YUAN CHING SECONDARY SCHOOL
Secondary Four Normal (Academic) Course
Preliminary Examination 2024

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS

4045/02

Paper 2

1 August 2024

Candidates answer on the question paper.

2 hours

READ THESE INSTRUCTIONS FIRST

Write your name, class 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 staple, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer **one** question.

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 70.

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.

	MARKS
Total	/ 70

This paper consists of **21** printed pages.

[Turn Over]

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Section A (62 marks)
Answer **all** the questions in this section.

1 **(a)** Evaluate $\dfrac{45.3}{0.0568 \times 16.5}$.

Answer ……. [1]

(b) y is directly proportional to the square of x.
Given that $y = 10$ when $x = 2$, find y when $x = 6$.

Answer y = ……... [2]

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2 **(a)** Write 0.006 013 74 in standard form, correct to 3 significant figures.

Answer ……. [1]

(b) Simplify $\left(\dfrac{x^6}{64}\right)^{-\frac{2}{3}}$.

Answer ……. [2]

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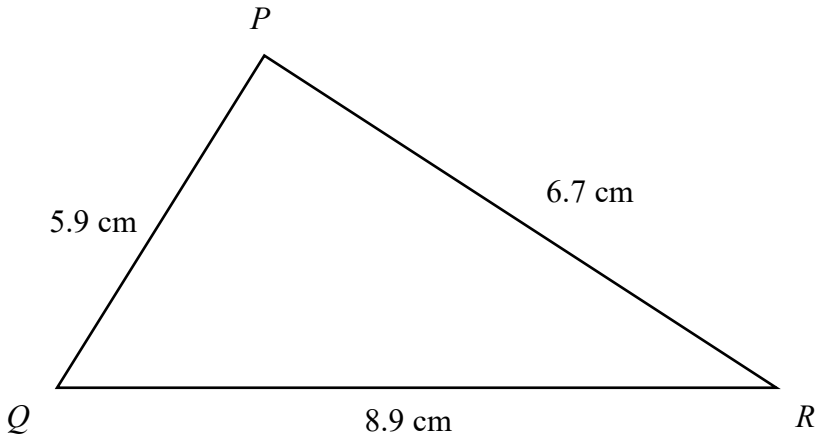
3 **(a)** The interior angle of a regular polygon is $165°$.
Find the number of sides of the polygon.

Answer …… sides [2]

(b) The diagram below shows triangle *PQR*.



Determine if triangle *PQR* is a right-angled triangle.
Show your working clearly.
Answer

……

……

…… [2]

4 Mr Wong travels from Singapore to Japan.
He exchanges Singapore dollars ($) $1500 into Japanese Yen (¥) when the exchange rate is $1 = ¥115.98.

(a) How much Japanese Yen (¥) does he have?

Answer ¥……. [1]

(b) In Japan, Mr Wong spends ¥23 370.
On his return, he exchanges the remaining Japanese Yen (¥) into Singapore dollars ($) when the exchange rate is $1 = ¥116.25.
How many Singapore dollars does he receive?

Answer $ …… [2]

5 **(a)** Solve the simultaneous equations.

$$6x + 2y = -2$$
$$4x - 3y = 29$$

Answer x = ……...

y = ……... [3]

(b) Two car rental companies charge the following values of y for x km driven.

Company A: $y = 3x + 150$
Company B: $y = 4x + 100$

(i) Which rental company has a higher initial fee?

Answer Company …… [1]

(ii) Calculate the driven distance for the cost of the two companies to be the same.

Answer ……... km [2]

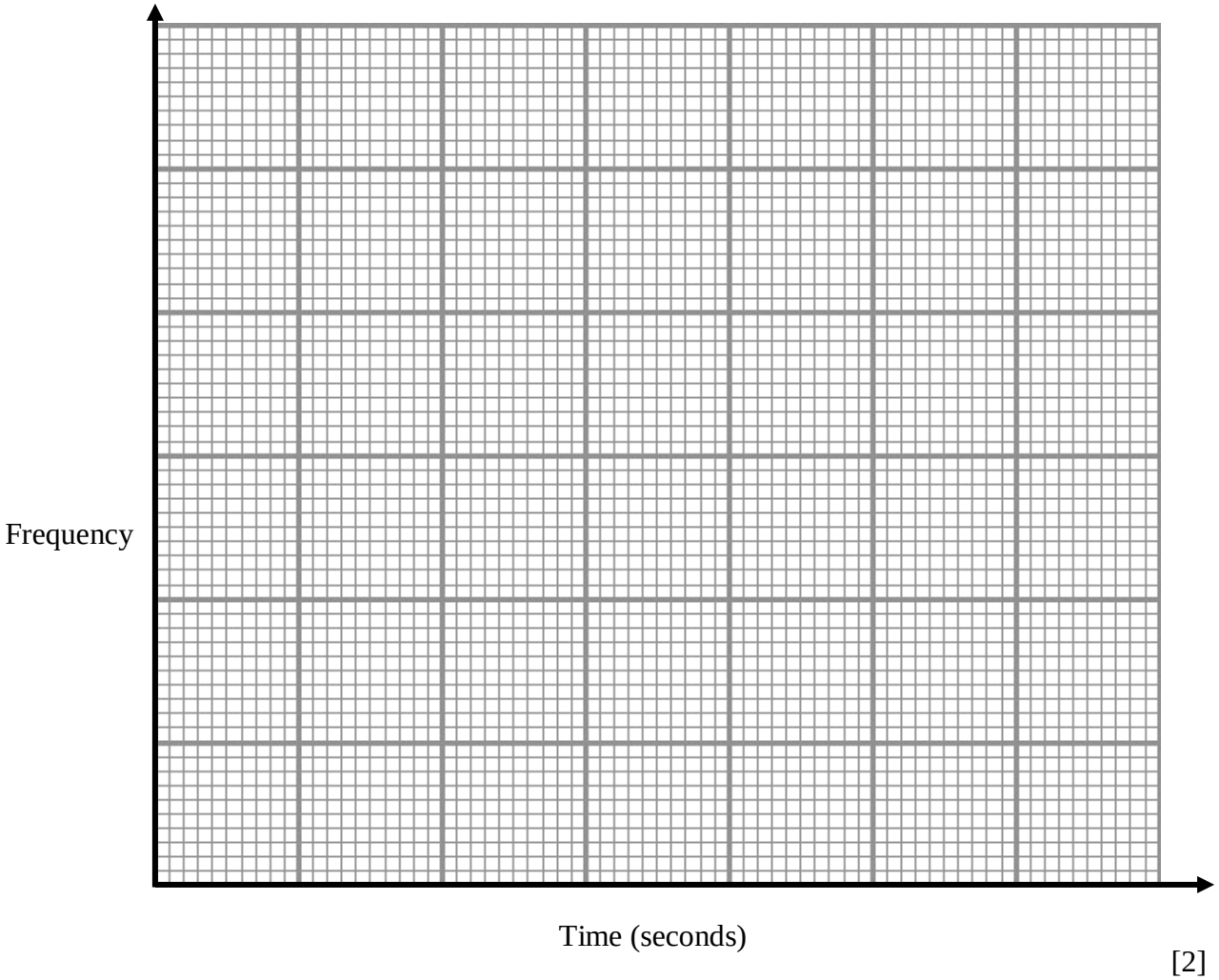
(c) A water balloon is launched into the air so that the height, h metres, after t seconds is $h = -4t^2 + 27t + 2$.
Calculate the time taken for the water balloon to burst as it hits the ground.

Answer …….. s [3]

6 The table gives information about the time spent, in minutes, by 50 students revising Mathematics on Sunday.

Time spent (x minutes)	**Frequency**
$0 < x \leq 15$	12
$15 < x \leq 30$	25
$30 < x \leq 45$	8
$45 < x \leq 60$	5

(a) On the grid, draw a histogram to represent this information.



[2]

(b) State the modal time interval.

Answer ..... [1]

Calculate an estimate of the

(c) **(i)** mean time,

Answer …….. min [2]

(ii) standard deviation time.

Answer …….. min [1]

(d) Find the percentage of students who spent more than 30 minutes revising Mathematics on Sunday.

Answer …….. [1]

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7 This table of values is for $y = x^3 - 6x + 1$.

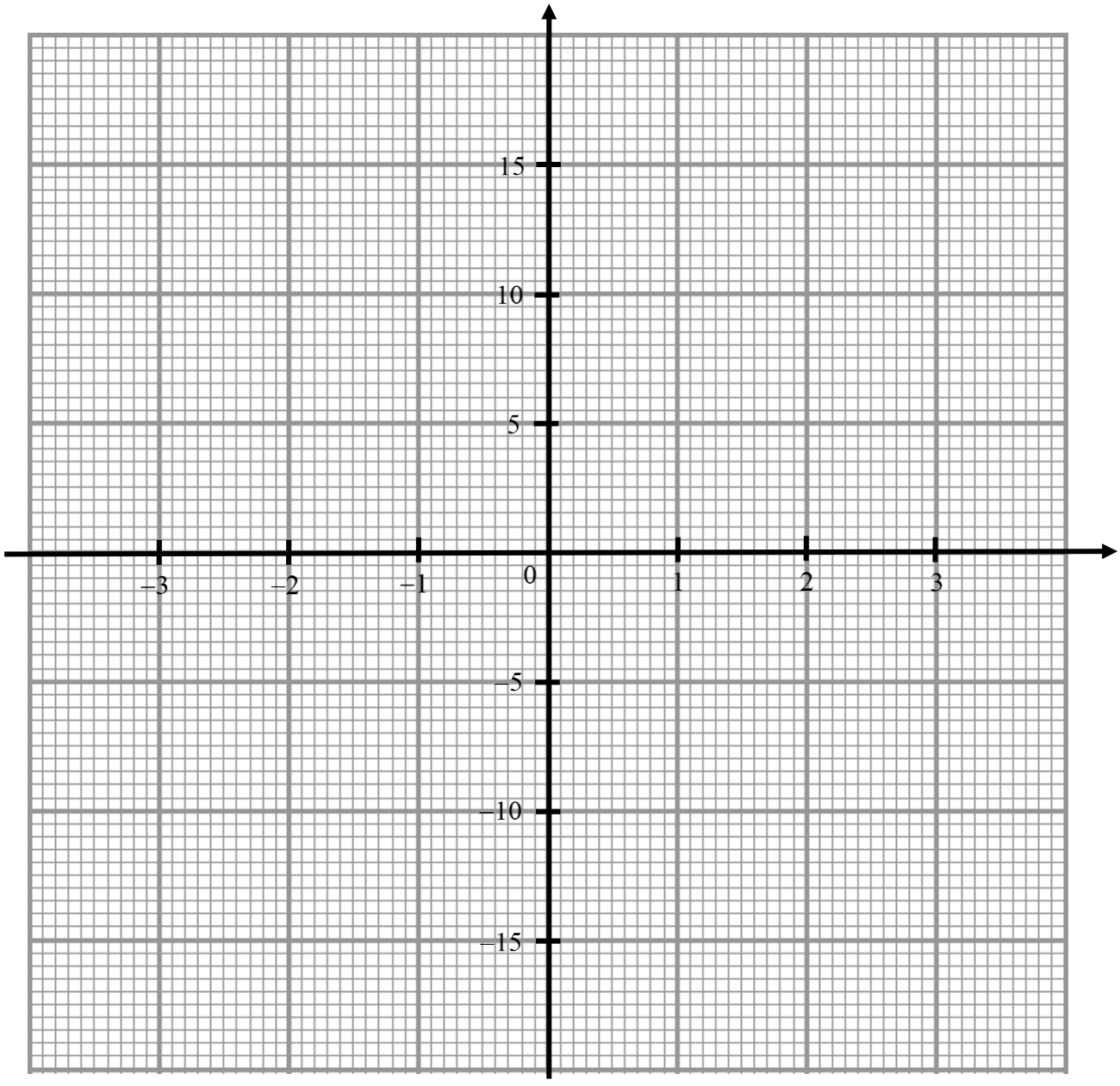
x	–3	–2	–1	0	1	2	3
y	–8	a	6	1	–4	b	10

(a) Calculate the value of a and the value of b.

Answer a = ……...

b = ……... [2]

(b) Draw the graph of $y = x^3 - 6x + 1$ for $-3 \leq x \leq 3$.



[3]

(c) Use your graph to find the largest value of x when $y = 2.5$.

Answer x = ……... [1]

(d) By drawing a tangent, estimate the gradient of the graph of $y = x^3 - 6x + 1$ when $x = 2$.

Answer ……. [2]

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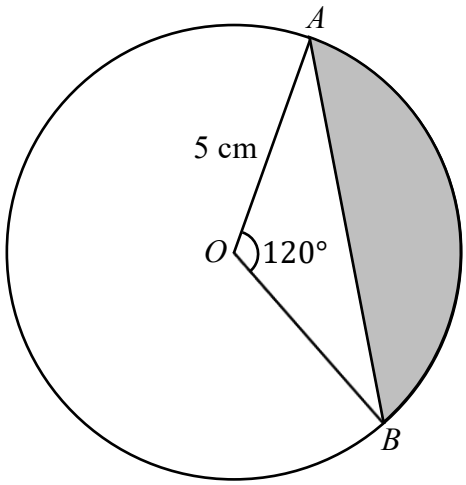
8 **(a)** Expand and simplify $(3x - 2)^2$.

Answer ……. [2]

(b) Factorise completely $8x^2 - 18y^2$.

Answer ……. [2]

9



A circle has centre O and radius 5 cm.
Minor sector AOB has an angle of $120°$.

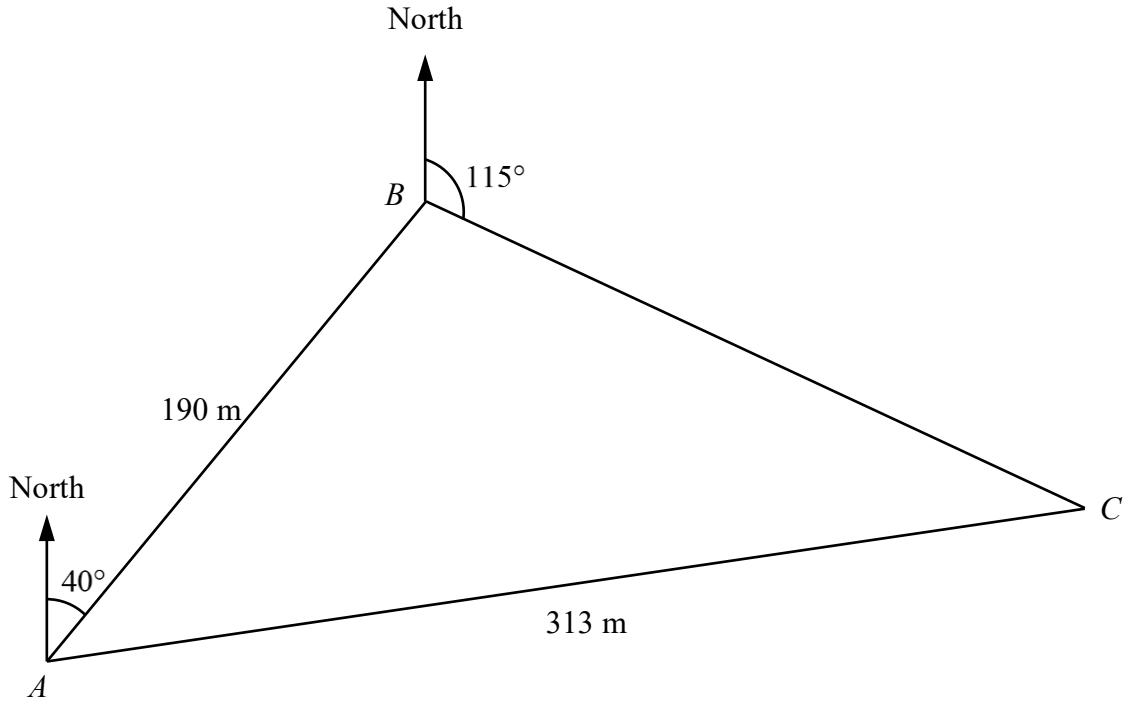
(a) Find the perimeter of major sector AOB.
Give your answer in the form $p\pi + q$.

Answer ……... cm [3]

(b) Find the area of the shaded segment.

Answer …….. cm^2 [3]

10



Mr Tan walks 190 m on a bearing of $040°$ from his office building at point *A* to the hawker centre at point *B* for lunch.
He then walks on a bearing of $115°$ from the hawker centre to a café at point *C* for a cup of coffee.

(a) Mr Tan looks up to his office from the café, which is 313 m away, at an angle of elevation of $23°$.
Calculate the vertical height of his office building.

Answer ……..... m [2]

(b) Calculate the bearing of *A* from *C*.

Answer ……..... ° [5]

11 James and Susan are preparing for a triathlon.
The triathlon comprises three activities, swimming, cycling and running.
The tables below provide information about the triathlon.

Activities	Distance
Swim	1500 m
Cycle	40 km
Run	10 km

	Cumulative Timings (x)	
Award / Gender	**Male**	**Female**
Gold	x < 2 h 10 min	x < 2 h 40 min
Silver	2 h 10 min ≤ x < 2 h 30 min	2 h 40 min ≤ x < 3 h 00 min
Bronze	2 h 30 min ≤ x < 2 h 50 min	3 h 00 min ≤ x < 3 h 20 min
Consolation	x ≥ 2 h 50 min	x ≥ 3 h 20 min

(a) Calculate the total distance covered, in kilometres, during the triathlon.

Answer ....…...…..…….... km [1]

(b) James's cumulative time for completing the three activities is 135 minutes.
State the award that he can obtain.

Answer ....…...…..……..... [1]

	Average speed (km / h) (y)		
Intensity / Activities	**Swimming**	**Cycling**	**Running**
With intense training	$3 < y \leq 5$	$22 < y \leq 30$	$8 < y \leq 11.9$
Without intense training	$0 < y \leq 3$	$0 < y \leq 22$	$0 < y \leq 8$

From past triathlons, the range of Susan's average speed for each of the activities is recorded in the table above.
Due to time constraints, Susan only has time to train intensely for one of the sports, which will allow her to improve her speed.

(c) Calculate the shortest amount of time, in hours, Susan requires to complete the cycling activity without intense training. Leave your answer in fraction.

Answer ……..……..…….. h [2]

(d) Susan plans to train intensively for either swimming or running.
Which should she decide on? Justify your decision with calculations.

Answer

……...

……... [4]

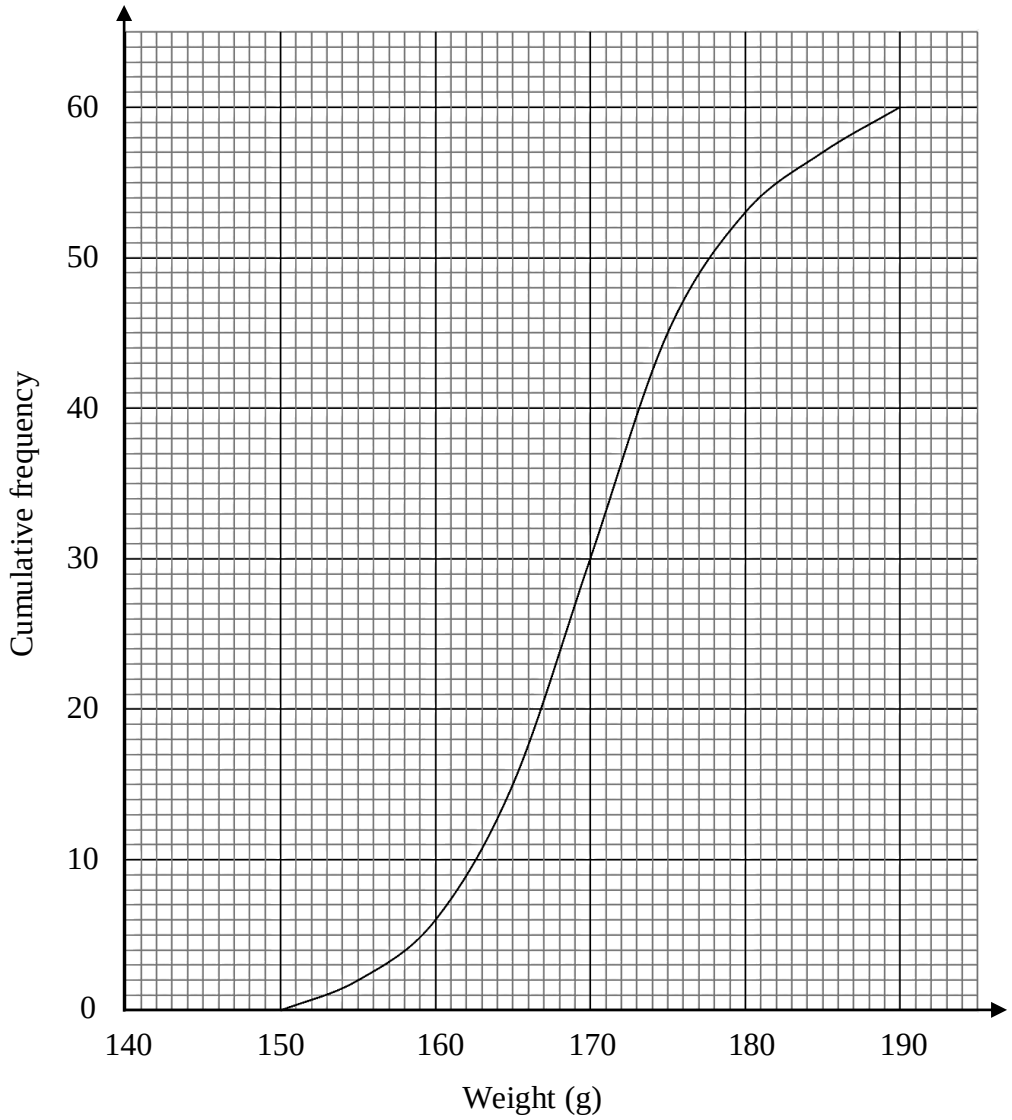
Section B (8 marks)

Answer **one** question from this section. Each question carries 8 marks.

12 Ah Seng owns a farm that grows tomatoes.
This year, he separates his tomato plants into two groups, Group A and Group B.

Ah Seng gave fertiliser to the tomato plants in Group A and weighed the 60 tomatoes from Group A.
The cumulative frequency graph shows some information about the weights of the tomatoes.

Cumulative frequency graph for tomato weights in Group A



Use the graph to estimate

(a) (i) the median weight,

Answer …….. g [1]

(ii) the interquartile range,

Answer …….. g [2]

(iii) the number of tomatoes that are more than 182g.

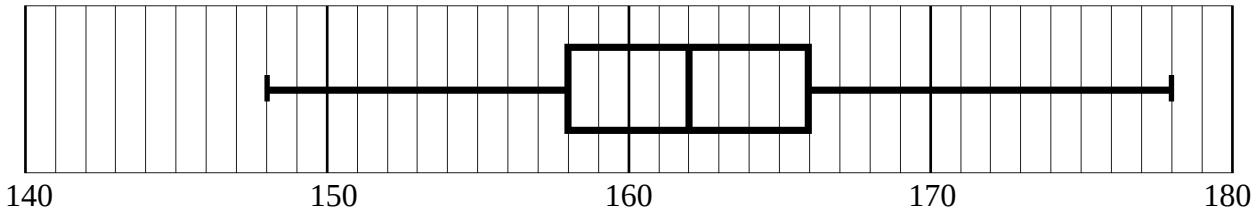
Answer …….. tomatoes [1]

(b) Calculate the percentile of a tomato weighing 177g.

Answer ……. % [2]

(c) Ah Seng did not give fertiliser to the tomato plants in Group B.
He weighed the 60 tomatoes from Group B.
The box-and-whiskers plot below shows the results collected.

Box-and-Whiskers plot for tomato weights in Group B



Compare the distribution of the weights of the tomatoes from Group A with the distribution of the weights of the tomatoes from Group B.

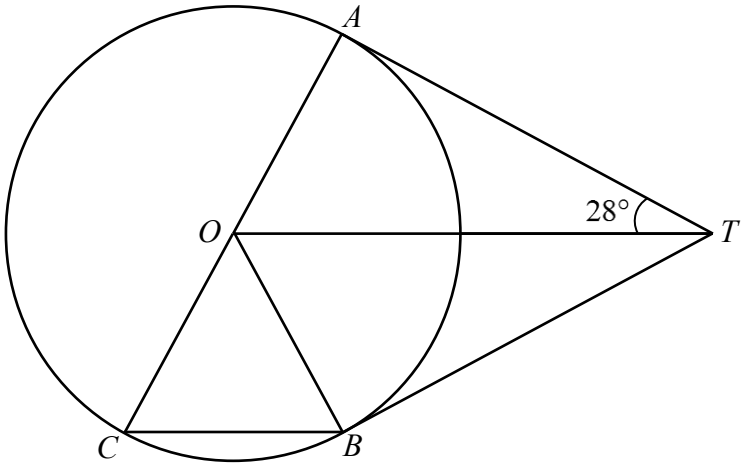
Answer ……...

…….

…….

……. [2]

13 (a)



A, *B* and *C* are points on the circumference of a circle with centre *O*.
TA and *TB* are tangents to the circle.
AC is the diameter of the circle and angle $OTA = 28°$.

Find, stating your reasons clearly,

(i) angle *AOB*,

Answer ……..... ° [2]

(ii) angle *OBC*.

Answer ……..... ° [2]

(b) A bag contains 5 red marbles, 3 blue marbles and 2 green marbles.
Jasmine takes one marble at random from the bag and puts it on the table.
She then takes a second marble at random from the same bag.

Calculate the probability that the two marbles are

(i) the same colour,

Answer ……. [3]

(ii) of different colours.

Answer ……. [1]

----- END OF PAPER -----

Efforts Today, Rewards Tomorrow

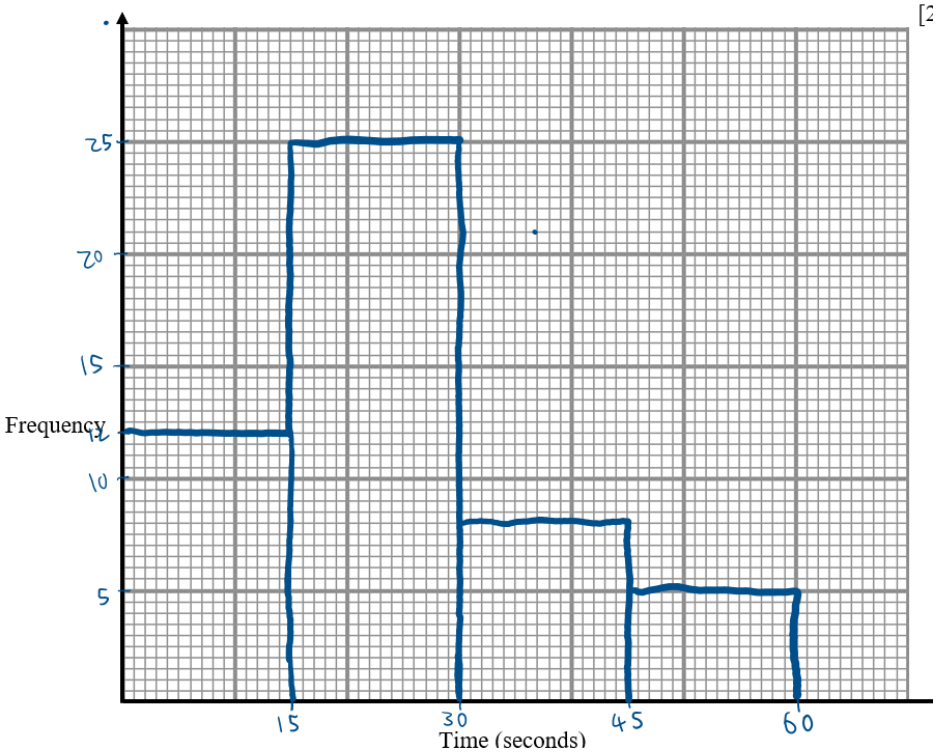
Answer Key

Q1	a) 48.3	**Q11**	a) 51.5
	b) 90		b) Silver Award
Q2	a) 6.01×10^{-3}		c) $1\frac{9}{11}$
	b) $\frac{16}{x^4}$		d) Running
Q3	a) 24	**Q12**	ai) 170
	b) No		aii) 10
Q4	a) 173 970		aiii) 5
	b) 1295.48		b) 81.7
Q5	a) $x=2, y=-7$		c) Group A heavier Group B more consistent
	bi) Company A	**Q13**	ai) 124
	bii) 50		aii) 62
	c) 5.60		bi) $\frac{14}{45}$
Q6	a) See below		bii) $\frac{31}{45}$
	b) $15<x\leq30$		
	ci) 24.3		
	cii) 13.3		
	d) 26		
Q7	a) $a=5, b=-3$		
	b) See below		
	c) 2.7		
	d) 6		
Q8	a) $9x^2-12x+4$		
	b) $2(2x+3y)(2x-3y)$		
Q9	a) $6\frac{2}{3}\pi+10$		
	b) 15.4		
Q10	a) 133		
	b) 259.1		

Q6a:

(a) On the grid, draw a histogram to represent this information.

[2



Q7b: