufficient money to cover all his transport expenses regardless of whether he takes the train or drives to Kobe.

(b) (ii) Suggest a feasible flight departure date and time from Singapore that Max can take.
Recommend a sensible amount of money in dollars ($) that he needs for his total transport expenses from home to Kobe.

Justify any decisions you make and show your calculations clearly.

Continuation of working space for question **10(b)(ii)**.

.....

..... [7]

BLANK PAGE