HUA YI SECONDARY SCHOOL
PRELIMINARY EXAM 2024

4-G2

NAME

CLASS

INDEX NUMBER

MATHEMATICS 4045/02

PAPER 2

05 August 2024

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Name, Class and Index Number in the spaces provided 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 staples, paper clips, 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.

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 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 your answers in degrees to one decimal place.
For π, use either your calculator value, or 3.142.

For Examiner's Use
70

This document consists of **19** printed pages and **1** blank page.

Setter: Ms Shirlynn Khoo

[Turn Over

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Section A (62 marks)

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

1 Written as the product of its prime factors, $396 = 2^2 \times 3^2 \times 11$.

(a) **(i)** Explain why 396 is not a perfect square.

……..

…….. [1]

(ii) Find the smallest positive integer value of k such that $396k$ is a perfect cube.

Answer k = ……..…… [1]

(b) **(i)** Express 2100 as the product of its prime factors.

Answer ……..…….. [2]

(ii) Hence find the highest common factor of 396 and 2100.

Answer ……..…….. [1]

2 A train travels with a speed of 70 km/h for 2.5 hours. It then travels for 2 hours at x km/h. Given that the average speed of the train for the whole journey is 80 km/h, find the value of x.

Answer $x =$ ……. [3]

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3 \$10 000 is placed in an account, earning compound interest of p % per annum. At the end of 2 years, the total amount in the account is \$10506.25.
Calculate p.

Answer $p =$ ……. [3]

4 Factorise the following expressions completely

(a) $2x^2 - 9x - 5$,

Answer ……..…….. [2]

(b) $2x^2 - 18y^2$.

Answer ……..…….. [2]

---

5 On a map, a length of 5 cm represents an actual distance of 1 km. Find

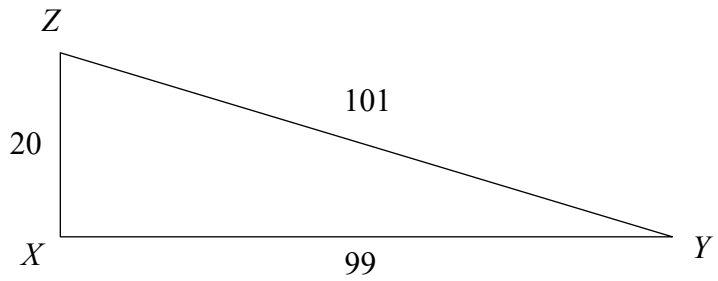
(a) the scale of the map, in the form of 1 : *n*,

Answer ……..……... [1]

(b) the area on the map, in cm^2, which represents an actual area of 8 km^2.

Answer …….. cm^2 [2]

6



XYZ is a triangle where $XZ = 20cm$, $XY = 99cm$ and $YZ = 101cm$.

(a) Is XYZ a right-angled triangle? Explain, showing your working clearly.

Answer

[2]

(b) Find the shortest distance from X to YZ.

Answer …… cm [3]

7 Leticia throws a fair 6-sided die and a fair coin together.

(a) Draw a tree diagram in the space below to display all the possible outcomes. [2]

Answer

(b) Find the probability of obtaining

(i) a prime number and a tail,

Answer ……..……... [1]

(ii) a ‘7’ and a tail.

Answer ……..……... [1]

8 The variables of x and y are connected by the equation $y = 2x^2 - 5x - 4$.
Some corresponding values of x and y are given in the following table.

x	-3	-2	-1	0	0.5	1	2	3	4	5
y	29	14	p	-4	-6	-7	-6	-1	8	21

(a) Calculate the value of p.

Answer $p =$ ……. [1]

(b) Draw the graph of $y = 2x^2 - 5x - 4$ for $-3 \le x \le 5$ on the grid provided on the next page. [2]

(c) Use your graph to find the values of x when $y = 15$.

Answer $x =$ ……. , ……. [2]

(d) Explain why it is not possible to find a value of x when $y = -15$.

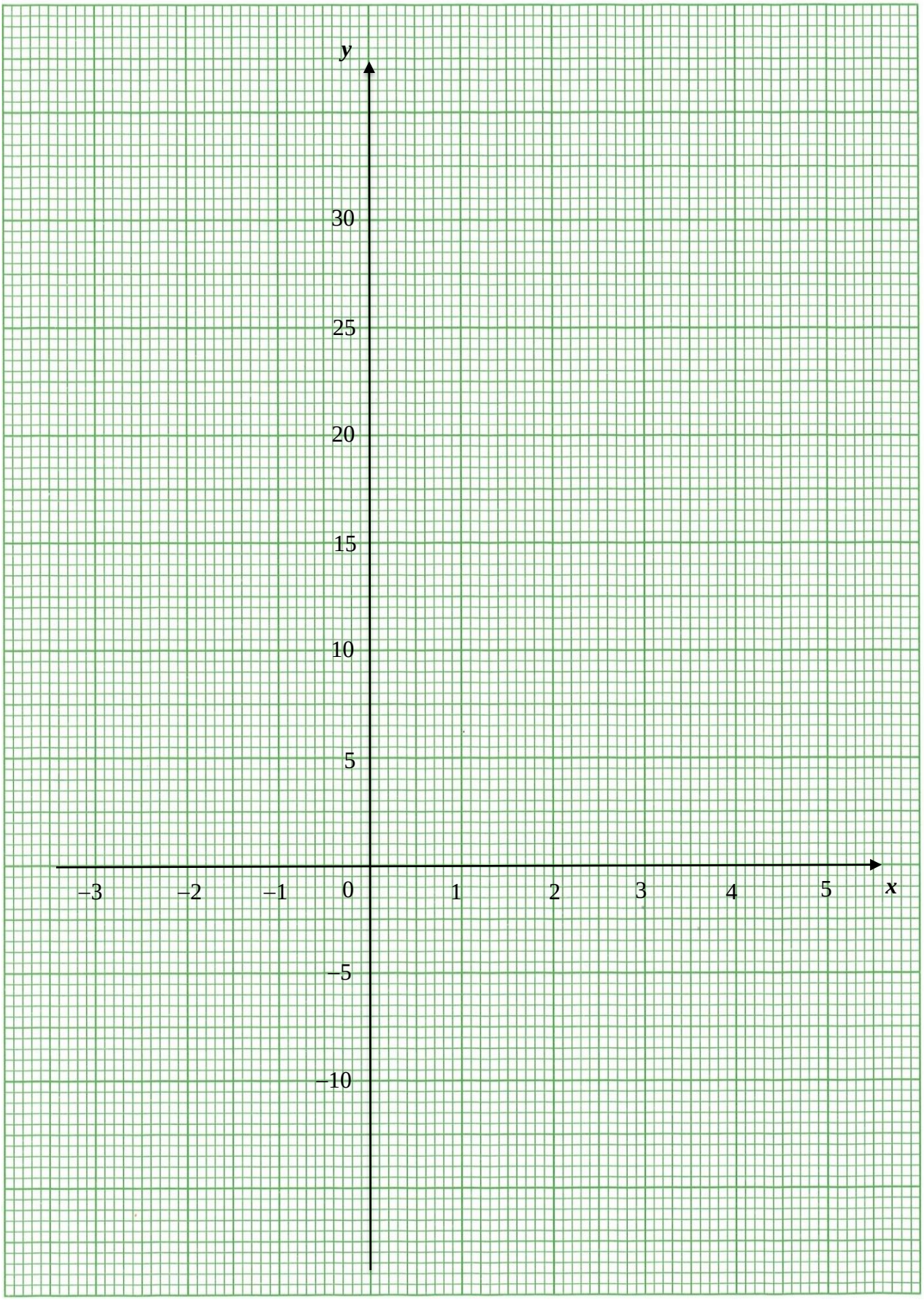
Answer

……

……. [1]

(e) By drawing a suitable tangent, find the gradient of the curve when $x = 2$.

Answer ……... [2]


y
30
25
20
15
10
5
−3
−2
−1
0
1
2
3
4
5
x
−5
−10

9 At the Great Singapore Sale, Caleb paid \$300 for x number of T-shirts. He plans to sell the T-shirts, at which he will make a profit of \$1.50 on each T-shirt.

(a) Write down, in terms of x, expressions for the

(i) amount of money that Caleb paid for each T-shirt,

Answer \$ ……..…… [1]

(ii) price at which he plans to sell each T-shirt.

Answer \$ ……..…… [1]

(b) However, Caleb later discovered that 30 of the T-shirts either had holes or stains on them so he kept them for other use. He sold the remaining T-shirts. After selling all the T-shirts, he found that his sale amounted to \$360. Form an equation in x and simplify it to $x^2 - 70x - 6000 = 0$. [3]

Answer

(c) Solve $x^2 - 70x - 6000 = 0$.

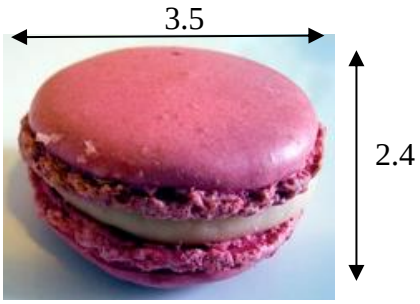
Answer $x =$ ……..…… , …… [3]

(d) Explain why one of the answers in **(c)** has to be rejected.

Answer

…… [1]

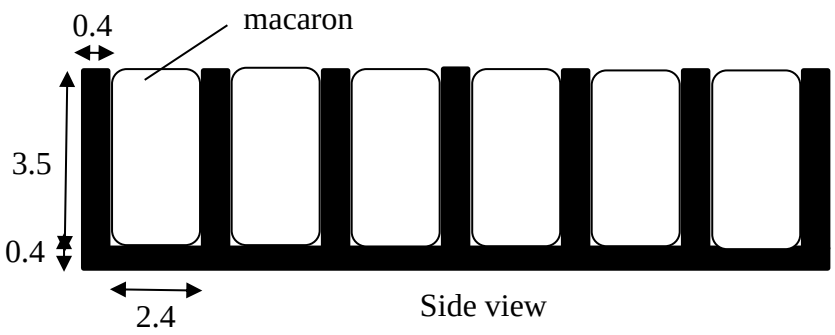
10 Janet has been a home-baker since the Covid-19 period. She bakes macarons, which take the estimated shape of a cylinder. The diameter of her macaron is 3.5 cm and its thickness is 2.4 cm.

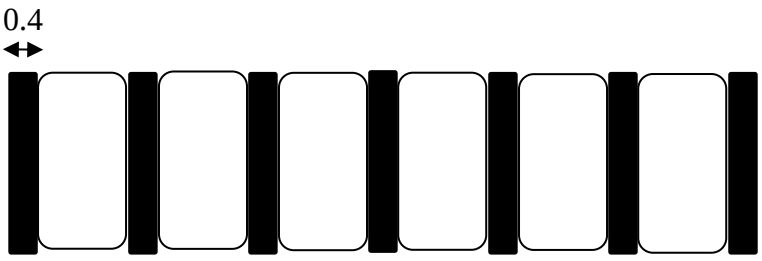


(a) Calculate the estimated volume of each macaron.

Answer …….. cm^3 [1]

Janet sells her macarons in boxes of 6.
Every 6 macarons are packed in an opened top six-pocketed thermoformed pockets, with a thickness of 0.4 cm to separate one macaron from another as shown in the diagram below.
Each of these pockets in the six-pocketed thermoformed pockets was created to fit in the macarons of dimensions stated above.





(b) Find the volume occupied by air in each single row of 6 macarons packed in the six-pocketed thermoformed pockets.

Answer …….. cm^3 [2]

Janet also custom-makes boxes and paper bags to pack the macarons from the same supplier that creates the thermoformed pockets. The prices quoted by the supplier are as shown.

Items	**Pricing**
six-pocketed thermoformed pockets	$2.80 each
box for 6 macarons	$1.65 per box
paper bag	$0.40 each

In her recipe, every 12 macarons require the following amount of ingredients.

Ingredients	**Mass required (in grams)**
almond flour	65
powdered sugar	65
castor sugar	45
egg whites	60

- Each egg is estimated to contain an average of 30 grams of egg white

The price list of a store she purchases her baking ingredients from is shown below.

Items	**Pricing**
1kg of almond flour	$30
1kg of powdered sugar	$2.50
800 g of castor sugar	$2.60
a dozen of eggs	$2.50

Janet provides delivery to her customers with the delivery costs shown below.

Purchase Amount	**Delivery cost**
below $50	$15
above $50	$10
for bulk orders, above $200	Free

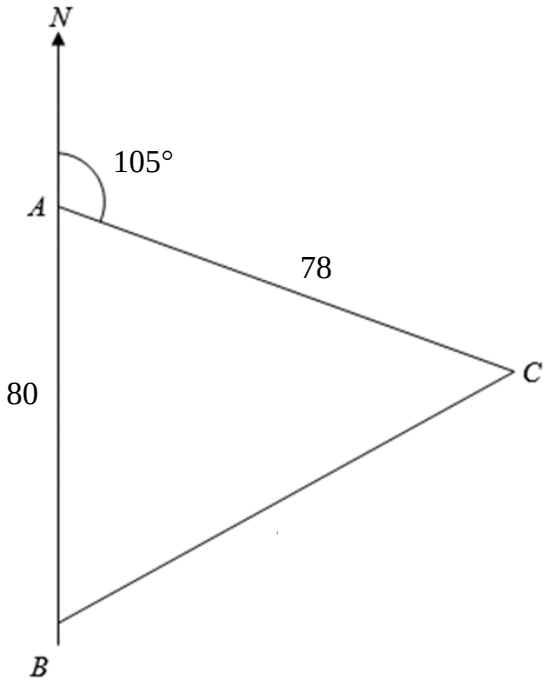
(c) **(i)** What is Janet's cost price of making and packing one box of macarons?

Answer $ …….. [4]

(ii) How much should Janet charge a customer who orders 72 macarons should she want to make a profit of 30%? Round off your answer to the nearest dollar.

Answer $ …….. [3]

11 Three points *A*, *B* and *C* are on level ground such that *A* is due north of *B*. $AB = 80m$, $AC = 78m$ and the bearing of *C* from *A* is $105°$.



Find

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

Answer ……..…° [1]

(b) $\angle ACB$,

Answer ……..…° [3]

(c) area of triangle *ABC*.

Answer ……..……. m^2 [2]

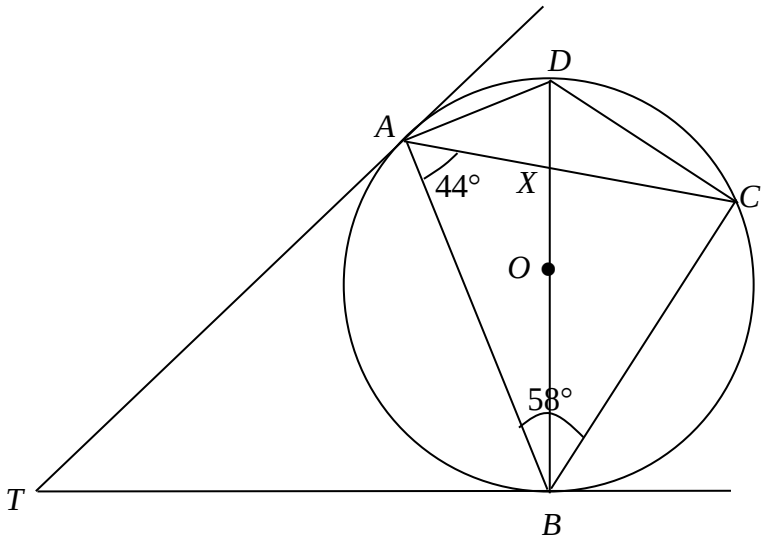
(d) A hot air balloon hovers 180m vertically above *A*. Calculate the angle of elevation of the hot air balloon from *C*.

Answer ……..……..…° [2]

Section B (8 marks)

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

12



In the figure above, *A*, *B*, *C* and *D* lie on the circle. *BD* is a diameter. *AT* and *BT* are tangents to the circle. $\angle BAC = 44°$ and $\angle ABC = 58°$.

(a) Find these angles, giving a reason for each.

(i) $\angle BDC$,
Answer

$\angle BDC =$ ……. Reason …….

…… [1]

(ii) $\angle ADC$.
Answer

$\angle ADC =$ ……. Reason …….

…… [1]

(b) Find the following angles, stating your reasons clearly.

(i) $\angle ABD$,

Answer ……..……..…° [2]

(ii) $\angle ATB$.

Answer ……..……..…° [3]

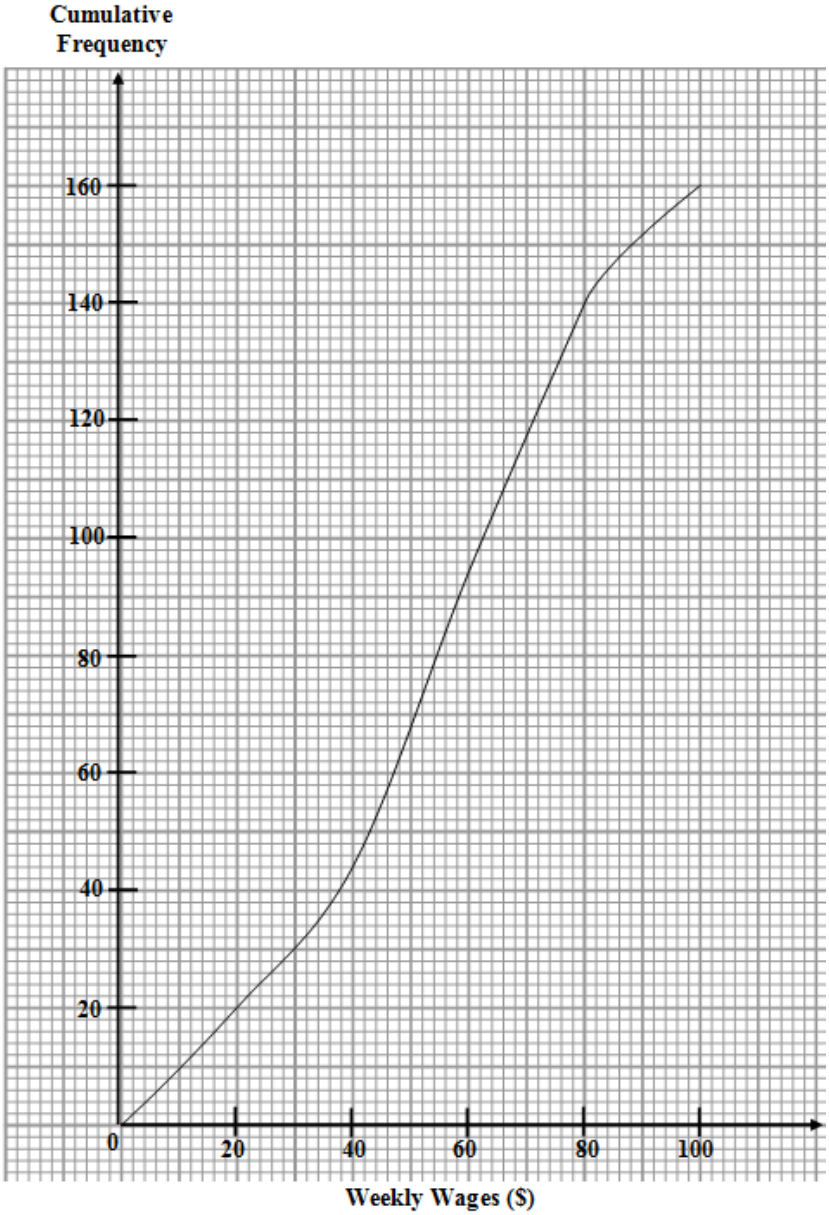
(c) Explain why $\angle OTB$ is equal to $\angle OTA$.

Answer

……...…….

…… [1]

13 The weekly wages of 160 workers in company *A* are shown in the cumulative frequency curve below.



(a) Use the graph to estimate the

(i) median wage,

Answer $..... [1]

(ii) inter-quartile range,

Answer $..... [2]

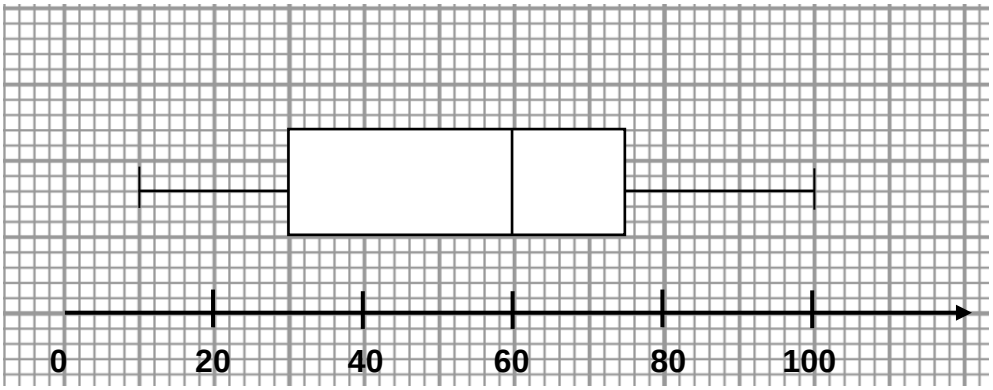
(iii) 70^{th} percentile.

Answer $..... [1]

(b) A full-time worker is one who earns more than \$60 per week. Calculate the probability of selecting two such workers at random for a particular job.

Answer ……..…….. [2]

(c) The weekly wages of another 160 workers working in company *B* is represented in the following box and whisker diagram.



Weekly Wages (\$)

(i) Give one reason why you may choose to work in company *A*.
Answer

……...

……... [1]

(ii) Give one reason why you may choose to work in company *B*.
Answer

……...

……... [1]

End of Paper

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