智行菩願

MANJUSRI SECONDARY SCHOOL
文 殊 中 學

2024 PRELIMINARY EXAMINATION

Name			
Class		Index Number	

MATHEMATICS
Secondary Four Normal (Academic) / NT SBB
Paper 1

4045/01
1 August 2024
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Name, index number and class 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.

Answer all 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, unless the question requires the answer in terms of π.

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 70.

For Examiner's Use	
Total	**/ 70**

Parent's / Guardian's Signature: ……..

Mathematical Formulae

Compound Interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

Answer **all** the questions.

1 Write the following numbers in order of length, starting with the **largest**.

$$\frac{48}{1000}, \qquad 48, \qquad \frac{48}{10^4}, \qquad 48 \times 10^4$$

Answer ……, ……, ……, …… [2]

largest

---

2 By rounding each number to 1 significant figure, **estimate** the value of

$$\frac{0.87 \times 547}{0.498}$$

Show your working.

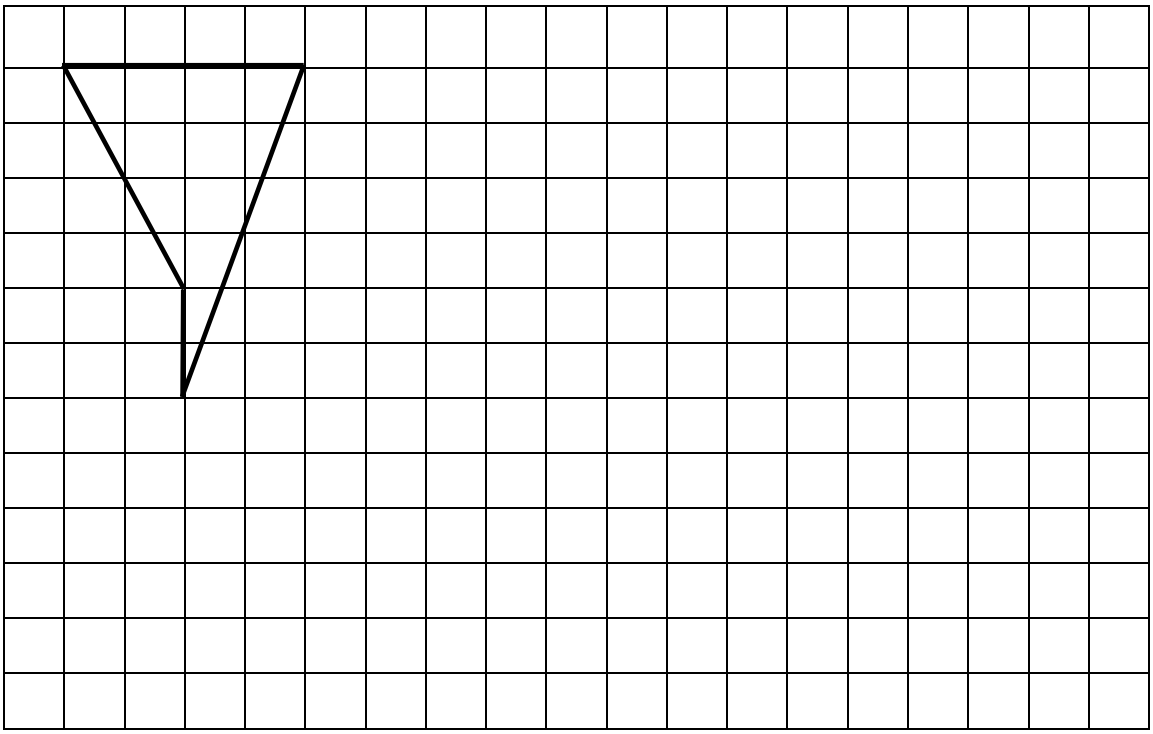
Answer …… [2]

---

3 Find the largest integer x satisfying the inequality $-5x > 36$.

Answer $x =$…… [2]

4



Draw an enlargement of this trapezium using a scale factor of 1.5. [2]

---

5 The first five terms of a sequence are 9, 16, 23 and 30.

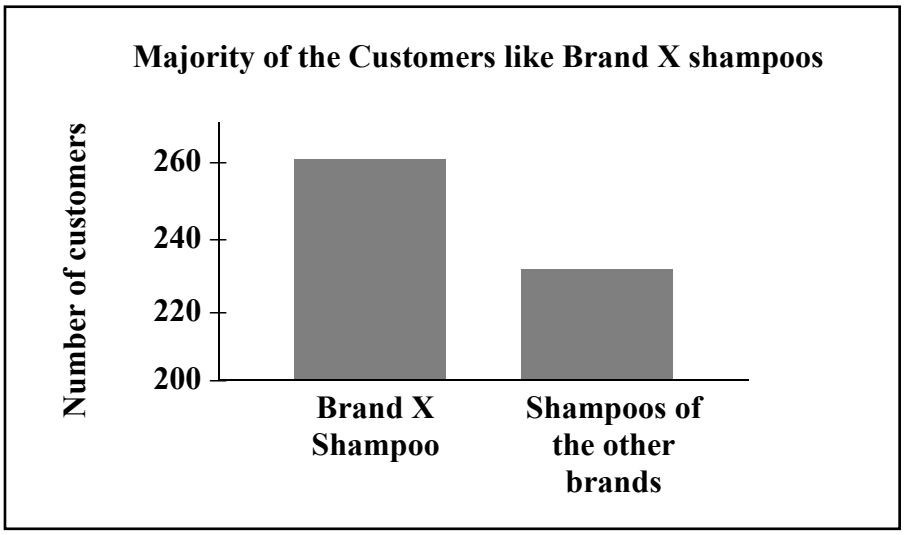
(a) Write down the next two terms in the sequence.

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

(b) Find an expression for the nth term of the sequence.

Answer ..... [1]

6



Bryan went to a supermarket to buy shampoo. He saw the above poster on a noticeboard and decided to buy Brand X shampoo as he saw that Brand X shampoo is twice as popular as the other brands.

Explain with calculations why Bryan was misled by the poster.

Answer ……,

……,,

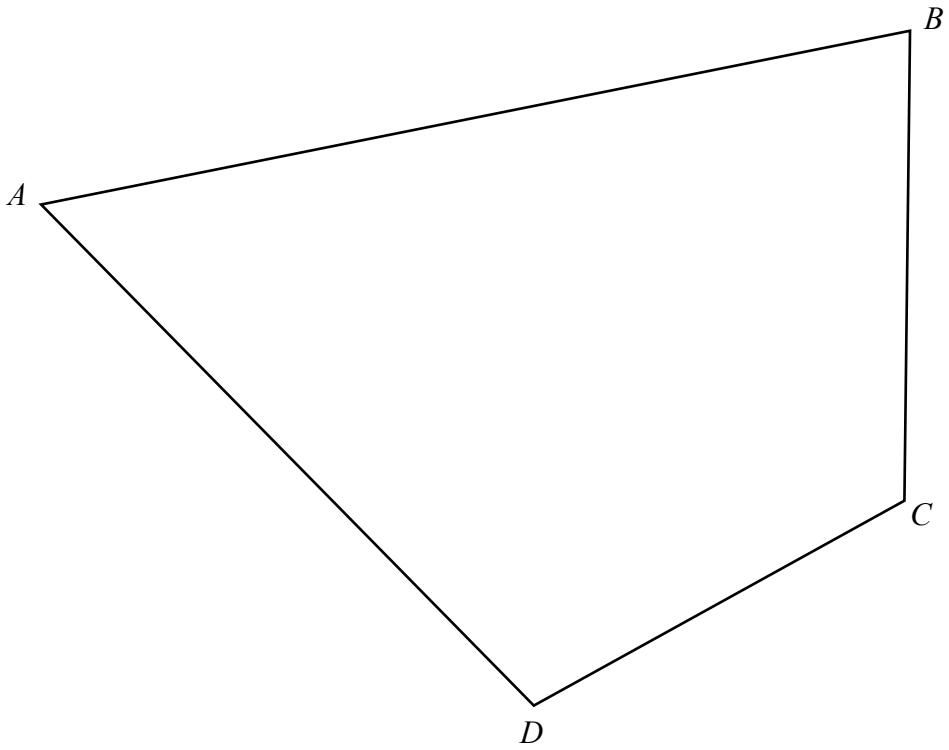
…… [2]

---

7 Given that $a = \frac{2b-1}{bc}$, make b the subject of the formula.

Answer $b =$ …… [3]

8



(a) Construct the angle bisector of angle *BCD*. [1]

(b) Construct the perpendicular bisector of *AD*. [1]

(c) *E* is the point of intersection of the bisector of angle *BCD* and the perpendicular bisector of *AD*. Measure the angle *AEB*.

Answer ……° [1]

9 Rope *A* is 1.26 m and rope *B* is 84 cm.

(a) Find the ratio of the length of rope *A* to the length of rope *B*.

Answer ……. : ……..... [1]

(b) Rope *B* is cut into three pieces in the ratio 2 : 3 : 5.
Find the difference in cm, between the lengths of the shortest and the longest piece.

Answer ……..…cm [2]

---

10 Solve the following equation, giving your anwers correct to 2 decimal places.

$(x+5)(x-6)=9$

Answer $x =$……..….. [3]

---

11 Solve the following equations

(a) $5x-3=9$,

Answer $x=$ ..... [1]

(b) $\dfrac{3x+4}{4x-2}=\dfrac{1}{5}$.

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

---

12 Factorise the following algebraic expressions completely

(a) $5wx+7wy-15xz-21yz$,

Answer ..... [2]

(b) $5y^2-17y+6$.

Answer ..... [2]

---

13 The table below shows the tax rates on chargeable income for the year of assessment 2024.

Chargeable Income	Income Tax Rate (%)	Gross Tax Payable ($)
First $20,000 Next $10,000	0 2	0 200
First $30,000 Next $10,000	- 3.50	200 350
First $40,000 Next $40,000	- 7	550 2,800
First $80,000 Next $40,000	- 11.5	3,350 4,600
First $120,000 Next $40,000	- 15	7,950 6,000

Mr Fong's annual income was $113 400. He donated $100 to Community Chest and he was entitled to the personal relief of $16,000.

Chargeable income = annual income – donation – total personal relief.

Calculate

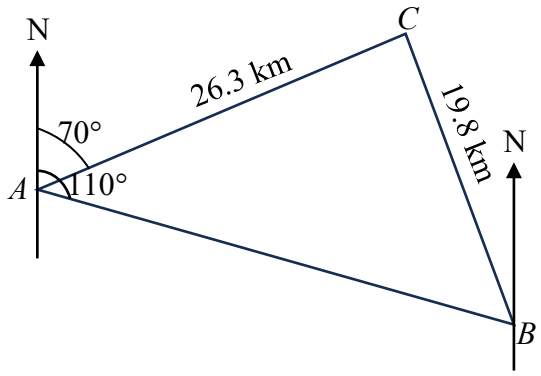
(a) Mr Fong's chargeable income.

Answer $…… [1]

(b) the amount of personal income tax that he needed to pay.

Answer $…… [2]

14



The diagram shows the position of 3 towns A, B and C. The bearing of B from A is 110° and the bearing of C from A is 070°. AC = 26.3 km and BC = 19.8 km.

Find

(a) angle ABC.

Answer ……..…° [2]

(b) the bearing of C from B.

Answer ……..…° [2]

15 **(a)** Simplify $\left(\frac{3m^{-3}}{2n^{6}}\right)^{2} \times m^{0}$, expressing your answer in positive indices.

Answer ……..…… [2]

(b) p is directly proportional to q^2.
If $q = 0.4$ when $p = 8$, find the value(s) of q when $p = 0.5$.

Answer q = ……..…… [2]

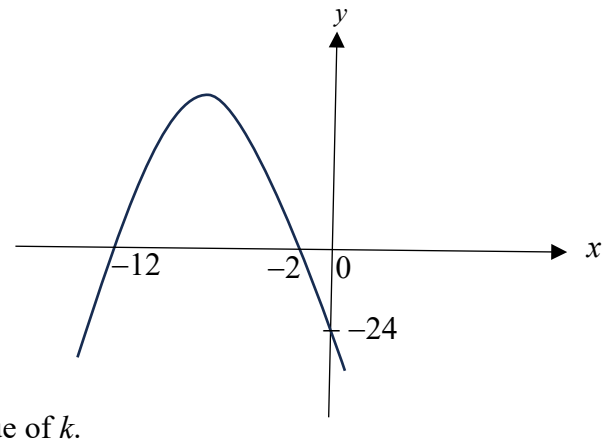
16 **(i)** Express $x^2 - 12x - 10$ in the form of $(x + a)^2 + b$. Find the values of a and b.

Answer $a = \ldots\ldots$, $b = \ldots\ldots$ [2]

(ii) Hence, solve $x^2 - 12x - 10 = 0$.

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

17 The sketch shows the quadratic curve of $y = k(x+2)(x+12)$.



(a) Find the value of k.

Answer $k =$ ……..… [2]

(b) Find the coordinates of the maximum point.

Answer (…… , ……) [2]

18 The scale given on a particular map is 1 : 250 000.

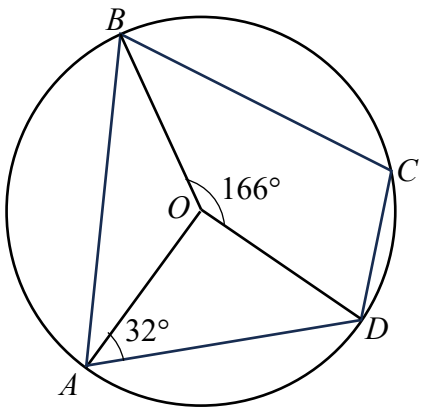
(a) The length of Singapore river is 1.28 cm on a map.
Find the length of the actual length of Singapore river in km.

Answer …….. km [2]

(b) The area of Singapore is 734.3 km^2.
Calculate the area on the map in cm^2.

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

19



Points A, B, C and D lie on a circle, centre O. $\angle OAD = 32°$ and $\angle BOD = 166°$.
Find the following angles, give reasons for your working.

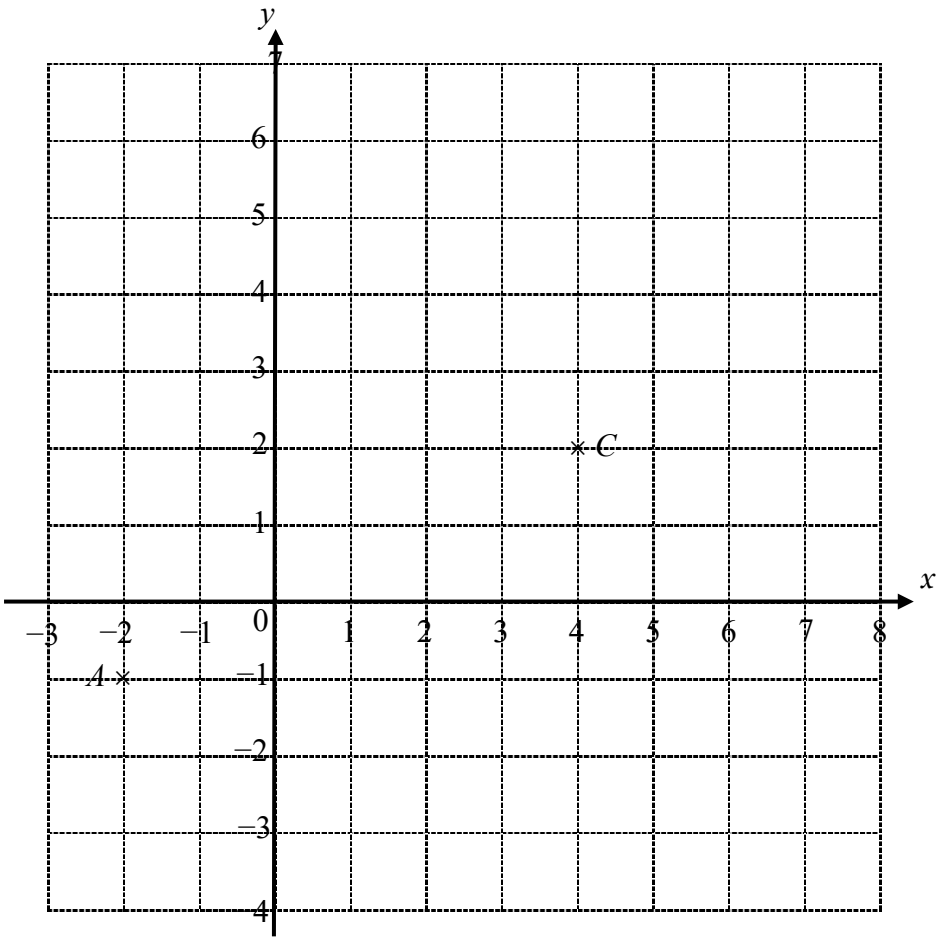
(a) $\angle BOA$

Answer ……° [2]

(b) $\angle BCD$

Answer ……° [2]

20



On the above grid, A is the point $(-2, -1)$, B is the point $(6, k)$ and C is the point $(4, 2)$.

(a) Find the value of k if the gradient of the straight line joining A and B is $\frac{1}{2}$.

.

Answer $k =$…… [1]

(b) Write down the equation of the straight line joining A and B.

Answer …….. [1]

(c) Calculate the length of AC.

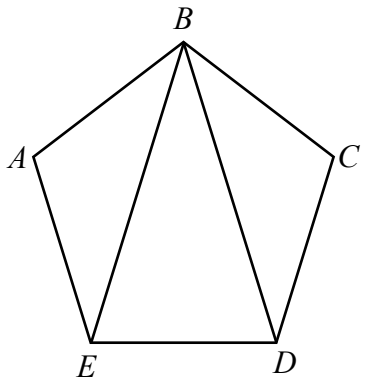
Answer ..... [2]

(d) On the grid above, draw the graph of $x + y = 3$. [1]

(e) From your graph, state the intersection point of the line AB and $x + y = 3$.

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

21



ABCDE is a regular pentagon.

(a) Prove that ΔABE is congruent to ΔCBD.

Answer

……..
……..
……..
……..
……...
…….. [3]

(b) Calculate

(i) $\angle BAE$,

Answer ……° [1]

(ii) $\angle EBD$.

Answer ……° [2]

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Answer **all** the questions.

1 Write the following numbers in order of lengths, starting with the **largest**.

$$\frac{48}{1000}, \qquad 48, \qquad \frac{48}{10^4}, \qquad 48 \times 10^4$$

$\frac{48}{1000}$, 48, $\frac{48}{10^4}$, 48×10^4

0.048, 48, 0.0048, 480000

(3) (2) (4) (1)

Answer: 48×10^4, 48, $\frac{48}{1000}$, $\frac{48}{10^4}$ B2 (B1 for at least 2 in correct order)

Answer ……, ……, ……, …… [2]

largest

---

2 By rounding each number to 1 significant figure, **estimate** the value of

$$\frac{0.87 \times 547}{0.498}.$$

Show your working.

$\frac{0.87 \times 547}{0.498} \approx \frac{0.9 \times 500}{0.5}$ M1 (At least 2 correct roundings)

$= 900$ A1

Answer …… [2]

---

3 Find the largest integer x satisfying the inequality $-5x > 36$.

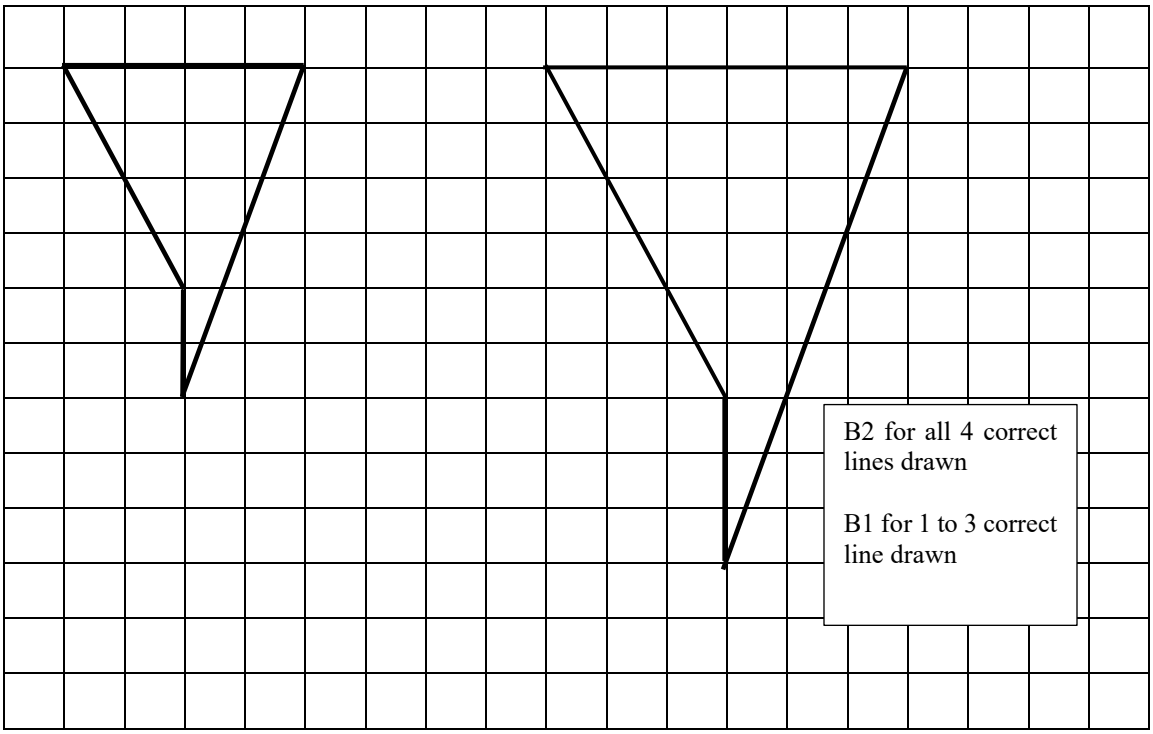
$x < \frac{36}{-5}$ M1

$x < -7.2$

Largest integer $= -8$ A1

Answer $x =$…… [2]

4



B2 for all 4 correct lines drawn

B1 for 1 to 3 correct line drawn

Draw an enlargement of this trapezium using a scale factor of 1.5. [2]

---

5 The first five terms of a sequence are 9, 16, 23 and 30.

(a) Write down the next two terms in the sequence.

37, 44 B1

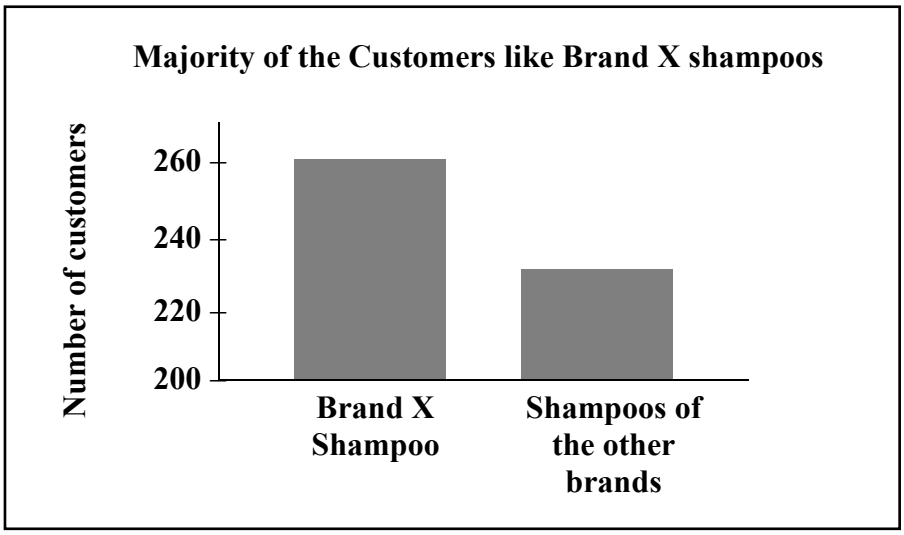
Answer ..... , ... [1]

(b) Find an expression for the nth term of the sequence.

$7n + 2$ B1

Answer ..... [1]

6



Bryan went to a supermarket to buy shampoo. He saw the above poster on a noticeboard and decided to buy Brand X shampoo as he saw that Brand X shampoo is twice as popular as the other brands.

Explain with calculations why Bryan was misled by the poster.

Answer ..

260 ÷ 230 = 1.13 , not 2 times. B1

The vertical axis did not start from zero, that enlarged the differences between the heights of the bars and gave misleading visual impact to the viewer. B1

….., ….,. [2]

---

7 Given that $a = \dfrac{2b-1}{bc}$, make b the subject of the formula.

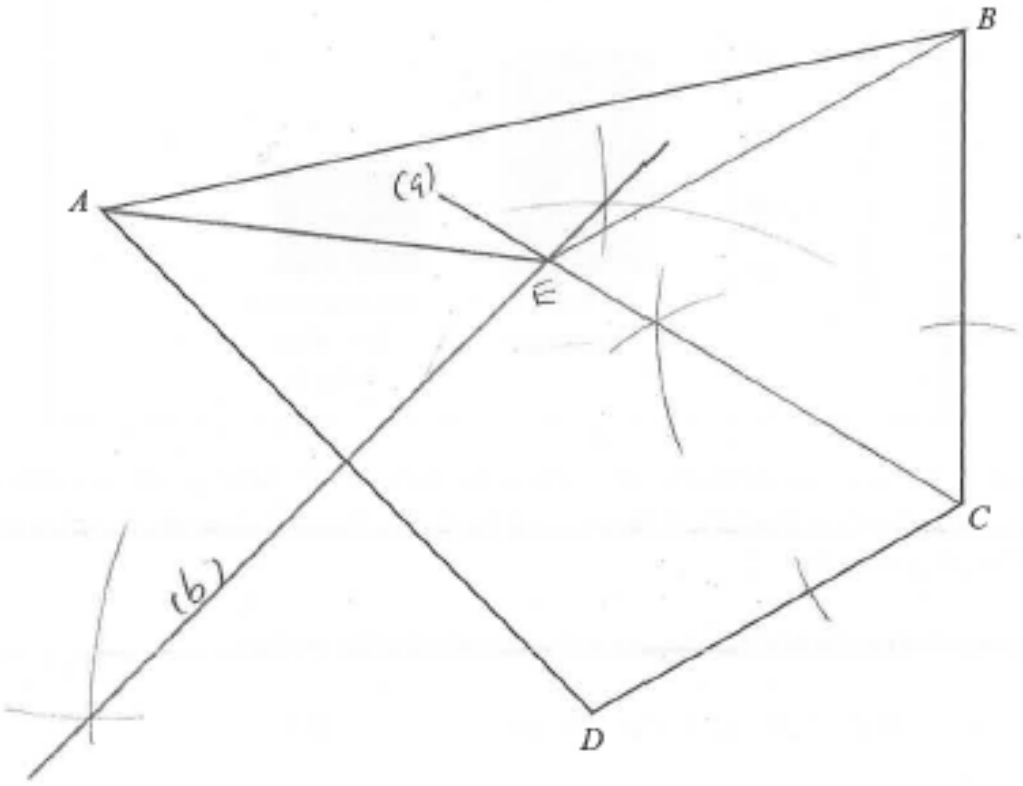
$abc = 2b - 1$ M1

$b(ac - 2) = -1$ M1

$b = \dfrac{-1}{ac-2}$ or $b = \dfrac{1}{2-ac}$ A1

Answer $b =$ ..... [3]

8



(a) Construct the angle bisector of angle *BCD*. [1]

(b) Construct the perpendicular bisector of *AD*. [1]

(c) *E* is the point of intersection of the bisector of angle *BCD* and the perpendicular bisector of *AD*. Measure the angle *AEB*.

Answer 145 ± 1 ° [1]

9 Rope *A* is 1.26 m and rope *B* is 84 cm.

(a) Find the ratio of the length of rope *A* to the length of rope *B*.

126 : 84 = 3 : 2 B1

Answer ……. : ……..... [1]

(b) Rope B is cut into three pieces in the ratio 2 : 3 : 5.
Find the difference in cm, between the lengths of the shortest and the longest piece.

10 units = 84 cm
1 unit = 8.4 cm M1
5-2 = 3 units = 8.4 cm × 3
= 25.2 cm A1

Answer ……. cm [2]

---

10 Solve the following equation, giving your anwers correct to 2 decimal places.

$(x+5)(x-6)=9$

$x^2-x-30-9=0$ M1
$x^2-x-39=0$
$x=\dfrac{-(-1)\pm\sqrt{(-1)^2-4(1)(-39)}}{2(1)}$ M1
$x=\dfrac{1\pm\sqrt{157}}{2}$
$x=6.76$ or -5.76 (2 d.p.) A1

Answer $x=$……..... [3]

---

11 Solve the following equations

(a) $5x-3=9$,

$5x=12$	
$x=2.4$	B1

Answer $x=$ …… [1]

(b) $\dfrac{3x+4}{4x-2}=\dfrac{1}{5}$.

$5(3x+4)=1(4x-2)$	M1
$15x+20=4x-2$	
$11x=22$	
$x=-2$	A1

Answer $x=$ ……..... [2]

---

12 Factorise the following algebraic expressions completely

(a) $5wx+7wy-15xz-21yz$,

$=w(5x+7y)-3z(5x+7y)$	M1
$=(5x+7y)(w-3z)$	A1

Answer …….. [2]

(b) $5y^2-17y+6$.

$=(5y-2)(y-3)$	B2

Answer ……..... [2]

---

13 The table below shows the tax rates on chargeable income for the year of assessment 2024.

Chargeable Income	Income Tax Rate (%)	Gross Tax Payable ($)
First $20,000 Next $10,000	0 2	0 200
First $30,000 Next $10,000	- 3.50	200 350
First $40,000 Next $40,000	- 7	550 2,800
First $80,000 Next $40,000	- 11.5	3,350 4,600
First $120,000 Next $40,000	- 15	7,950 6,000

Mr Fong's annual income was $113 400. He donated $100 to Community Chest and he was entitled to the personal relief of $16,000.

Chargeable income = annual income – donation – total personal relief.

Calculate

(a) Mr Fong's chargeable income.

Chargeable income = 113 400 – 100 – 16 000
= $ 97 300 B1

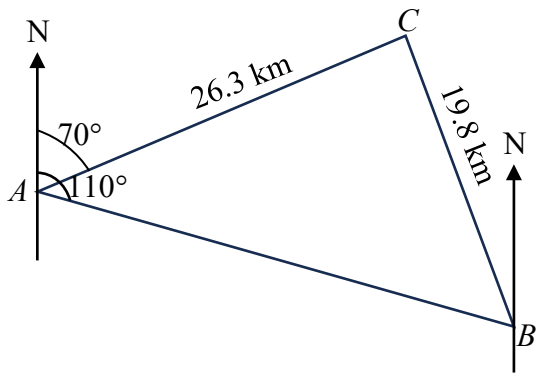
Answer $..... [1]

(b) the amount of personal income tax that he needed to pay.

Tax payable = $3350 + $17 300 × 11.5% M1
= $3350 + $1989.50
= $5339.50 A1

Answer $..... [2]

14



The diagram shows the position of 3 towns A, B and C. The bearing of B from A is 110° and the bearing of C from A is 070°. AC = 26.3 km and BC = 19.8 km.

Find

(a) angle ABC.

$\angle CAB = 110° - 70° = 40°$

$\dfrac{\sin \angle ABC}{26.3} = \dfrac{\sin 40°}{19.8}$ M1

$\sin \angle ABC = \dfrac{\sin 60°}{19.8} \times 26.3$

$\angle ABC = 58.628°$

$= 58.6°$ A1

Answer ……..…° [2]

(b) the bearing of C from B.

The bearing of C from B = 180° + 110 ° + 58.6° M1

= 348.6° (1 d.p.) A1

Answer ……..…° [2]

15 **(a)** Simplify $\left(\frac{3m^{-3}}{2n^{6}}\right)^{2} \times m^{0}$, expressing your answer in positive indices.

$\left(\frac{3m^{-3}}{2n^{6}}\right)^{2} \times m^{0} = \frac{3^{2}m^{-6}}{2^{2}n^{12}} \times 1$ M1 for at least 1 index law used correctly

$= \frac{9}{4m^{6}n^{12}}$ A1

Answer ……..…… [2]

(b) p is directly proportional to q^2.
If $q = 0.4$ when $p = 8$, find the value(s) of q when $p = 0.5$.

$p = kq^2$, where k is a constant.
Sub $q = 0.4$ and $p = 8$:
$8 = k \times 0.4^2$
$8 \div 0.4^2 = k$
$k = 50$ M1
When $p = 0.5$,
$0.5 = 50\ q^2$
$q = \pm\sqrt{\frac{0.5}{50}} = \pm 0.1$ A1 (A0 if negative answer is omitted)

Answer q = ……..…… [2]

16 **(i)** Express $x^2 - 12x - 10$ in the form of $(x+a)^2 + b$. Find the values of a and b.

$x^2 - 12x - 10$
$= x^2 - 12x + 6^2 - 6^2 - 10$ M1
$= (x-6)^2 - 46$
a = –6, b = –46 A1

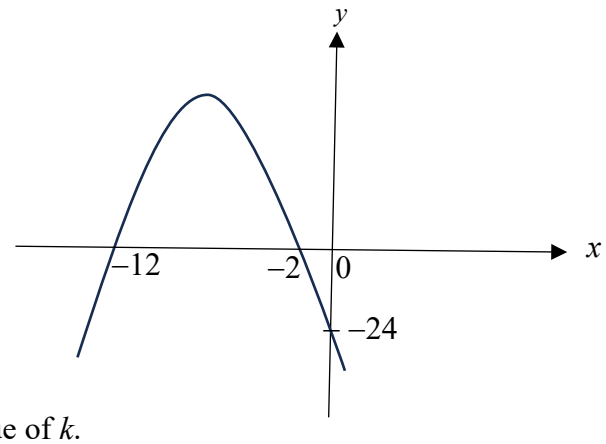
Answer $a = \ldots\ldots$, $b = \ldots\ldots$ [2]

(ii) Hence, solve $x^2 - 12x - 10 = 0$.

$x^2 - 12x - 10 = 0$
$(x-6)^2 - 46 = 0$
$x - 6 = \pm\sqrt{46}$ M1
$x = 6 \pm \sqrt{46}$
x = 12.8 or –0.782 (3 sf) A1

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

17 The sketch shows the quadratic curve of $y = k(x+2)(x+12)$.



(a) Find the value of k.

$-24 = k\,(2)(\,12)$	M1
$-24 = 24\,k$	
$k = -1$	A1

Answer $k =$ ……..… [2]

(b) Find the coordinates of the maximum point.

Line of symmetry: $x = \dfrac{(-12)+(-2)}{2} = -7$	M1
$y = -(-7+2)(-7+12) = 25$	
Max point = (−7, 25)	A1

Answer (…… , ……) [2]

18 The scale given on a particular map is 1 : 250 000.

(a) The length of Singapore river is 1.28 cm on a map.
Find the length of the actual length of Singapore river in km.

Map scale = 1 cm : 2.5 km	M1
Actual length of Singapore river	
= 2.5 km × 1.28	
= 3.2 km	A1

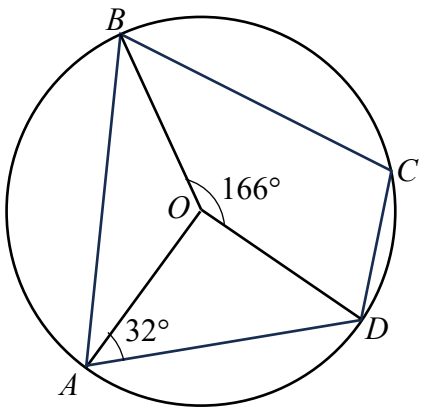
Answer …….. km [2]

(b) The area of Singapore is 734.3 km^2.
Calculate the area on the map in cm^2.

Area scale = $(1\ cm)^2 : (2.5\ km)^2$	M1
$= 1\ cm^2 : 6.25\ km^2$	
Map area of Singapore	
= 734.3 ÷ 6.25	
= 117.488 cm^2 (accept 117 cm^2)	A1

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

19



Points A, B, C and D lie on a circle, centre O. $\angle OAD = 32°$ and $\angle BOD = 166°$.
Find the following angles, give reasons for your working.

(a) $\angle BOA$

$\angle BAD = 166° \div 2$ ($\angle$ at centre = 2×$\angle$ at circumference) M1

$= 83°$

$\angle BAO = 83° - 32° = 51°$

$\angle BOA = 180° - 51° \times 2 = 78°$ ($\angle$ sum of Δ) A1

Alternate method:

$\angle AOD = 180° - 2 \times 32°$ ($\angle$ sum of isosceles Δ) (M1)

$= 116°$

$\angle BOA = 360° - 116° - 166°$ ($\angle$s at a point) (A1)

Answer ……° [2]

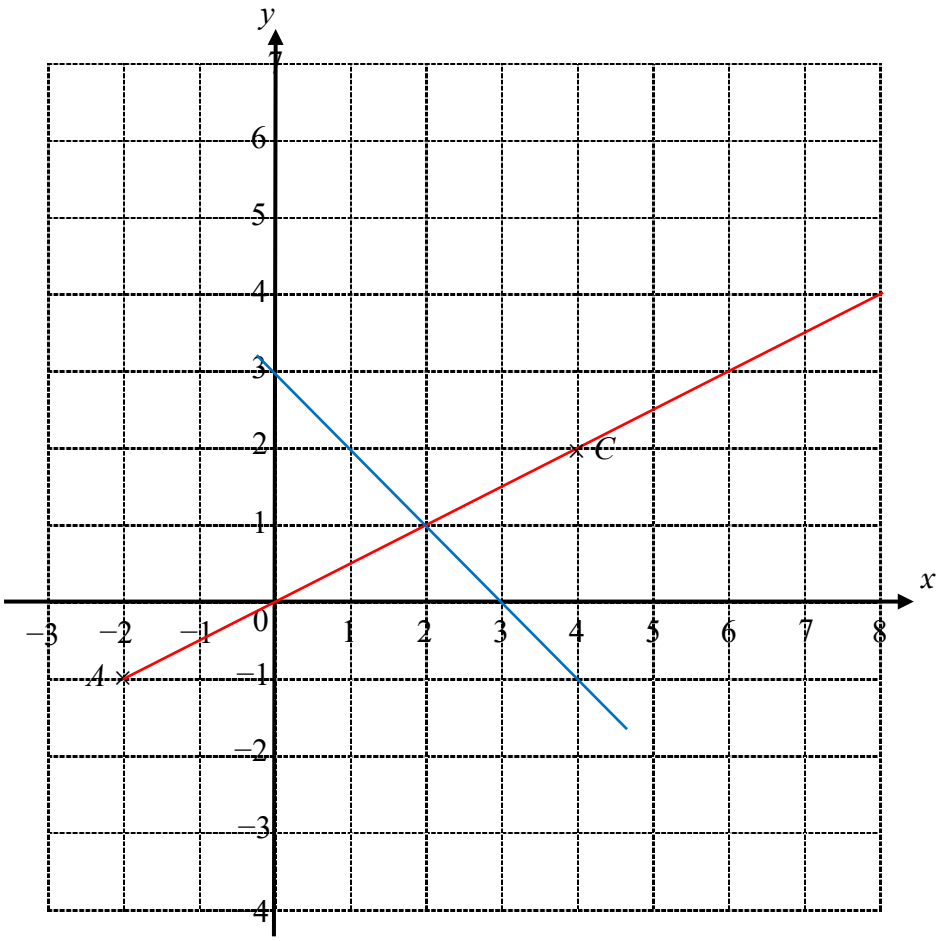
(b) $\angle BCD$

$\angle BCD = 180° - 83°$ ($\angle$ in opp segment) M1

$= 97°$ A1

Answer ……° [2]

20



On the above grid, A is the point $(-2, -1)$, B is the point $(6, k)$ and C is the point $(4, 2)$.

(a) Find the value of k if the gradient of the straight line joining A and B is $\frac{1}{2}$.

.

$k = 3$ B1

Answer $k =$..... [1]

(b) Write down the equation of the straight line joining A and B.

$y = \frac{1}{2}x$ B1

Answer ..... [1]

(c) Calculate the length of AC.

$AC = \sqrt{(-2-4)^2 + (-1-2)^2}$ M1

$= \sqrt{45}$

$= 6.71$ units A1

Answer ..... [2]

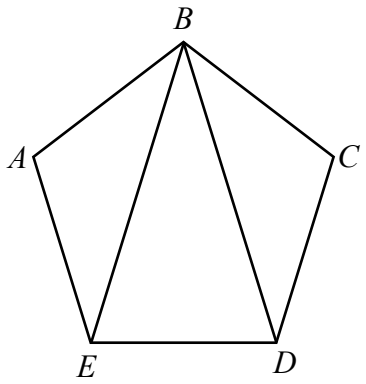
(d) On the grid above, draw the graph of $x + y = 3$. [1]

(e) From your graph, state the intersection point of the line AB and $x + y = 3$.

(2, 1) B1

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

21



ABCDE is a regular pentagon.

(a) Prove that ΔABE is congruent to ΔCBD.

Answer

$AB = BC$, $AE = CD$ (sides of a regular pentagon) M1

$\angle BAE = \angle BCD$ (angles of regular pentagon) M1

$\therefore \Delta ABE$ is congruent to ΔCBD (SAS) A1

[3]

(b) Calculate

(i) $\angle BAE$,

$$\angle BAE = \frac{(5-2)\times 180°}{5} = 108° \qquad \text{B1}$$

Answer ……° [1]

(ii) $\angle EBD$.

$\angle ABE = (180–108)° \div 2$ (base angles of isosceles Δ) M1

$= 36°$

$= \angle CBD$

$\angle EBD = 108° - 36° \times 2$

$= 36°$ A1

Answer ……° [2]

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MANJUSRI SECONDARY SCHOOL
文 殊 中 學

2024 PRELIMINARY EXAMINATION

Name

Class

Index Number

MATHEMATICS
Secondary Four Normal (Academic) / NT SBB
Paper 2

4045/02
2 August 2024
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Name, index number and class 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.

Answer all questions. In Section A and answer one question in Section B.
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, unless the question requires the answer in terms of π.

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 70.

For Examiner's Use	
Total	**/ 70**

Parent's / Guardian's Signature: ……..

Mathematical Formulae

Compound Interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

Section A (62 marks)

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

1 Work out

(a) $\dfrac{-1-\sqrt{6-0.5(2)^2}}{2}$,

Answer ……..... [1]

(b) $\dfrac{5.3^2}{4.83\times 2.4}$.

Answer ……..... [1]

---

2 The table shows the land size of 4 countries.

Countries	Area in km^2
India	3.29×10^9
Myanmar	6.77×10^5
Indonesia	1.49×10^6
Vietnam	331 114

Calculate the total land sizes of the four countries, giving your answer in standard form.

Answer ……..... [1]

---

3 **(a)** Written as a product of its prime factors, $8640 = 2^x \times 3^y \times 5$ .Find the values of x and y.

Answer x = …… , y = …….. [2]

(b) Written as a product of its prime factors, $378 = 2\times 3^3 \times 7$.
Find the smallest positive integer p, such that $378p$ is a square number.

Answer ……..... [1]

---

4 Solve these simultaneous equations.

$$5x - 3y = 23$$
$$2x + y = 18$$

Show your working.

Answer $x =$ …… , $y =$ ……. [3]

---

5 Jane bought a bottle of perfume at £62.00 in UK for her mother, inclusive of tax.
The exchange rate between Singapore dollars (S$) and Pound sterling (£) was S$1 = £0.58.
When she returned to Singapore, she found that the same perfume was priced at S$102, before the 9% GST is charged.

The price of the perfume is cheaper in which country,

Singapore or UK?

Answer …… [3]

---

6 The stem-and-leaf diagram shows the height, in cm, of plants in a plant nursery.

4	3		
5	1	7	
6	0	1	
7	3	6	6
8	4		

Key 4|3 = 43

(a) State

(i) the modal height,

Answer ……..…. cm [1]

(ii) the median height,

Answer ……..…. cm [1]

(b) Calculate

(i) the mean height,

Answer ..……..... cm [2]

(ii) the standard deviation.

Answer ……..…. cm [1]

7 Rose received a bonus of $5000. She wanted to save it in a bank for 5 years. The bank offered two plans.

Plan A	Plan B
3% simple interest per annum	2.8 % compound interest compounded yearly

Explain which plan should Rose choose? Show your working clearly.

Answer

She should choose Plan …… because ……

…… [4]

8 The points P, Q and R lie on the circumference of a circle. $PQ = 34$ cm, $QR = 16$ cm and $PR = 28$ cm.

Determine if PQ is a diameter.

Answer ……

……

…… [3]

9 The table shows the information of students from 4B and 4C.

	Boys	**Girls**
4B	**23**	**14**
4C	**19**	**16**

Two student supporters are selected at random from the two classes **without replacement**. Find the probability that

(a) the first student chosen is a 4B boy and the second student is a 4C girl,

Answer …… [1]

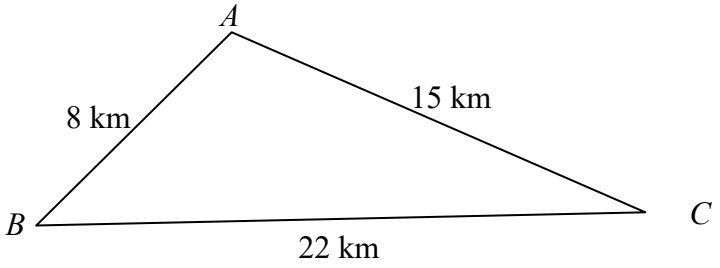
(b) both students chosen are girls,

Answer …… [1]

(c) at least one of the students chosen is from **4B**.

Answer …… [2]

10 A, B and C are three ships on the sea.



Calculate

(a) $\angle ABC$,

Answer ..... ° [3]

(b) the area of ΔABC,

Answer ..... km^2 [2]

(c) the shortest distance from A to BC.

Answer ..... km [2]

11 A hat in the shape of a cone is shown below in figure 1. The measurements are in cm.

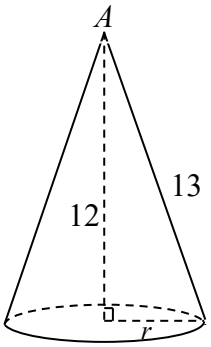


Figure 1

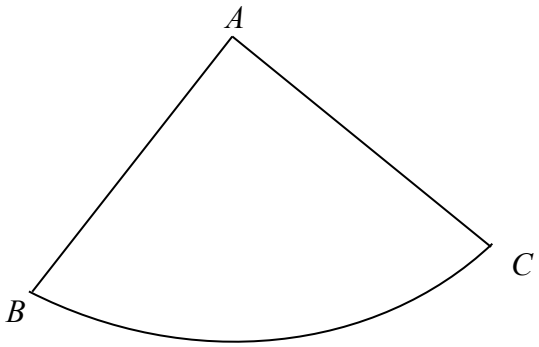


Figure 2

The cone is made from a sector (Figure 2) by joining AB and AC together.

The circumference of the circle of the base of the cone is the arc length of the sector.

Find

(a) the radius, r, of the base circle of the cone,

Answer ..... cm [2]

(b) the circumference of the base circle of the cone,

Answer ..... cm [1]

(c) $\angle BAC$, in radians.

Answer ..... radians [2]

12 Mary bought a washing machine for $2840. She paid a down payment of 20% and repaid the balance in 36 equal monthly instalments. The interest charged was 5% per annum on the remaining amount.

Find

(a) the amount of the down payment,

Answer $ ..... [2]

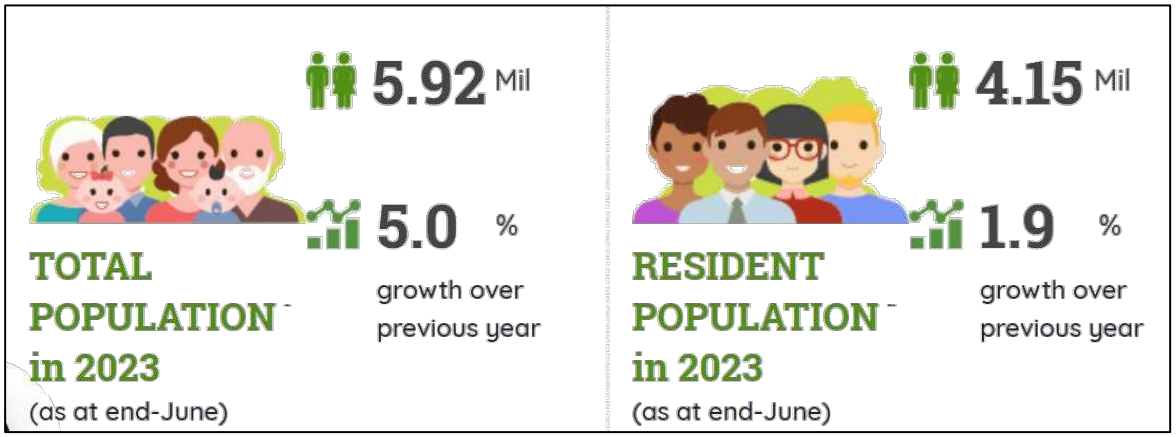
(b) the interest paid,

Answer $ ..... [2]

(c) the amount of each monthly instalment.

Answer $ ..... [2]

13 The infographics below shows Singapore's population in 2023. (https://www.singstat.gov.sg)



** The total population comprises Singapore residents and non-residents.

(a) Using the above information, John calculated some data in the shaded part of the table below.

	Total Population (in million)	Resident Population (in million)	Non-resident Population (in million)
2023	5.92	4.15	*x*
Percentage growth over previous year	5%	1.9%	*z*
2022	*y*	4.07	1.57

Calculate the value of

(i) *x*, the non-resident population in 2023,

Answer x = …….. million [1]

(ii) *y*, the total population in 2022.

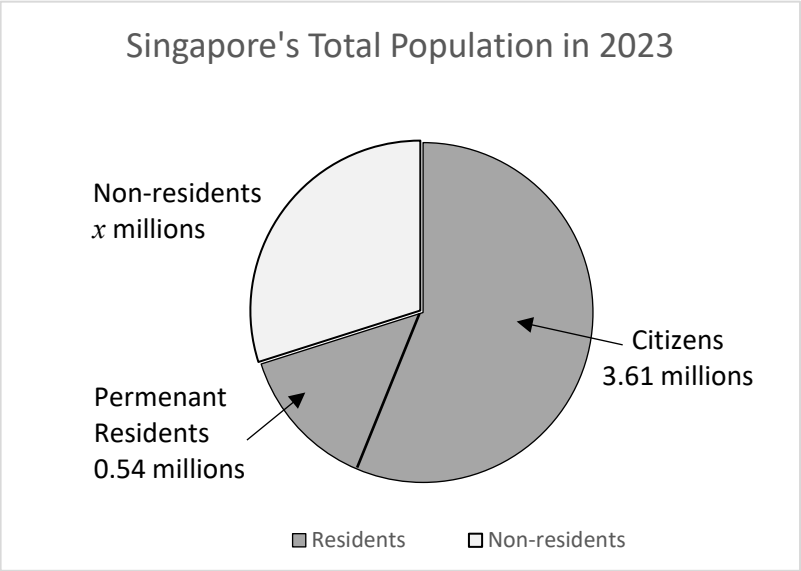
Answer y =…… million [2]

(iii) John's calculated value of z, the percentage growth over previous year for non-resident population is 3.1%. Do you think he is correct? Verify with your working.

Answer ……
……[3]

(b) Resident population comprises Singapore citizens and permanent residents.

Jane created a pie chart below based on the data from the website.



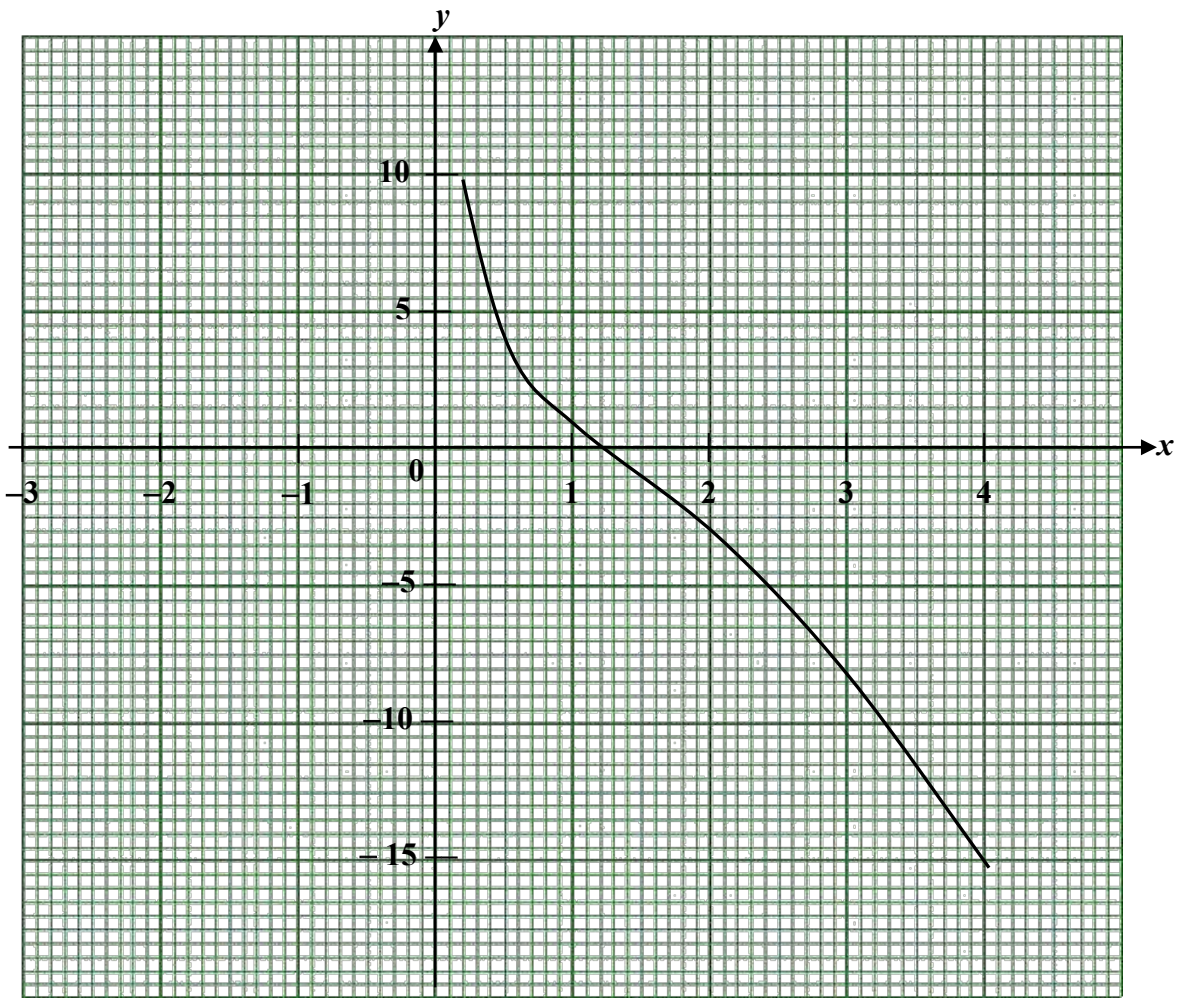
Calculate the angle of the sector representing "Citizens" in the pie chart.
(Cannot be done by measurements)

Answer …… ° [2]

14 **(a)** Complete the table of values for the curve $y = \frac{2}{x} - x^2$. [1]

x	–3	–2.5	–2	–1.5	–1	–0.5
Y	–9.7	–7.05	–5	–3.6	–3	

(b) Draw the graph of $y = \frac{2}{x} - x^2$ for $0.2 \le x \le 4$. A part of the graph of $y = \frac{2}{x} - x^2$ has been drawn for you. [2]



(c) Explain why it is not possible to find a value of y when $x = 0$.

Answer ……

…… [1]

(d) Use your graph to find the values of x when $y = -5$.

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

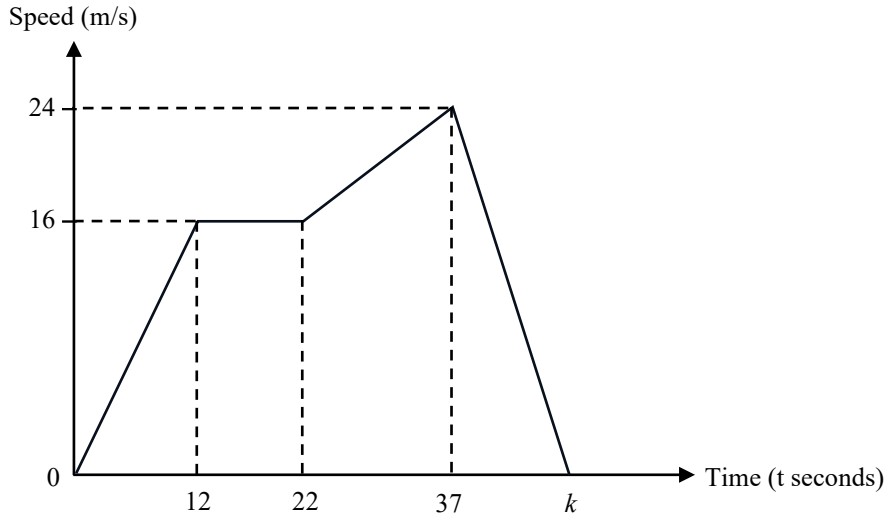
(e) By drawing a suitable tangent, find the gradient of the curve when $x = -2$.

Answer ..... [2]

Section B (8 marks)

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

15 The diagram shows the speed-time graph of a vehicle.



(a) Find the acceleration at $t = 10$.

Answer ……..….. m/s^2 [1]

(b) Given that the distance travelled by the vehicle from $t = 37$ to $t = k$ is 96 m.
Find the value of k.

Answer k = …… [2]

(c) Find the average speed of the whole journey.

Answer …… m/s [3]

(d) Express 24 m/s into km/h.

Answer …… km/h [2]

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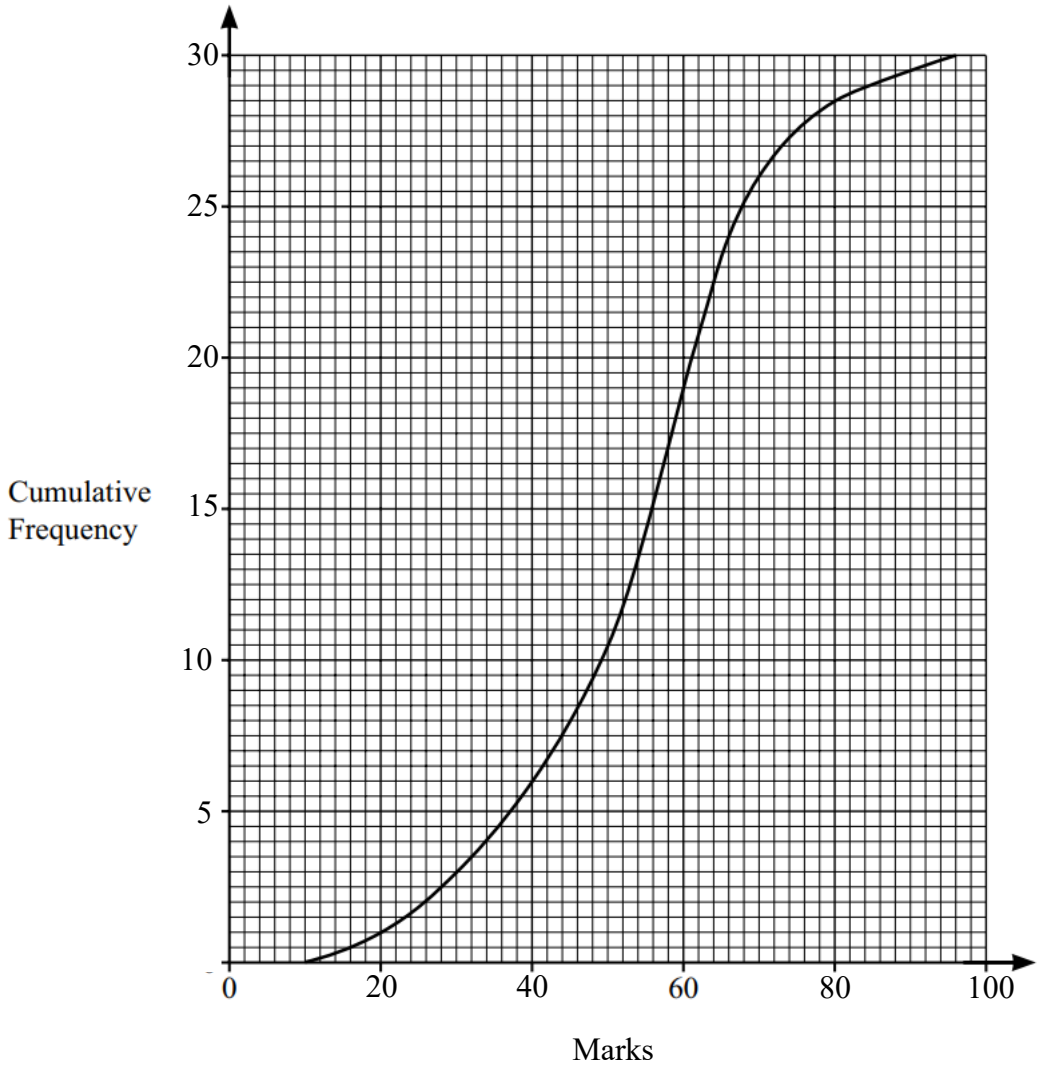
16 **(a)** The marks of students in a Mathematics test in **4H** are recorded.
The results are shown in the cumulative frequency diagram.



(i) Find the inter-quartile range.

Answer ..... marks [2]

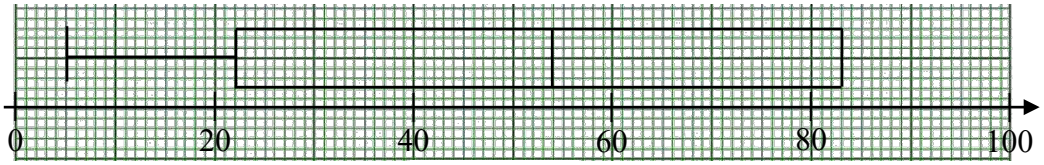
(ii) Find the 90th percentile.

Answer ..... marks [1]

(iii) 20 %of the students scored distinctions. Find the minimum marks for distinction.

Answer ..... marks [2]

(b) The same mathematics test marks of **4I** students are presented in the incomplete box-and-whiskers plot below.



Marks

It is given that the median mass is 54 marks and the range is 93 marks.

(i) Based on the information given, **complete** the box-and-whiskers plot above. [1]

(ii) Find the inter-quartile range for class 4H.

Answer ..... marks [1]

(c) Which class' recorded marks were more consistent on average?
Give a reason for your answer.

Answer

Class ..... because .....

..... [1]

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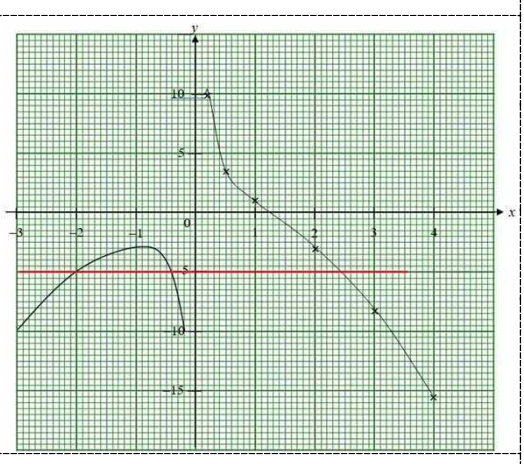
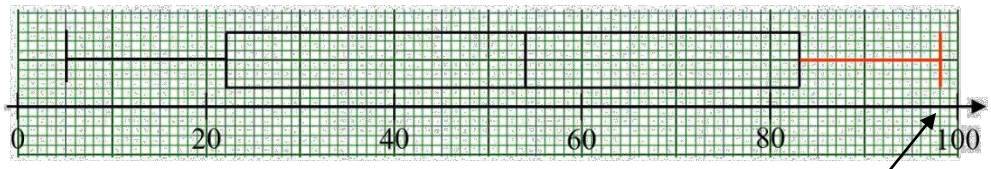
2024 4NA Prelim Paper 2 Answer Key

1	(a)	-1.5	(b)	2.42 (3 s.f.)
2		3.29×10^9		
3	(a)	$x = 6, y = 3$	(b)	$p = 2 \times 3 \times 7 = 42$
4		$x = 7,\ y = 4$		
5		The price in UK is cheaper.		
6	(a)	(i) 76 cm (ii) 61 cm	(b)	(i) 64.6 cm (ii) 12.7 cm
7		Rose should choose Plan A		
8		$QR^2 + PR^2 = 16^2 + 28^2 = 1\,040$ $PQ^2 = 34^2 = 1156$ Since $16^2 + 28^2 \neq 34^2$, $\angle PRQ$ is not a right angle. Hence, PQ is not a diameter.		
9	(a)	$\frac{46}{639}$ or 0.0720 (b) $\frac{145}{852}$ or 0.170	(c)	$\frac{1961}{2556}$ or 0.767
10	(a)	23.4° (1 d.p.) (b) 35.0 km^2	(c)	3.18 km
11	(a)	5 cm (b) 31.4 cm	(c)	2. 42 radians
12	(a)	\$568 (b) \$340.80	(c)	\$72.58
13	(a)	(i) 1.77 million (ii) 5.64 million (iii) 12.7%		
	(c)	219.5°		
14	(a)	-15.5	(b)	
	(c)	When $x = 0$, $\frac{2}{x}$ is undefined, so y is undefined.		
	(d)	$x = -2, -0.4$ or 2.45. (± 0.1)		
	(e)	Correct tangent drawn Gradient = 3.57 ± 0.2		
15	(a)	$\frac{4}{3}$ m/s^2 (b) 45	(c)	14.5 m/s (d) 86.4 km/h

16	(a)	(i) 20 (ii) 73	(iii)	66
	(b) (i)	 Max mark = 5+93 = 98 B1		
	(ii)	Interquartile range = 82 – 21 = 61	(c)	4H because 4H's interquartile range is smaller than 4I.

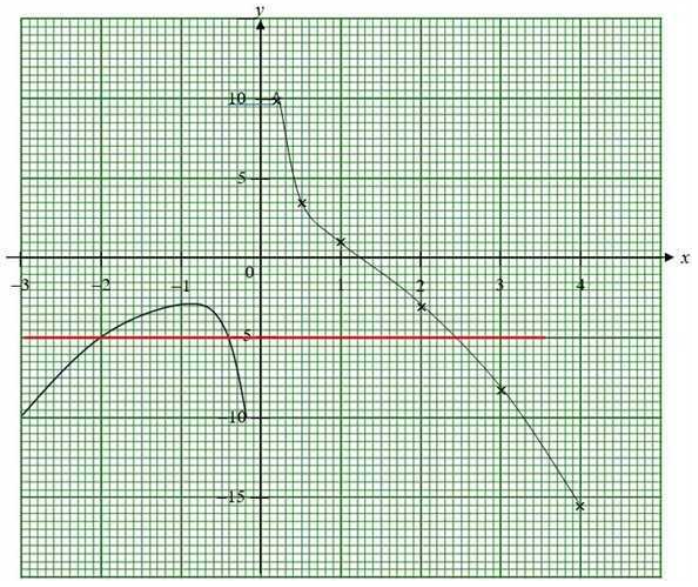
2024 4NA Prelim Paper 2 Marking Scheme

1	(a)	-1.5	B1	
	(b)	2.42 (3 s.f.)	B1	
2		3 292 498 114 $= 3.29 \times 10^9$	B1	
3	(a)	$8640 = 2^6 \times 3^3 \times 5$ $x = 6$, $y = 3$	 B1 B1	
	(b)	$p = 2 \times 3 \times 7 = 42$	B1	
4		$5x - 3y = 23$ ————(1) $2x + y = 18$ ————(2) (2) × 3: $6x + 3y = 54$ ————(3) (1) + (3): $11x = 77$ $x = 7$ Sub $x = 7$ into (2): $2 \times 7 + y = 18$ $y = 4$	 M1 M1 A1	
5		Price of Perfume in UK: £62.00 = S$ (62 ÷ 0.58) = S$ 106.90 (2 dp) Price of perfume in Singapore: S$102 × 1.09 = S$ 111.18 The price in UK is cheaper.	 M1 M1 A1	Accept S$102 × 1.09 = S$ 111.18 111.18 × £0.58 =£64.48 >£62
6	(a)(i)	Mode = 76 cm	B1	
	(ii)	Median = 61 cm	B1	
	(b)(i)	Mean = (43+51+57+60+61+73+76+76+84) ÷ 9 = 64.6 cm (3 s.f.)	M1 A1	
	(ii)	Standard deviation = 12.7 cm (3 s.f.)	B1	
7		Plan A's total interest after 5 years = $5000 × 3% × 5	M1	

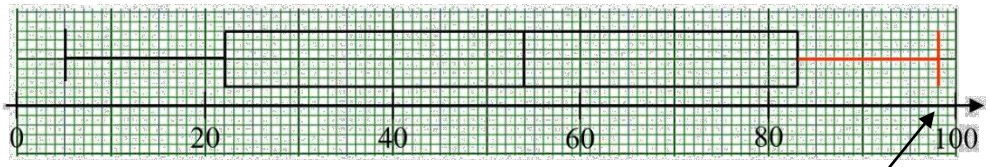
		= \$750 Plan B's interest after 5 years = \$5000 $(1+2.8\%)^5$ – \$5000 = \$740.31 (2 d.p.) Or Plan A's total amount = \$5000 × 3% × 5 + \$5000 = \$5750 = Plan B's total amount after 5 years = \$5000 $(1+2.8\%)^5$ = \$5740.31 < \$5750 Rose should choose Plan A <u>for higher interest (or higher total amount)</u> after 5 years	M1 M1 (M1) (M1) (M1) A1	For total amt of plan B For interest For simple interest For total amount Must provide reason
8		The sum of the square of the two shorted sides $=QR^2 + PR^2$ $= 16^2 + 28^2 = 1\,040$ The square of the longest side $PQ^2 = 34^2 = 1156$ Since $16^2 + 28^2 \neq 34^2$, $\angle PRQ$ is not a right angle. Angle in semicircle is not a right angle, so PQ is not a diameter.	M1 M1 A1	-1 mark If $16^2 + 28^2 = 34^2$, is seen from the beginning Must state angle in semicircle is not 90°
9	(a)	<table><tr><th></th><th>Boys</th><th>Girls</th><th>Total</th></tr><tr><td>4B</td><td>23</td><td>14</td><td>37</td></tr><tr><td>4C</td><td>19</td><td>16</td><td>35</td></tr><tr><td>Total</td><td>42</td><td>30</td><td>72</td></tr></table> $\frac{23}{72}\times\frac{16}{71}=\frac{46}{639}$ or 0.0720 (3 s.f.)	B1	
	(b)	$\frac{30}{72}\times\frac{29}{71}=\frac{145}{852}$ or 0.170 (3 s.f.)	B1	
	(c)	$1-\frac{35}{72}\times\frac{34}{71}$	M1	

		$= \frac{1961}{2556}$ 0r 0.767(3 s.f.)	A1	
10	(a)	$\cos \angle ABC = \frac{8^2 + 22^2 - 15^2}{2 \times 8 \times 22}$ $= \frac{323}{352}$ $\angle BAC = 23.420°$ $= 23.4°$ (1 d.p.)	M2 A1	M1 for correct numerator M1 for correct denominator
	(b)	Area of $\Delta ABC = \frac{1}{2} \times 8 \times 22 \times \sin 23.420°$ $= 34.977$ $= 35.0$ km^2 (3 s.f.)	M1 A1	
	(c)	Let h be the shortest (perpendicular) distance from A to BC. Area of $\Delta ABC = 34.977$ $\frac{1}{2} \times 22 \times h = 34.977$ $h = \frac{34.977}{11}$ $= 3.18$ km (3 s.f.)	M1 A1	
11	(a)	$r^2 + 12^2 = 13^2$ $r = \sqrt{13^2 - 12^2}$ $= 5$ cm	M1 A1	
	(b)	Circumference $= 2\pi \times 5$ $= 31.416$ cm $= 31.4$ cm (3 s.f.)	 B1	
	(c)	$r \times \angle BAC = 31.416$ cm $\angle BAC = 31.416 \div 13$ $= 2.42$ radians (3 s.f.)	M1 A1	
12	(a)	\$2840× 20% = \$568	B1	
	(b)	\$2840 – \$568 = \$2272 Interest = \$2272 × 5% × $\frac{36}{12}$ = \$340.80	M1 A1	

	(c)	Monthly instalment = (\$2272+ \$340.80) ÷ 36 = \$72.5777… = \$72.58	M1 A1	

13	(a)(i)	1.77 million	B1	
	(a)(ii)	$\frac{5.92}{105}\times 100$ million = 5.64 million (3 s.f.)	M1 A1	
	(a)(iii)	The growth in non-residents from 2022 to 2023 = 1.77 – 1.57 = 0.2 million The percentage growth, z $= \frac{0.2}{1.57}\times 100\%$ = 12.7% (3 s.f.) No, it should be 12.7%	M1 A1 A1	
	(b)	$\frac{3.61}{5.92}\times 360°$ = 219.5 ° (1 d.p.)	M1 A1	if $\frac{3.61}{5.92}$ is seen
14	(a)	–4.25	B1	
	(b)		G1 G1	Correct points plotted Smooth curve drawn

	(c)	When $x = 0$, $\frac{2}{x}$ is undefined, will result in "divisionby zero error" so y is undefined.	B1	
	(d)	$x = -2$, -0.4 or 2.45. (±0.1)	B2	for all correct answers B1 for only 1 or 2 correct answers.
	(e)	Correct tangent drawn Gradient = 3.57 ± 0.2	B1 B1	
15	(a)	Acceleration = $\frac{16}{12} = \frac{4}{3}$ m/s^2	B1	
	(b)	$\frac{1}{2}(k-37)(24) = 96$ $k - 37 = \frac{96}{12}$ $k = 37 + 8 = 45$	M1 A1	
	(c)	Total distance $= \frac{1}{2} \times 12 \times 16 + 10 \times 16 + \frac{1}{2} \times (16 + 24) \times 15 + 96$ = 652 m Average speed = $\frac{652}{45}$ = 14.5 m/s (3 s.f.)	M1 M1 A1	
	(d)	<u>Method 1:</u> 24 m/s = $\frac{24}{1000}$ km ÷ $\frac{1}{3600}$ h = 0.024 × 3600 km/h = 86.4 km/h <u>Method 2:</u> 1sec → 24 m = $\frac{24}{1000}$ km = 0.024 km 1hour = 3600s→0.024 km × 3600 = 86.4 km	M1 A1 (M1) (A1)	
16	(a)(i)	Interquartile range = 64 – 44 = 20	M1 A1	
	(ii)	90% × 30 = 27 90th percentile = 73	 B1	
	(iii)	20% × 30 = 6	M1	

		Min mark for distinction = 66	A1	
	(b)(i)	 Max mark = 5+93 = 98 B1		
	(ii)	Interquartile range = 83 – 22 = 61	B1	
	(c)	Class 4H because 4H's interquartile range is smaller than 4I.	B1	