ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2024

SECONDARY 4 EXPRESS / 4 NORMAL (ACADEMIC) SBB / 5 NORMAL (ACADEMIC)

Candidate's Name	Class	Register Number

MATHEMATICS

PAPER 1

4052/01

21 August 2024

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use paper clips, glue or correction fluid.

Answer **all** the 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 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.

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 **90**.

90

Setter: Ms Estee Teo
Vetter: Mr Francis Tan

This question paper consists of **18** printed pages (including this cover page)

[Turn over]

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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

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

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

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)** Expand and simplify $2a-3(a+5b)$.

Answer ..... [1]

(b) Factorise completely $-3x^2+12y^2$.

Answer ..... [2]

---

2 **(a)** Calculate $\dfrac{5048.9^2-30140}{14.69+9.656}$.

Write your answer correct to 5 significant figures.

Answer ..... [1]

(b) Write your answer to **part (a)** in standard form.

Answer ..... [1]

---

3 Given that $\sin\theta = 0.4$, find the two possible values for angle θ, where $0° \le \theta \le 180°$.

Answer θ = ... or ..... [2]

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4 (i) A stack of coloured paper contains green, purple and blue sheets of paper.
A piece of paper is selected at random from the stack.
The probability that the paper is green is 10%.
The probability that the paper is purple is $\frac{7}{20}$.
Find the probability that the paper is blue.

Answer ..... [1]

(ii) A few pieces of green paper were added to the stack.
The probability of picking a piece of purple paper from this stack at random is now $\frac{1}{3}$.

If there were 120 sheets of paper initially, find the new probability of picking a blue piece of paper.

Answer ..... [3]

---

5 5.4 4.8 7.8 6.4 1.9 9.3 6.3 8.7

(a) Find the median of the set of numbers.

Answer ..... [1]

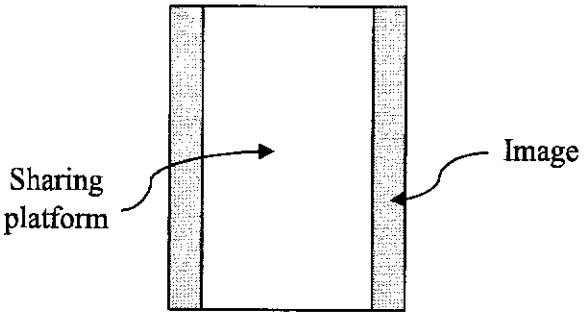
(b) Find the range of the set of numbers.

Answer ..... [1]

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6 A picture taken on a particular handphone has dimensions in the ratio width : height = 3 : 4. On a sharing platform, the recommended dimensions for the picture are in the ratio width : height = 9 : 16.

When uploaded, the picture only fills the height of the sharing platform and not the width, as shown in the diagram, with the grey areas representing the portions of the image that will not be seen on the sharing platform.



Find the fraction of the image that will not be seen on the sharing platform.
Give your answer in its lowest terms.

Answer ..... [3]

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7 Simplify $\frac{(-2q)^4}{6\sqrt{p^5}} \times \frac{3\sqrt{p}}{-q}$. Leave your answer in positive index notation.

Answer ..... [3]

---

8 The cost of a pen is $\$a$.
The cost of a marker is $\$b$.

Amelia buys 5 pens and 3 markers for \$11.90.
Benny buys 8 pens and 2 markers for \$14.

Form and solve two simultaneous equations to find the cost of a pen and the cost of a marker.

Answer Pen \$ .....

Marker \$ ..... [3]

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9 In this scale drawing, A is a house on a piece of land.

Scale : 1 cm to 10 m



An object is buried 100m from house A at a bearing of 200°.

(a) Mark and label on the drawing the position, T, of the object. [2]

(b) A house B is located equidistant between house A and the object T, and is on a bearing of between 90° and 180° from house A.

Mark and label on the drawing a possible location of house B. [2]

[Turn over]

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10 The first four diagrams in a sequence are shown below.



Diagram 1

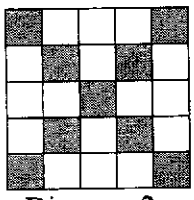


Diagram 2

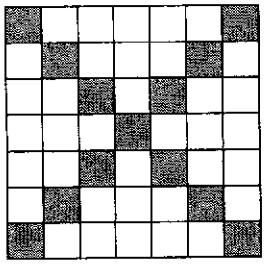


Diagram 3

(a) Find the number of grey squares in Diagram 5.

Answer ..... [1]

(b) Find an expression, in terms of n, for the number of grey squares in Diagram n.

Answer ..... [2]

(c) Diagram n has 400 white squares.
Find n.

Answer Diagram ..... [3]

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11 264 1-cm cubes are to be arranged to form a cuboid.
Only one length of the cuboid is a prime number.

Find a possible set of dimensions of the cuboid.

Answer ..... cm by ..... cm by ..... cm [2]

---

12 A model of a school is made.
The actual floor area of the school field is 4050 square metres.

(a) On the model, the area of the school field is 20 cm^2.
Find the scale of the model in the form 1 : n, where n is correct to two significant figures.

Answer 1 : ..... [2]

(b) The scale on another model is 1 : 4000.
Find the area of the school field on this model.

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

[Turn over]

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13 The table shows the heights of 50 students, measured in January 2023.

Heights, h cm	Frequency
$130 \leq h < 140$	1
$140 \leq h < 150$	4
$150 \leq h < 160$	16
$160 \leq h < 170$	27
$170 \leq h < 180$	2

(a) Calculate an estimate for

(i) the mean height of the students,

Answer ..... cm [1]

(ii) the standard deviation of the heights.

Answer ..... cm [1]

(b) The heights of the same group of students were measured again in January 2024.

The shortest height measured was 146 cm.
The tallest height measured was 180 cm.

State how the mean and standard deviation will change in January 2024.

.....

..... [1]

---

14 Given that $9^{2x} = 243 \times 3^{x}$, find x.

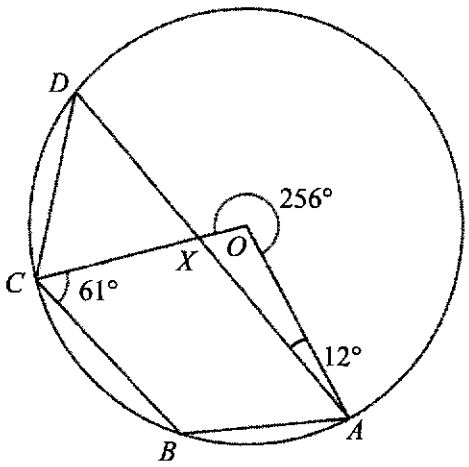
Answer ..... [2]

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15 Factorise $10x^2 + 11x - 6$.

Answer ..... [2]

16



A, B, C and D are four points on a circle, centre O.
Angle $OCB = 61°$, angle $OAD = 12°$ and reflex angle $AOC = 256°$.
OC and AD intersect at the point X.

Find angle BAD.
Give reasons for each step of your working.

Answer Angle BAD = ... [3]

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17 Jade has a sum of money in her bank account.
She gives half of it to her mother and uses \$150.
She receives \$500 on her pay day into the bank account.
She then uses 20% of the amount in her bank account and is left with **not more than** \$800.

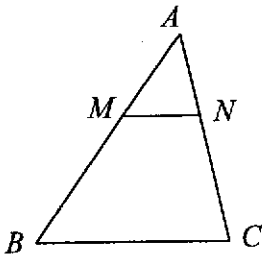
(a) By using x to represent the original sum of money in Jade's bank account, write down an inequality in x.

Answer ..... [2]

(b) Solve your inequality to find the largest possible value of x.

Answer ..... [2]

18



In the diagram, M and N lie on AB and AC respectively such that $AM : MB = AN : NC = 1 : 3$.

Show that MN is parallel to BC.
Give a reason for each statement you make.

Answer

[4]

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19 $2a = \dfrac{x}{3x-2y}$

Rearrange the formula to make x the subject.

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

---

20 Write as a single fraction in its simplest form $\dfrac{6x}{18x-3} - \dfrac{1}{1-6x}$.

Answer ..... [3]

[Turn over]

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21 The population of a town was tracked across a few decades.

The population, P, after t years can be modelled by the equation $P = n \times 2^{0.1t}$ where n is the population in the year 1960.

(a) The initial population of the town was 310 people.
Find n.

Answer ..... [1]

(b) Find the population of the town in the year 2000.

Answer ..... [1]

(c) From the above data, Geraldine concluded that the population in the year 2040 will be 32 times the population in the year 1960.

By using calculations, explain whether Geraldine is correct.

Answer

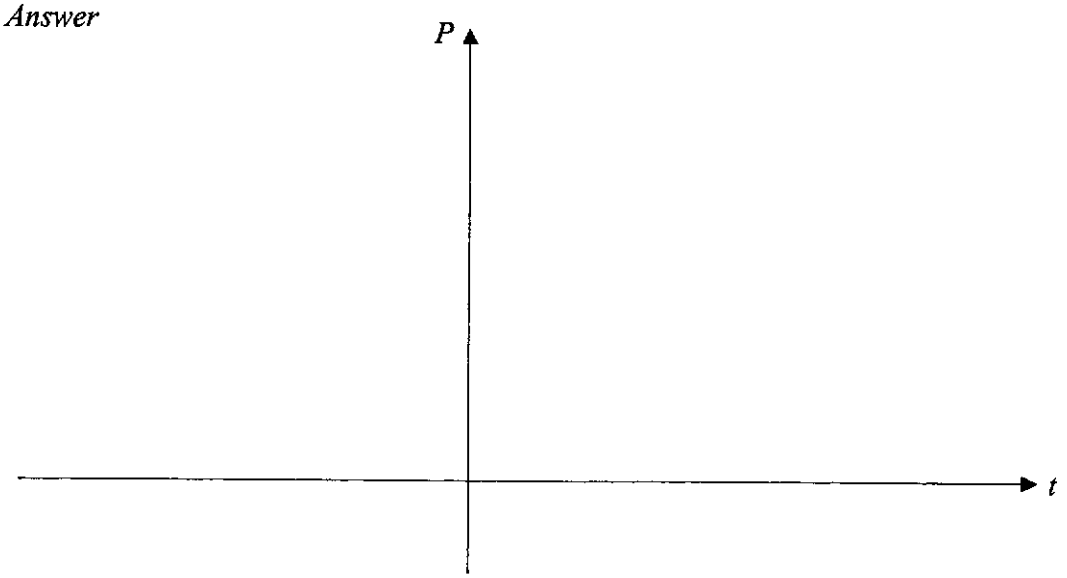
[3]

[Turn over]

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21 **(d)** Sketch the graph of the function $P = n \times 2^{0.1t}$, using the information obtained in parts **(a)** and **(b)**. Show the values on the axes clearly.

Answer



[2]

22 On Monday, a car travelling from work to home at an average speed of p km/h takes 30 minutes to complete the journey.

On Tuesday, the car decreased its average speed by q% and took 45 minutes instead to complete the same journey.

Find the value of q.

Answer ..... [3]

[Turn over]

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23 Gwee is making cookies and brownies.

A single chocolate cookie requires 14g of sugar, 10g of butter and 10g of chocolate.
A slice of brownie requires 30g of sugar, 19g of butter and 25g of chocolate.
This information can be represented by the matrix $\mathbf{A} = \begin{pmatrix} 14 & 10 & 10 \\ 30 & 19 & 25 \end{pmatrix}$.

Gwee wants to make x cookies and 20 brownies.
This information can be represented by the matrix $\mathbf{B} = \begin{pmatrix} x & 20 \end{pmatrix}$.

(a) Find, in terms of x, the matrix $\mathbf{T} = \mathbf{BA}$.

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

(b) Explain what the elements of the matrix **T** represent.

.....

..... [1]

(c) In the supermarket, the ingredients are sold in the following quantities:

1 pack of sugar (500g)
1 packet of butter (200g)
1 pack of chocolate (240g)

If Gwee buys 2 packets of sugar, find the largest integer value of x.

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

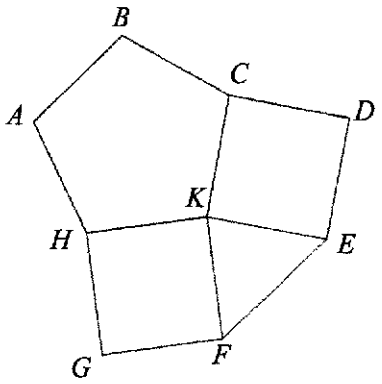
(d) State the corresponding quantity of butter and chocolate required.

Answer ..... packets of butter

..... packs of chocolate [2]

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24



The diagram shows a regular pentagon, two squares and a triangle.

(a) Find angle *ABC*.

Answer ..... [2]

(b) Explain why the triangle *KFE* is not an equilateral triangle.

.....

.....

.....

..... [2]

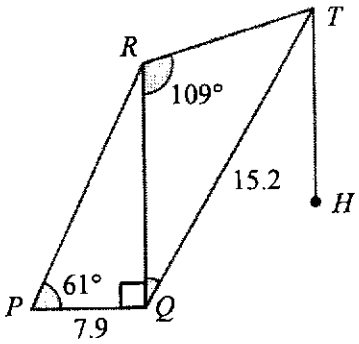
(c) A polygon has interior angle *BCD*.
Find the number of sides of the polygon.

Answer ..... [3]

[Turn over]

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25



The diagram shows a simplified diagram of a crane with base PQ lifting a load H.
PQ is perpendicular to RQ and TH.
TQ is a fixed beam that moves through angle RQT.
$PQ = 7.9$ m, $TQ = 15.2$ m, angle $RPQ = 61°$ and angle $QRT = 109°$.

The safe working angle for angle RQT is between 10° to 90°.
Determine if the crane is safe for use when angle $QRT = 109°$.

Answer

[4]

End of Paper

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ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2024

SECONDARY 4 EXPRESS / 4 NORMAL (ACADEMIC) SBB
SECONDARY 5 NORMAL (ACADEMIC)

Candidate's Name	Class	Register Number

MATHEMATICS

PAPER 2

4052/02

27 August 2024
2 hours and 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces 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 paper clips, glue or correction fluid.

Answer **all** questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degree, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

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 **90**.

90

Setter: Ms Lee Jie Li
Vetted by: Mr Francis Tan

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Mathematical Formulae

Compound Interest

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

Mensuration

Curved surface area of a cone $= \pi rl$

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

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

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

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

Arc length $= r\theta$, where θ 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

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

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

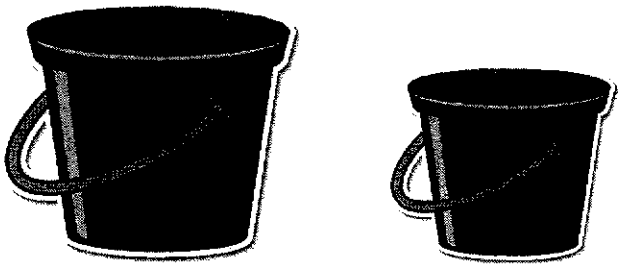
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1 Write down the following numbers in ascending order.

$$-\frac{25}{37},\ (-0.51)^{\frac{2}{3}},\ \sqrt{0.36},\ 0.\dot{6},\ -\frac{\pi}{6}$$

Answer ....., ..., ..., ..., ... [1]

2



The diagram shows two geometrically similar pails.
The area of the base of the smaller pail is 54 cm^2.
The area of the base of the larger pail is 150 cm^2.

The height of the larger pail is 26 cm.
Calculate the height of the smaller pail.

Answer ..... cm [2]

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3 **(a)** Solve $\frac{2x}{5} = 2 + \frac{3x-11}{15}$.

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

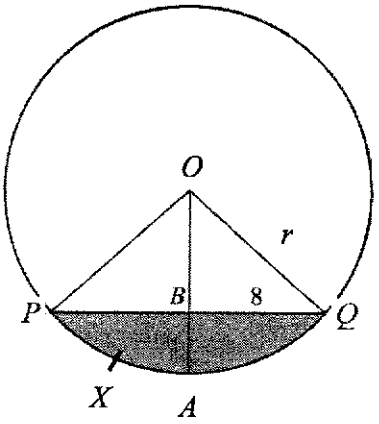
(b) Simplify $\frac{12p^2q^2}{7r^3} \div \frac{3p^5r}{14q^3}$, giving your answer in positive index notation.

Answer ..... [2]

[Turn over

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4 **(a)** The diagram shows the cross-section of a pipe filled with water.
The cross-section is a circle with centre O and radius r cm.
P, X, A and Q are points on the circle.
PBQ is a straight line such that $PB = BQ$ and $BQ = 8$ cm.
The ratio of $AB : BO$ is $1 : 2$.



Show that $r = 10.733$ cm. [3]

Answer

(b) Find arc length AXP.

Answer ..... cm [3]

[Turn over

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5 Tom requires a 7 year loan of $120 000 to purchase a new car.
Bank *M* charges an interest of 4% per annum compounded monthly.
Bank *N* charges a simple interest of 4.3% per annum.

Determine which bank loan Tom should take. Justify your answer clearly.
Answer

He should take loan from Bank ..... because .....
..... [4]

6 **(a)** The cash price of a furniture set is $10 850.
Kate buys the sofa on hire purchase.
She pays a deposit of one fifth of the cash price.
She then makes 24 monthly payments of $$x$.
Given that the total amount that Kate pays for the furniture set is $11 578,
find the value of x.

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

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(b) The exchange rate between Singapore dollars ($) and US dollars (USD) is $1 = USD 0.74.
The exchange rate between British pounds (£) and Singapore dollars ($) is £1= $1.72.

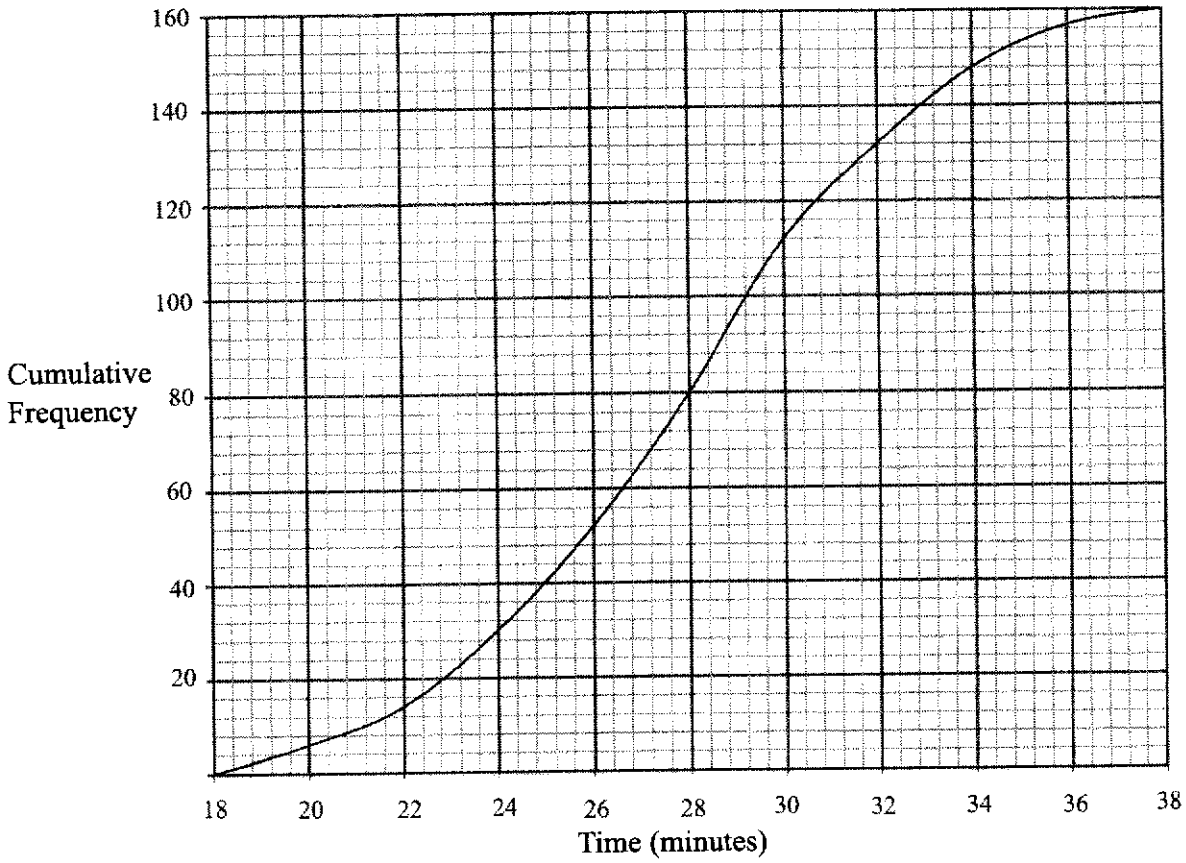
Kate wants to buy a handbag.
The same handbag costs USD 234 on online shopping platform *A* and £234 on online shopping platform *B*.

By comparing the exchange rates, explain how you can tell that the handbag costs more on online shopping platform *B*. [2]

Answer

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7 **(a)** The cumulative frequency graph shows the distribution of the times of the first 160 students from school A to finish the cross-country run in 2024.



Use the curve to estimate

(i) the median time,

Answer ..... mins [1]

(ii) the interquartile range of the times,

Answer ..... mins [2]

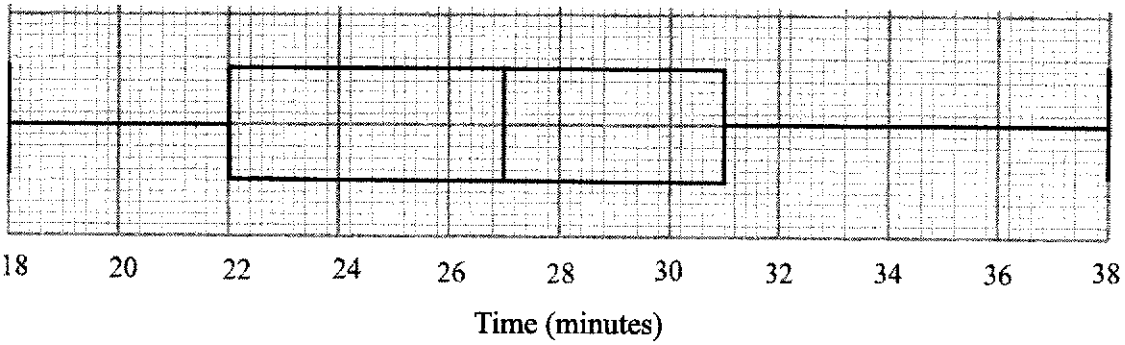
(iii) the value of p, given that $p\%$ of the students take more than 26 minutes.

Answer $p =$ ..... [2]

[Turn over

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(b) The box-and-whisker plot represents the distribution of the times of the first 160 students from school B to finish the cross-country run in 2024.



Below are three statements comparing these times from the two schools.
For each one, write whether you agree or disagree, giving a reason for each answer. [3]

Statement	Agree/disagree	Reason
The students in school B are slower on average.		
The times of the first 40 students from school A were closer together compared to that of school B.		
The times of students in school A are more consistent compared to that of school B.		

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8 **(a)** Complete the table of values for $y=\frac{1}{2}\left(x^3+x^2\right)-4x+3$.

x	–4	–3	–2	–1	0	1	2	3
y		6	9	7	3	0	1	9

[1]

(b) On the grid given on page 11, draw the graph of $y=\frac{1}{2}\left(x^3+x^2\right)-4x+3$ for $-4 \le x \le 3$. [3]

(c) Use your graph to write an inequality in k where $\frac{1}{2}\left(x^3+x^2\right)-4x+3=k$ has three solutions.

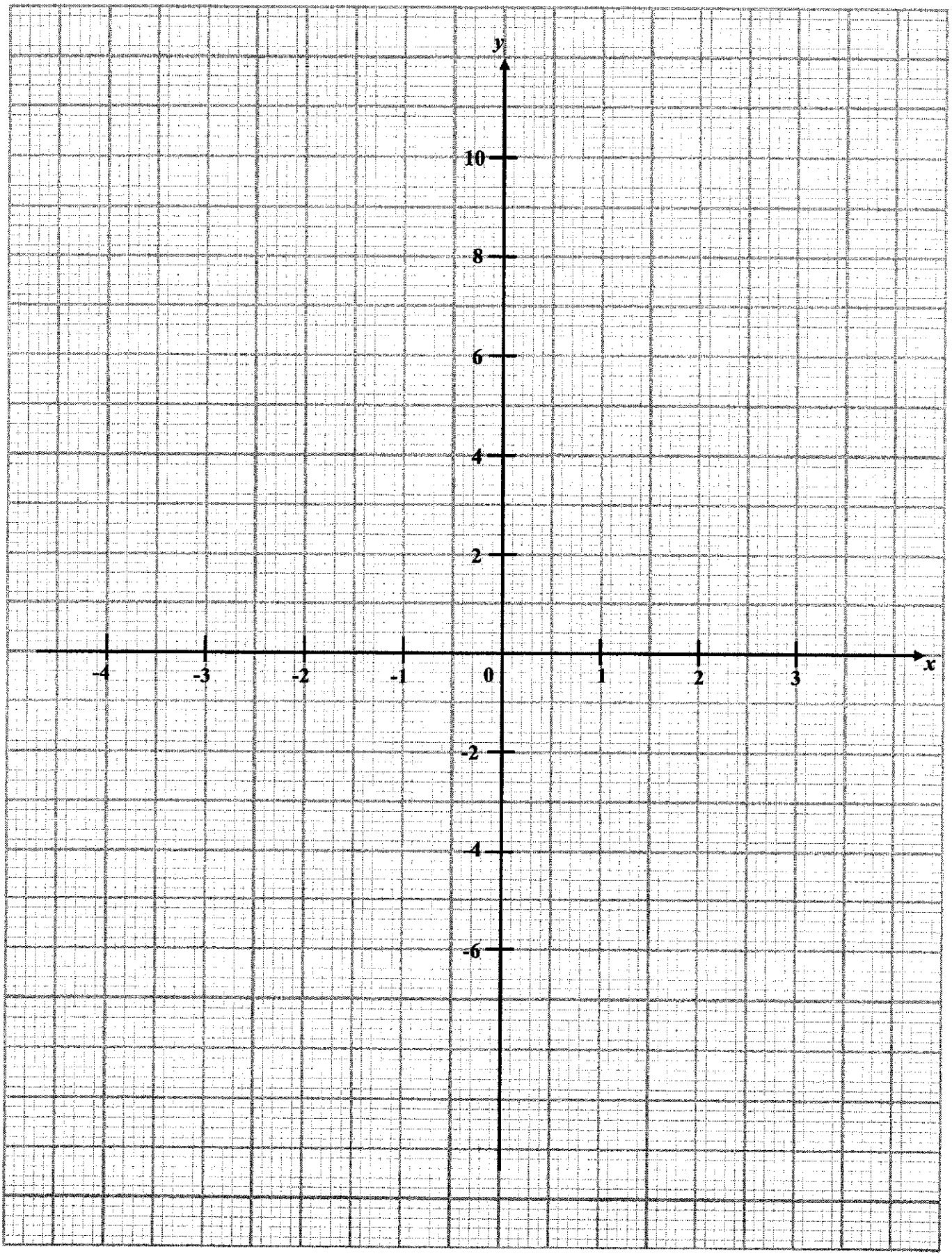
Answer ..... [2]

(d) Using the graph, find the gradient of the curve at $x=-2.7$.

Answer ..... [2]

[Turn over

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[Turn over

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(e) By drawing a suitable straight line on the grid, solve the equation $x^3 + x^2 - 6x - 2$.

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

[Turn over

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9 **(a)** $\xi = \{x: x \text{ is an integer and } 1 \leq x \leq 12\}$

$A = \{x: x \text{ is a prime number}\}$

$B = \{x: x \text{ is a factor of } 10\}$

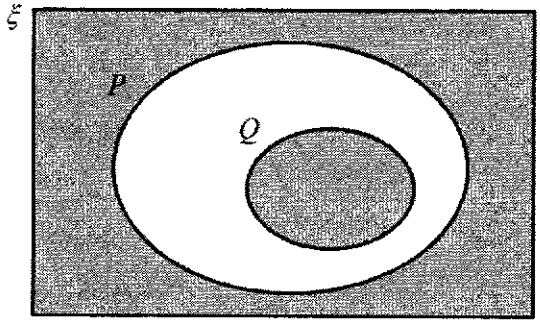
(i) List the elements of $A \cap B'$.

Answer ..... [1]

(ii) List the elements of $(A \cup B)'$.

Answer ..... [1]

(b) Write down the set represented by the following shaded region.



Answer ..... [1]

(c) The sets ξ, A and B satisfy the conditions $n(\xi) = 41$, $n(A) = 25$, $n(B) = 7$.
Find

(i) the largest possible value of $n(A \cup B)'$,

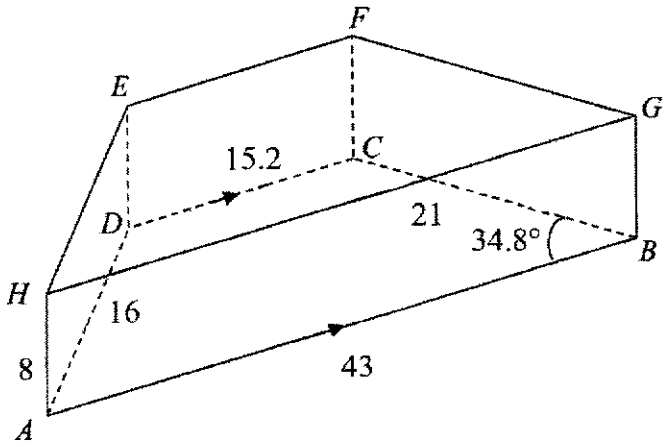
Answer ..... [1]

(ii) the smallest possible value of $n(A \cup B)'$.

Answer ..... [1]

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10 The diagram shows a trapezoidal prism.
The base $ABCD$ is on flat ground.
$ABGH$, $BCFG$, $ADEH$ and $DCFE$ are vertical rectangular planes.
$AB = 43$ m, $BC = 21$ m, $CD = 15.2$ m, $AD = 16$ m, $AH = 8$ m and $\angle ABC = 34.8°$.
AB is parallel to DC.



(a) Calculate the length of AC.

Answer ..... m [2]

(b) Calculate angle FAC.

Answer ..... ° [2]

[Turn over

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(c) Calculate the area of triangle AFB.

Answer ..... m^2 [4]

(d) Calculate the perpendicular distance from point D to the line AB.

Answer ..... m [2]

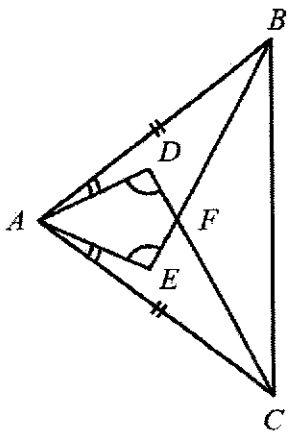
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(e) A point P moves along AB.
Find the largest angle of depression of P from E.

Answer ..... ° [2]

11 In the diagram, $AB = AC$, $\angle AEB = \angle ADC$ and $\angle BAD = \angle CAE$.

Prove that the triangles ABE and ACD are congruent. [3]



Answer

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12 $ABCD$ is a parallelogram and its diagonals intersect at point M.

$\overrightarrow{AB} = \begin{pmatrix} 8 \\ 2 \end{pmatrix}$ and $\overrightarrow{AM} = \begin{pmatrix} 2.5 \\ -2 \end{pmatrix}$.

The coordinates of A are $(0,4)$.

(i) Show that the position vector of C is $\begin{pmatrix} 5 \\ 0 \end{pmatrix}$. [1]

Answer

(ii) Find the coordinates of vertex D.

Answer (_____, _____) [2]

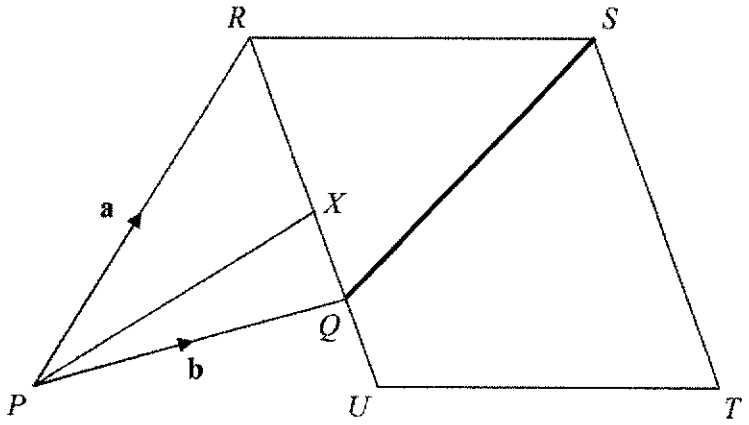
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(iii) Find the length of diagonal BD.

Answer ..... [4]

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13



In the diagram, PQR is a triangle and $RSTU$ is a parallelogram.

Q is a point on RU such that $RQ:QU=3:1$ and X is the midpoint of RU.

$\overrightarrow{PR}=\mathbf{a}$, $\overrightarrow{PQ}=\mathbf{b}$ and $\overrightarrow{UT}=-\frac{1}{3}\mathbf{a}+\frac{4}{3}\mathbf{b}$.

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

(i) $\overrightarrow{QR}$

Answer $\overrightarrow{QR}=$ ..... [1]

(ii) $\overrightarrow{XR}$

Answer $\overrightarrow{XR}=$ ..... [1]

(b) Show that P, X and S lie on a straight line. [3]

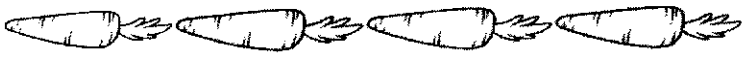
Answer

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(c) Calculate the ratio of area of triangle PRS to the area of parallelogram $RSTU$.

Answer ..... : ..... [2]

14 **Most Popular Vegetables among Students**

Vegetables	Number of students who chose it
Broccoli	
Carrot	
Tomato	

Key: Each picture represents 20 students

Explain how the above pictogram may be misleading.

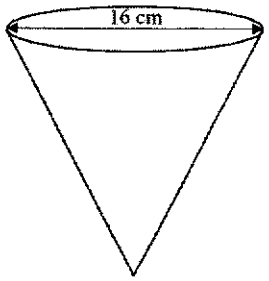
.....

..... [1]

[Turn over

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15 (a) The diagram shows an inverted right circular cone with a base diameter of 16 cm.



The curved surface area of the cone is 136π cm^2.
Find the height of the cone.

Answer ..... cm [3]

(b) Water is poured into the empty cone.
Given volume of water is 163.84π cm^3, find the height of the water in the cone.

Answer ..... cm [3]

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16 Mrs Tan runs a shop selling pancakes, waffles and coffee.
She hires three workers in the shop, namely Amy, Betty and Clara.
Amy makes the pancakes, Betty makes the waffles and Clara makes the coffee.

Information on the shop and items are as shown:

[1]Opening hours	[1]Rental Cost	[1]Wage per worker	[1]Other operating cost*
10am to 9pm daily	$7000	$1920	$340

1. These are calculated per month, each month is taken to be 30 days.
* Other operating cost comprises other costs such as utilities, excluding ingredient cost.

Item	Selling price per item	Ingredient cost price per item
Pancakes	$5.50	$2.85
Waffles	$6.50	$2.90
Coffee	$3.00	$1.70

(a) Calculate the total expenses per month, excluding ingredient cost.

Answer $.....[1]

[Turn over

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(b) In one day, a total of 124 pancakes and waffles are made.
The time taken to make a waffle is 30 seconds more than the time taken to make a pancake.
On average, Amy and Betty each spend 8 hours a day making pancakes and waffles.
They work every day when the shop is open.
On average, the shop sells 70 cups of coffee a day.

If Mrs Tan wants to raise the current price of the coffee by $\$p$ so that she can make a profit of at least \$3000 a month from her business, suggest a minimum value of p.
Justify your answers clearly with calculations.

[Turn over for additional working space and (c)]

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Additional working space for 16(b)

Answer p = ... [8]

(c) State an assumption you have made in your calculations in **(b)**.

.....

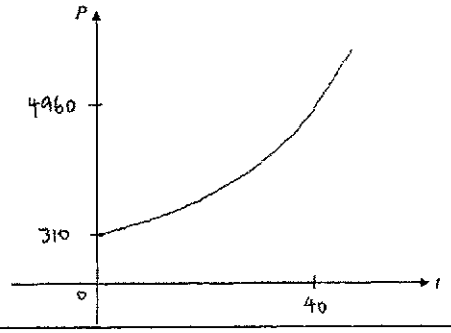
..... [1]

End of Paper

Zhonghua Secondary School

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Zhonghua Secondary School
2024 4Exp/5NA/4NA SBB Preliminary Examinations
4052/1 Mathematics Paper 1
Answer Key

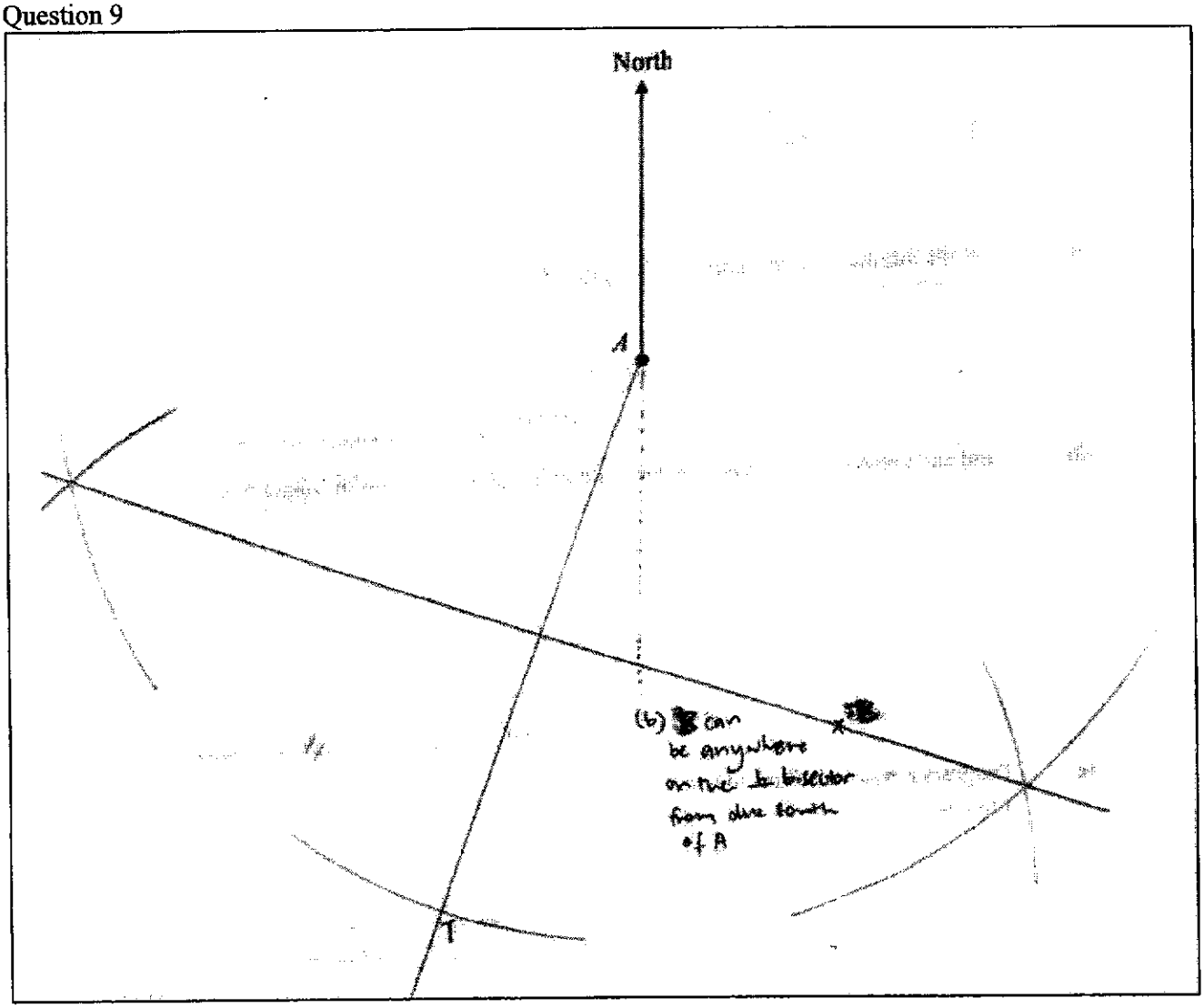
1a	$-a-15b$	17a	$\left[\left(\frac{x}{2}-150\right)+500\right]\times 0.8\le 800$
1b	$-3(x-2y)(x+2y)$		
2a	1045800	17b	1300
2b	1.0458×10^6	18	$\angle MAN=\angle BAC$ (common angle) $\frac{AM}{AB}=\frac{AN}{AC}=\frac{1}{4}$ (given) ΔMAN is similar to ΔBAC as two pairs of sides are in the same ratio and the included angle is equal (SAS similarity) $\angle AMN=\angle ABC$ (corresponding angles of similar triangles) => MN // BC (converse of corresponding angles)
3	23.6° or 156.4°		
4i	$\frac{11}{20}$		
4ii	$\frac{11}{21}$		
5a	6.35		
5b	7.4		
6	$\frac{1}{4}$		
7	$-\frac{8q^3}{p^2}$	19	$x=\frac{4ay}{6a-1}$
8	Pen = \$1.30; Marker = \$1.80	20	$\frac{2x+1}{6x-1}$
9	*See next page*		
10a	21	21a	310
10b	2(2n + 1) – 1 or 4n + 1	21b	4960
10c	10	21c	Population in 2040 = $310\times 2^{0.1(80)}$ = 79360 No. of times the population increased from 1960 to 2040 = 79360 ÷ 310 = 256 Hence, Geraldine is incorrect as it is 256 times and not 32 times.
11	2cm by 6cm by 22cm 3cm by 4cm by 22cm 4cm by 6cm by 11cm		
12a	1400		
12b	2.53125		
13ai	160		
13aii	7.81		
13b	The mean height will increase. *[shortest height has increased, more taller heights]* The standard deviation will decrease. *[slightly smaller range of values as there are no more values in the smallest class interval]*	21d	
14	$\frac{5}{3}$		
15	$(5x-2)(2x+3)$	22	$\frac{100}{3}$
16	55°		

[Turn over]

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23a	$\mathbf{T} = \begin{pmatrix} 14x+600 & 10x+380 & 10x+500 \end{pmatrix}$	24a	108°
23b	T represents the total amount of sugar, butter and chocolate respectively that is required to make x cookies and 20 brownies.	24b	$\angle HKE / \angle BCD = 360° - 72° - 90° - 90° = 72°$ For triangle KFE to be an equilateral triangle, each interior angle must be 60°. Since $\angle HKE = 72° \neq 60°$, triangle KFE is not equilateral.
23c	28	24c	20
23d	4 packets of butter 4 packs of chocolate	25	$\angle RQT = 8.5575°$ Since $\theta = 8.5575° < 10°$, the crane is not safe for use when angle $QRT = 109°$.

Question 9



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2024 4Exp/5NA/4NA SBB Preliminary Examinations
4052/1 Mathematics Paper 2
Answer Key

1a	$-\frac{25}{37}$ $-\frac{\pi}{6}$ $\sqrt{0.36}$ $(-0.51)^{\frac{2}{3}}$ $0.\dot{6}$	11	In triangle ABE and ACD, $\angle AEB = \angle ADC$ (Given) $\angle BAE = \angle BAD + \angle DAE$ $= \angle CAE + \angle DAE$ (since given $= \angle CAD$ $\angle BAD = \angle CAE$) $AB = AC$ (Given) Hence, ABE and ACD are congruent. (AAS congruence test) (since two pairs of corresponding angles and the non-included sides are equal).
2	15.6		
3a	$\frac{19}{3}$		
3b	$\frac{8q^5}{p^3r^4}$		
4b	9.03		
5	Interest from Bank M = \$38701.66 Interest from Bank N = \$36120 Bank *N* is a better option because the interest earned under Bank *N* (\$36120) is lower than that under Bank *M* (\$38701.66)./ He would pay \$2581.66 less interest under Bank *N* compared to Bank *M*.	12a(i)	$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$ $= \begin{pmatrix} 0 \\ 4 \end{pmatrix} + 2\overrightarrow{AM}$ $= \begin{pmatrix} 0 \\ 4 \end{pmatrix} + \begin{pmatrix} 5 \\ -4 \end{pmatrix}$ $= \begin{pmatrix} 5 \\ 0 \end{pmatrix}$
6a	392		
6b	USD 1 = \$$\frac{1}{0.74}$ = \$ 1.35 (2d.p.) Since £1 = \$1.72 which is more than \$1.35(cost of USD1), £234 will cost more than USD 234, hence the handbag costs more on the online shopping portal *B*.	12a(i)	$(-3, -2)$
7a(i)	28	12a(iii)	13.6
7a(ii)	5.8		
7a(iii)	67.5	13a(i)	$\mathbf{a} - \mathbf{b}$
7b	Disagree. The median time for students in school B is 27 minutes which is shorter than median time for school A (28 minutes), hence students in school B are faster on average. Disagree. The lower quartile of times from school B is 22 mins which is shorter than that of school A(25mins), hence times of the	13a(ii)	$\frac{2}{3}(\mathbf{a} - \mathbf{b})$
		13b	Since $\overrightarrow{PX} = \overrightarrow{XS}$, $\overrightarrow{PX}$ is parallel to $\overrightarrow{XS}$ and they have a common point X,

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	first 40 students from school B were closer together compared to that of school A. Agree. The interquartile range of times from school A is 5.8 mins which is smaller than that of school B(9 mins), hence the times in school A were more consistent compared to that of school B.	13c 14	Thus P, X and S are collinear points/lie on the same straight line. 1:2 The sizes of the pictures in the pictogram are different, hence readers might be misled that carrots is the most popular fruit but the most popular fruit is broccoli.
8b	$-0.25 < k < 9$		
8d	Accurate answer: 4.24	15(a)	15
8e	$x = -2.85$ or -0.35 or 2.2.	15(b)	12
9a(i)	{3,7,11}	16(a)	13100
9a(ii)	{4,6,8,9,12}	16(b)	Let t be the time taken to make a pancake in seconds. Do working and obtained $t = -\frac{480}{31}$ or $t = 450$ (rejected since $t > 0$) $\therefore t = 450$ Continue to work out, we get $p = \frac{3000 - 1198}{70 \times 30}$ $= \$0.8580$ $\approx \$0.90$ $\therefore$ Minimum $p = 0.90$
9b	$P \cup Q$		
9c(i)	16		
9c(ii)	9		
10(a)	28.4		
10(b)	15.7		
10(c)	310	16(c)	The respective **rates** at which the pancakes, waffles and coffee are made are **constant**. OR The respective numbers of pancakes and waffles sold **each day** are **constant.**
10(d)	12.0		
10(e)	33.7°		

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