

CLASS	INDEX NUMBER	NAME
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BUKIT MERAH SECONDARY SCHOOL



END-OF-YEAR EXAMINATION 2024 SECONDARY 3 EXPRESS

MATHEMATICS
Paper 1

4052/01

2 October 2024
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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

Answer **all** the 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 number of marks for this paper is 80.

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.

Calculator Model

For Examiner's Use

This document consists of **17** printed pages and **1** blank page.

Setter: Mr Lui Meng Whye

[Turn over]

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Answer **all** the questions.

1 Solve $6 - 3x = 24$.

Answer $x = \dots\dots\dots$ [1]

2 Expand and simplify $(3x - y)(2x + y)$.

Answer $\dots\dots\dots$ [1]

3 (a) Calculate $\frac{300^2}{12.7 - 10.8}$.

Write your answer correct to 4 significant figures.

Answer $\dots\dots\dots$ [1]

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

Answer $\dots\dots\dots$ [1]

4 Charles's mass has dropped to 55 kg after going through a weight-loss programme.

If he has lost 9% of his mass, find his mass before the programme.

Answer $\dots\dots\dots$ kg [2]

5



500 ml
\$40.50

4



300 ml
\$25



75 ml
\$6.25

A company manufactures three sizes of the same brand of shampoo.

Show that the cost of the shampoo is **not** directly proportional to the quantity of shampoo.

Answer

6 Express $\frac{3x}{(2x-1)^2} - \frac{2}{2x-1}$ as a single fraction in its simplest form.

[2]

Answer [2]

7 The sine of an angle is 0.8312.

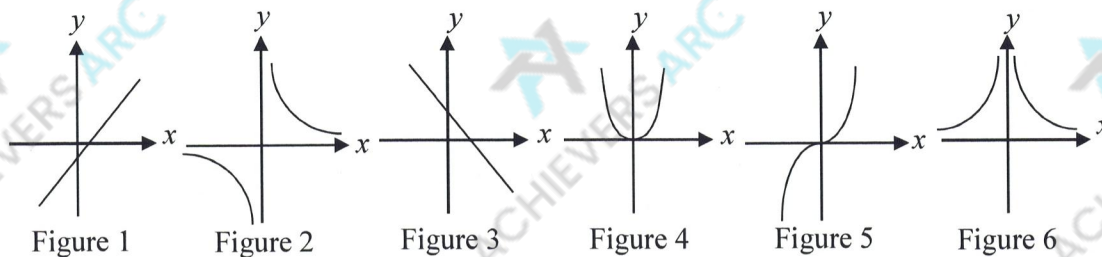
Give two possible values for the angle. Write down your answers in degrees.

Answer or [2]

- 8 The dimensions of a rectangular tile are 40 cm by 35 cm. Harry arranges some of these tiles to form a square. Find the smallest possible area of the square.

Answer cm² [3]

9



Which of the above figures could represent the graph of each of the following equations?

(a) $2y = -3x + 2$

Answer Figure [1]

(b) $y = \frac{4}{x^2}$

Answer Figure [1]

(c) $y = 5x^3$

Answer Figure [1]

- 10 Albert and Ben each have an amount of money.
The ratio Albert's amount : Ben's amount is 5 : 3.
Albert gives Ben \$22.
The new ratio Albert's amount : Ben's amount is 3 : 4.

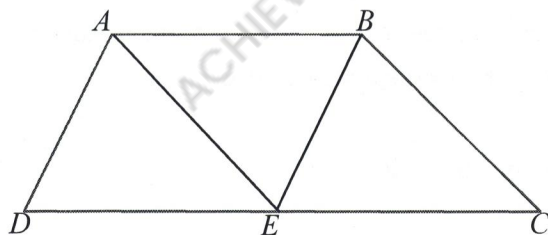
Find how much money Albert has now.

Answer \$..... [3]

- 11 Simplify $\frac{9x - x^3}{3x^2 + 4x - 15}$.

Answer [3]

12



$ABCD$ is a trapezium with E on DC such that AE is parallel to BC , and BE is parallel to AD .

Show that triangle ADE and triangle BEC are congruent.

Give a reason for each statement you make.

Answer

- 13 The table shows the grade a candidate will receive for a mathematics course based on the mean score of three components in the mathematics course.

The full score of each component is 100.

Grade	Mean score of three components
A	At least 90
B	At least 80 but less than 90
C	At least 60 but less than 80
D	Less than 60

George scores 73 and 85 in the first two components of the mathematics course.

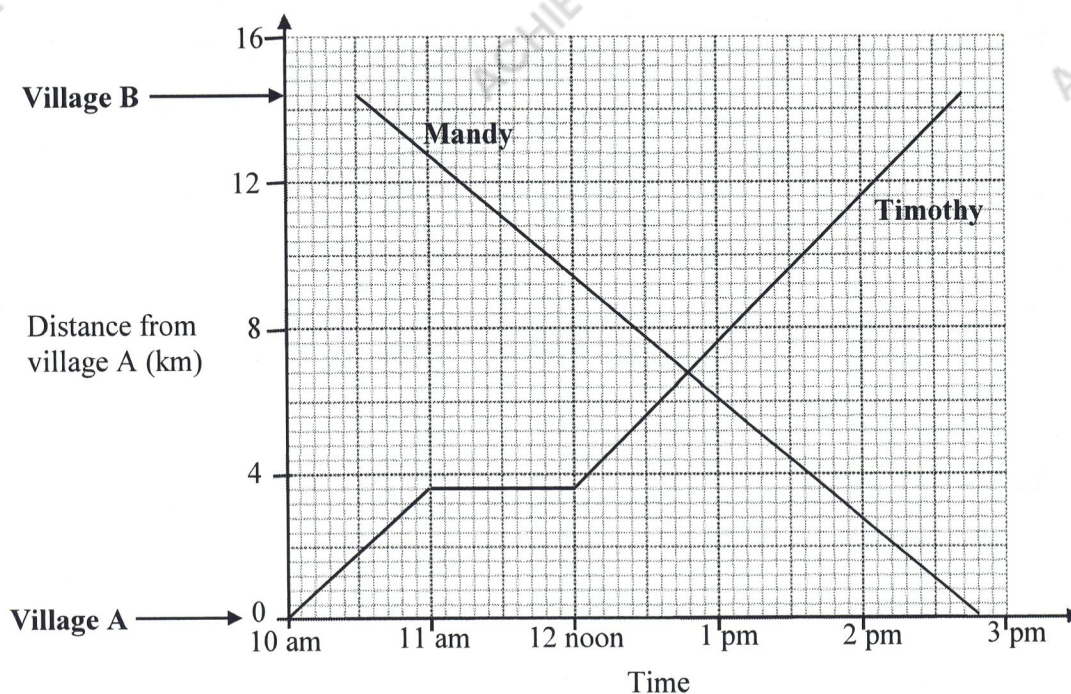
Let x be George's score in the third component.

- (a) Express George's mean score of the three components in terms of x .

Answer [1]

- (b) By forming inequalities and solving them, find the range of scores George must obtain in the third component to receive a 'B' grade for the course.

Answer [3]



The distance-time graph shows the journeys of Mandy and Timothy between two villages, A and B.

- (a) Find Timothy's speed, in km/h, for the first hour of his journey.

Answer km/h [1]

- (b) (i) Find the time when Mandy and Timothy passed each other.

Answer [1]

- (ii) How far were they from village B when they passed each other?

Answer km [1]

- (c) Another person, Wayne, travelled from village A to village B at a constant speed of 8 km/h. Write 8 km/h as a speed in metres per second.

Answer m/s [1]

- 15 (a) (i) Simplify $a^2b \times a^5b^{-2}$, expressing your answer in positive index form.

Answer [1]

- (ii) Simplify $(16x^8)^{\frac{3}{4}}$.

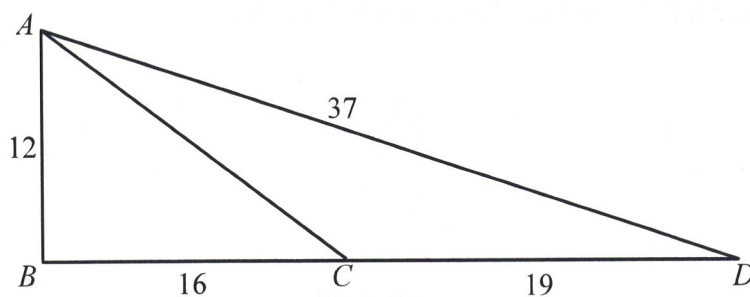
Answer [2]

- (b) Given that $\frac{3^p}{81^q} = 27^r$, find an expression for p in terms of q and r .

Answer $p =$ [2]

16 In the diagram, ABD is a triangle and BCD is a straight line.

$AB = 12$ cm, $BC = 16$ cm, $CD = 19$ cm and $AD = 37$ cm.



(a) Show that $\angle ABC$ is a right angle.

Answer

[2]

(b) Find the exact value of

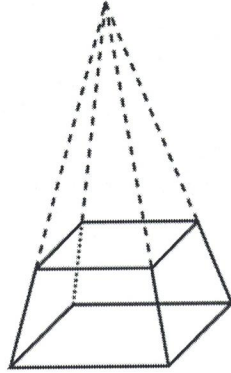
(i) $\sin \angle ACD$.

Answer [2]

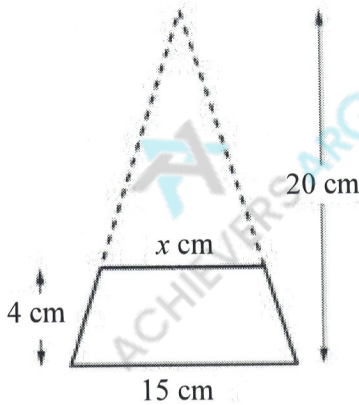
(ii) $\cos \angle ACD$.

Answer [1]

- 17 A glass block is in the shape of a frustum of a square-based pyramid. The frustum is made by removing a small square-based pyramid from a larger square-based pyramid as shown in the diagram. The vertical height of the frustum is 4 cm.



This is a side view of the glass block.



- (a) Use similar triangles to find the value of x .

Answer $x = \dots\dots\dots$ [2]

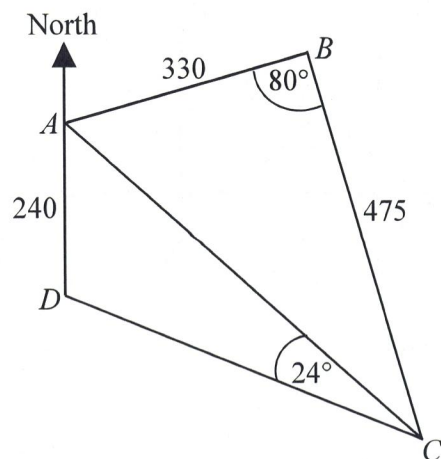
- (b) 1 cm^3 of the glass has a mass of 2.6 grams.
Calculate the mass of the glass block.

Answer $\dots\dots\dots$ g [3]

18 $ABCD$ is a playground on horizontal ground crossed by a path AC .

A is due north of D . $AB = 330$ m, $BC = 475$ m and $AD = 240$ m.

Angle $ABC = 80^\circ$, angle $ACD = 24^\circ$ and angle ADC is obtuse.



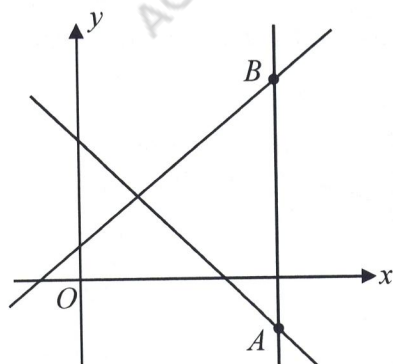
(a) Calculate the distance AC .

Answer m [2]

(b) Calculate the bearing of D from C .

Answer [3]

- 19 The diagram shows the three lines $x = 8$, $y = 6 - x$ and $2y = 3x + 2$.



- (a) Find the coordinates of A and B .

Answer A is (.....,) [1]

B is (.....,) [1]

- (b) The point $(0, k)$ is equidistant from the points A and B .

Find the value of k .

Answer $k = \dots\dots\dots$ [2]

- (c) Find the equation of the line that is parallel to the line $2y = 3x + 2$ and passes through the point $(2, 6)$.

Answer [2]

20 The first five terms of a sequence are 58, 55, 52, 49 and 46.

- (a) Write down an expression for the n th term of the sequence.

Answer [2]

- (b) Explain why -136 is not a term of this sequence.

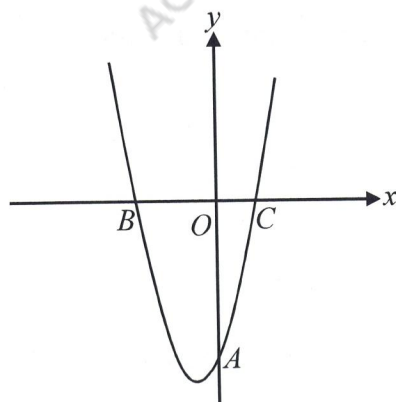
.....
..... [1]

- (c) The sum of the first n terms of this sequence is given by $\frac{n}{2}(119 - 3n)$.

Using algebra, find the value of n when the sum of the first n terms is 498.

Answer $n =$ [3]

- 21 (a) The diagram shows the graph of $y = (x+5)(x-3)$.



- (i) The graph cuts the y -axis at point $A(0, a)$. Write down the value of a .

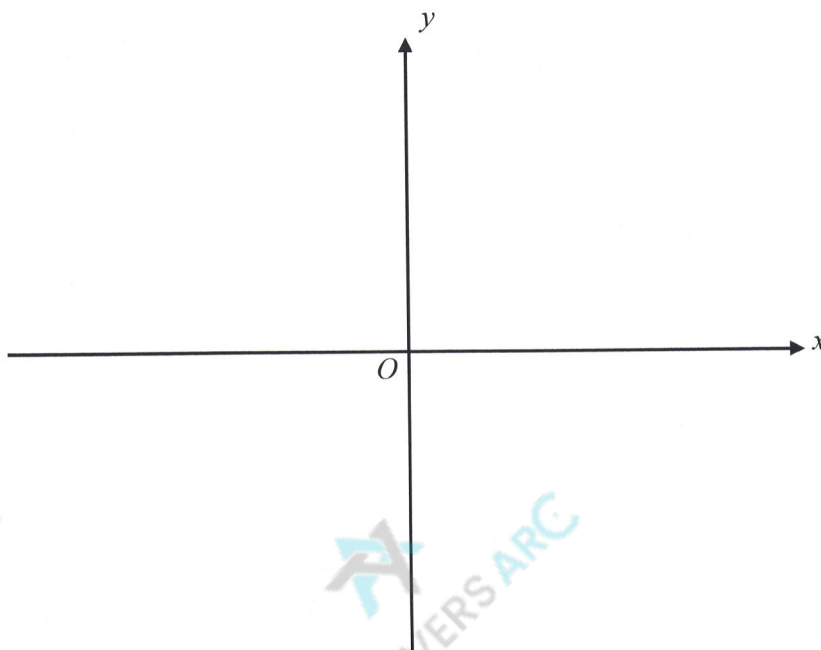
Answer $a = \dots\dots\dots$ [1]

- (ii) The graph cuts the x -axis at B and C .
Find the equation of the line of symmetry of the graph.

Answer $\dots\dots\dots$ [2]

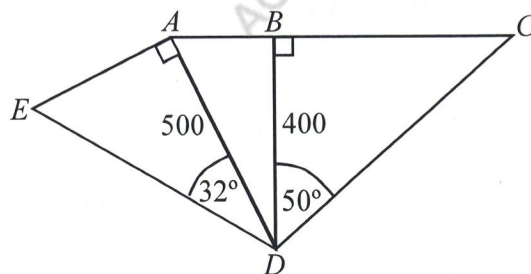
- (b) Sketch the graph of $y = (x+2)^2 - 1$ on the axes below.

Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve.



[3]

22 The diagram shows a park $ABCDE$.



Angle $EAD = \text{angle } CBD = 90^\circ$, angle $EDA = 32^\circ$ and angle $BDC = 50^\circ$.

$BD = 400$ m and $AD = 500$ m.

Calculate

(a) the length of BC ,

Answer m [2]

(b) the length of DE ,

Answer m [2]

(c) the area of the park $ABCDE$.

Answer m^2 [3]

End of Paper

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CLASS	INDEX NUMBER	NAME
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BUKIT MERAH SECONDARY SCHOOL



END-OF-YEAR EXAMINATION 2024 SECONDARY 3 EXPRESS

MATHEMATICS

Paper 2

4052/02

4 October 2024
1 hour 30 minutes

Candidates answer on the Question Paper.

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

TURN OVER FOR QUESTION 1

Answer **all** the questions.

- 1 (a) Rearrange the formula $b = \frac{3a+c}{5-a}$ and express a in terms of b and c .

Answer $a = \dots\dots\dots$ [2]

- (b) Solve the equation $\frac{w-1}{8} = \frac{2}{w-1}$.

Answer $w = \dots\dots\dots$ or $w = \dots\dots\dots$ [3]

(c) The expression $x^2 + 8x - 12$ can be written in the form $(x+4)^2 + n$.

(i) Find the value of n .

Answer $n = \dots\dots\dots$ [1]

(ii) Explain why when $x = -4$, the expression $x^2 + 8x - 12$ has its minimum value.

$\dots\dots\dots$
 $\dots\dots\dots$ [1]

(d) Solve the simultaneous equations.

$$6x - 3y = 16$$

$$9x + 4y = 7$$

Answer $x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

- 2 The distance between two towns, A and B , is 100 km.

A bus travelled from A to B at an average speed of x km/h.

- (a) Write down an expression, in terms of x , for the time, in hours, that the bus took to complete the journey from A to B .

Answer hours [1]

- (b) A car also travelled from A to B . Its average speed was 10 km/h greater than that of the bus. Write down an expression, in terms of x , for the time, in hours, that the car took to complete the journey from A to B .

Answer hours [1]

- (c) Given that the difference in time for the two modes of transport was 45 minutes, form an equation in x and show that it reduces to

$$3x^2 + 30x - 4000 = 0.$$

Answer

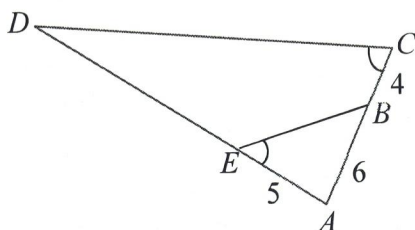
- (d) Solve the equation $3x^2 + 30x - 4000 = 0$, giving your answers correct to two decimal places.

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- (e) Calculate the total time that the bus and the car spent travelling from A to B .
Give your answer in hours and minutes, correct to the nearest minutes.

Answer $\dots\dots\dots$ hours $\dots\dots\dots$ minutes [2]

- 3 (a) In the diagram below, $AB = 6$ cm, $BC = 4$ cm, $AE = 5$ cm and $\angle AEB = \angle ACD$.
Triangles AEB and ACD are similar. Find the length of DE .



Answer $DE = \dots\dots\dots$ cm [2]

(b)



The diagram shows two geometrically similar wooden wedges.

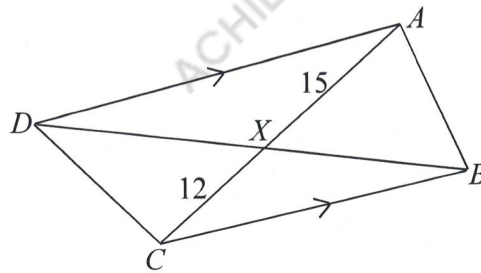
The wedges are made of the same type of wood.

The cost of the smaller wedge is \$0.40 and the cost of the larger wedge is \$1.35.

Calculate the height of the smaller wedge given that the height of the larger wedge is 4.5 cm.

Answer $\dots\dots\dots$ cm [3]

(c)



In the diagram, $ABCD$ is a quadrilateral with DA parallel to CB .

DB and CA meet at X where $CX = 12$ cm and $XA = 15$ cm.

(i) Explain why triangles XCB and XAD are similar.

.....

 [2]

It is given also that $XB = 18$ cm.

(ii) Find the length of DX .

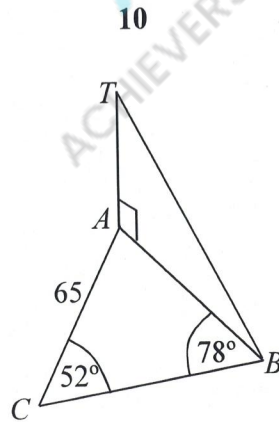
Answer $DX =$ cm [2]

(iii) Find the ratio of the area of triangle XCB to the area of triangle XAD .

Answer : [1]

(iv) Find the ratio of the area of triangle DXC to the area of triangle AXB .

Answer : [2]



In the diagram, ABC represents a horizontal triangular field. A vertical tree, TA , is growing at A .

A path runs along the edge BC of the field.

$AC = 65$ m, angle $ACB = 52^\circ$ and angle $CBA = 78^\circ$.

- (a) Calculate the length of AB .

Answer $AB = \dots\dots\dots$ m [2]

- (b) The angle of elevation of the top, T , of the tree when viewed from B is 15° .
Calculate the height of the tree.

Answer $\dots\dots\dots$ m [2]

- (c) Calculate the shortest distance from A to the path BC .

Answer m [2]

- (d) Calculate the greatest angle of elevation of the top, T , of the tree when viewed from a point on the path BC .

Answer [2]

- 5 The variables x and y are connected by the equation $y = 11 - 2x - \frac{3}{x}$.

Some corresponding values of x and y are given in the table below.

x	0.3	0.5	1	2	3	4	5	6	7
y	0.4	4	6	5.5	4	2.3	0.4	-1.5	p

- (a) Find the value of p , giving your answer correct to 1 decimal place.

Answer $p = \dots\dots\dots$ [1]

- (b) On the grid opposite, draw the graph of $y = 11 - 2x - \frac{3}{x}$ for $0.3 \leq x \leq 7$. [3]

- (c) Use your graph to find the solutions to the equation $8 - 2x - \frac{3}{x} = 0$.

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

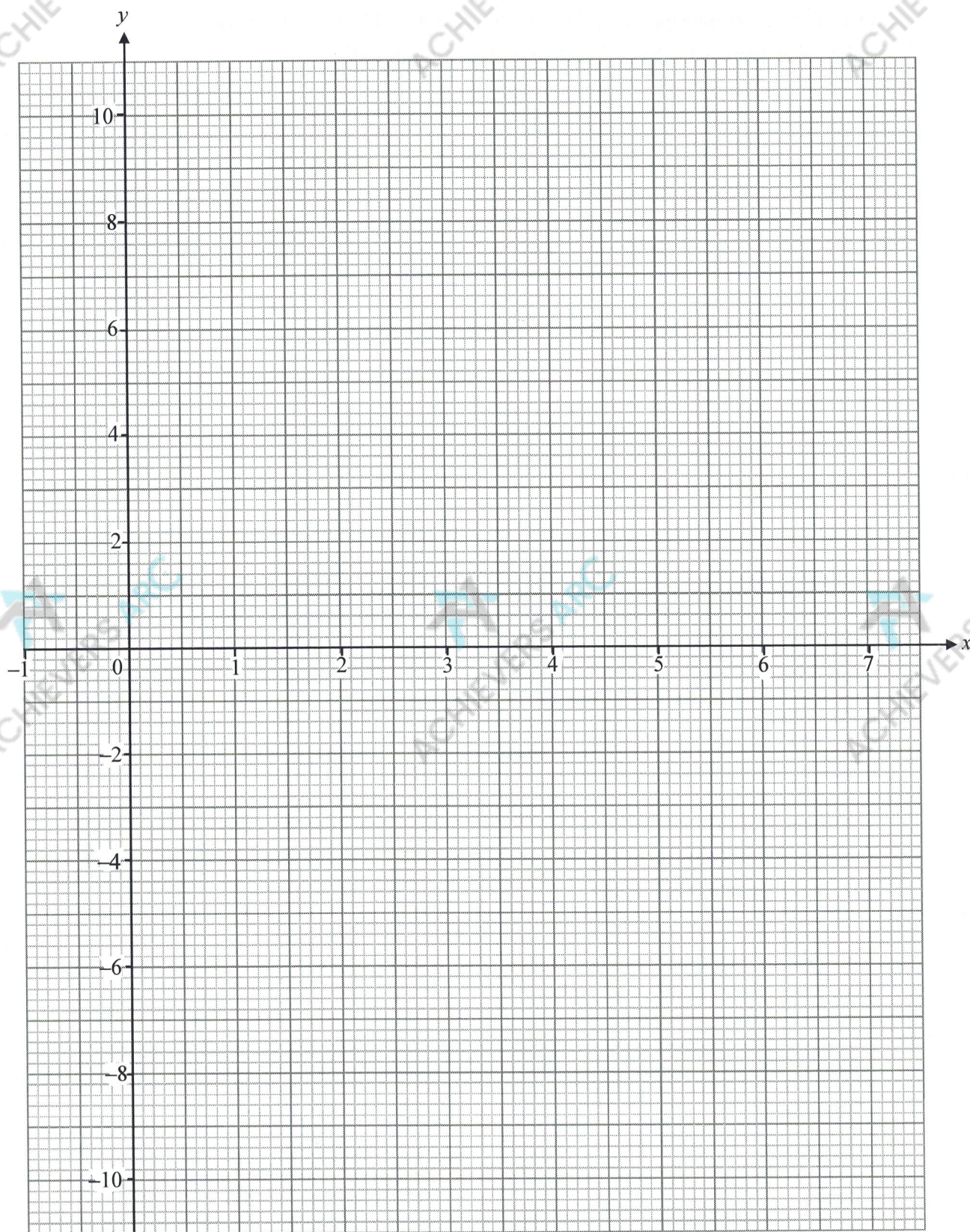
- (d) By drawing a tangent, find the gradient of the curve at $(2, 5.5)$.

Answer $\dots\dots\dots$ [2]

- (e) The x -coordinates of the points where the line $y = x + 3$ intersects the curve are the solutions to the equation $3x^2 + Ax + B = 0$. Find the value of A and the value of B .

Answer $A = \dots\dots\dots$

$B = \dots\dots\dots$ [2]



- 6 (a) The value of a mobile phone depreciated from \$450 to \$380 within 3 years. If the value depreciated by $y\%$ each year, find the value of y .

Answer $y = \dots\dots\dots$ [3]

- (b) The table shows the mobile plans offered by three telecommunications companies, **A**, **B** and **C**.

	A	B	C
Monthly subscription	\$40.82	\$30.56	\$25.24
Talk Time	Unlimited	350 minutes	400 minutes
SMS/MMS	0 message	100 messages	150 messages
Data	50 GB	30 GB	20 GB

For example, a customer who signs up for the mobile plan offered by telecommunications company **B** will enjoy up to 350 minutes of free Talk Time, 100 free SMS/MMS messages and 30 GB of free data every month.

The table shows the additional charges for excess mobile phone usage imposed by each of the three telecommunications companies.

Type of Use	Additional Charge
Talk Time	\$0.098 per minute
SMS/MMS	\$0.04 per SMS/MMS message
Data	0.001084 cents per KB

Mr Tan compares the mobile plans offered by the three telecommunications companies. There is a 20% discount on his total monthly bill if he signs up for the mobile plan offered by telecommunications company A. Mr Tan uses 400 minutes of Talk Time, 100 SMS/MMS messages and 21 GB of data every month.

Using the mobile plan offered by each of the three telecommunications companies, calculate Mr Tan's total monthly bill, including a 9% Goods and Services Tax (GST).
[1 GB = 10^6 KB]

Suggest which telecommunications company Mr Tan should choose given that all the three telecommunications companies provide the same good service.

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