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BUKIT MERAH SECONDARY SCHOOL

Name



PRELIMINARY EXAMINATION 2022 SECONDARY 4 NORMAL (ACADEMIC)

MATHEMATICS SYLLABUS A

Paper 1

4045/01

18 August 2022 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 of the 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 20 printed pages.

Setter: Mr Eric Yong

[Turn over

Mathematical Formulae

Compound Interest

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

Mensuration

Curved surface area of a cone = πrl Surface area of a sphere = $4\pi r^2$ Volume of a cone = $\frac{1}{3}\pi r^2 h$ Volume of a sphere = $\frac{4}{3}\pi r^3$ Area of triangle ABC = $\frac{1}{2}ab\sin C$ Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

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

PartnerInLearning 134 Answer all the questions.

1 (a) Evaluate $\sqrt{\frac{9.32}{5.2^3 \times 0.08}} + \left(3.05 - 1\frac{3}{7}\right)^2$, giving your answer correct to 2 significant figures.

(b) A number is rounded off to 3 significant figures as 0.0308. What is the smallest possible value of the number?

Answer [1]

2 The numbers a, b, c and d are represented on the number line shown below.

1.8	a b	c d	1.9

The values of a, b, c and d are listed below.

1.843, 1.8,
$$\frac{3\pi}{5}$$
, 184%

Find a, b, c and d.

BP~140

3 Factorise completely

(a) $14ab^2 + 21a^2b$,

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

4 (a) Given that $x^2 - 4x - 2 = (x + p)^2 + q$, find p and q.

Answer p = q = [2]

(b) Hence, or otherwise, solve the equation $x^2 - 4x - 2 = 0$.

5 (a) Calculate the sum of the interior angles of a polygon with 10 sides.

(b) Calculate the number of sides of a regular polygon with an interior angle of 162°.

Answersides [2]

6 Nathan is p years old. His brother, Matthew, is 3 years older than him. His sister, Joelle, is 7 years younger than Matthew. Express their average age in terms of p.

Answeryears old [3]

7 Express $\frac{2-x}{5} - \frac{x-1}{10}$ as a single fraction.

8 A road of actual length 8.25 km is 11 cm on a map.

(a) Find the scale of the map in the form 1: n.

(b) On the map, a reservoir has an area of 10 cm². Find the actual area, in km² of the reservoir.

9 Triangle *ABC* is equilateral and *BD* is parallel to *AC*. Triangle *DEC* is isosceles and angle *EDC* is 35°.



Giving reasons, find

(a) angle BDE,

(b) angle BAD.

BP~144

10 (a) Simplify
$$xy^2 \times \frac{3y}{x^2}$$

(b) Expand and simplify x+2(5-3x).

11 Given $2 = \frac{3-p}{p+q}$, write p as the subject of the equation.

12 Consider the pattern below.



The table below records the numbers of dots and lines in each pattern.

(a) Complete the table.

Answer

n	1	2	3	4	n
No. of dots	3	4	5	6	
No. of lines	3	5	7	9	

[2]

 (b) The sum of dots and lines in pattern 1 is 6. The sum of dots and lines in pattern 2 is 9. Can the sum of dots and lines in any pattern be 503? Explain your answer with clear working.

Answer	
	[2]

13



In the diagram above, $\triangle ABD$ is a right-angled triangle, where BC = 7.5 cm, $\angle ACB = 45^{\circ}$ and $\angle ADB = 23^{\circ}$.

Find

(a) the length of AB,

(b) the length of CD.

Answer $CD = \dots$ [2]

14 Solve these simultaneous equations.

$$3x + 8y = 11$$
$$x + 4y = 3$$

Answer	<i>x</i> =	
	<i>y</i> =	[3]

15 A line of the form, y = mx + c, is given below. Find the values of m and c.



16 A right-angled triangle *ABC* is drawn on the grid below. *BCD* is a straight line.



(a) Find the length of line AC.

- Answer $AC = \dots$ units [2]
- (b) Write down the value of $\cos \angle ACD$.
- Answer $\cos \angle ACD = \dots$ [1] (c) A line *l* passes through *B* and has the same gradient as line *AC*. Find the equation of the line *l*.

- 17 A quadratic equation can be written in the form, $ax^2 + bx + c = 0$.
 - (a) Identify the values of a, b and c in the equation, $8x^2 10 = 5x$.

Answer	<i>a</i> =	
	<i>b</i> =	
	<i>c</i> =	[1]

(b) Hence, solve the equation, $8x^2 - 10 = 5x$.

18 John walks at a speed of $1\frac{1}{9}$ m/s. Express this speed in km/h.

Answer km/h [1]

19 Kelvin took a plane to travel from Singapore to London. When the local time in Singapore is 9.00 a.m., it is 2.00 a.m. in London. The plane left Singapore at 9.35 a.m. local time and reached London at 2.15 p.m. local time. Calculate the duration of his flight from Singapore to London. Give your answer in hours and minutes.

Answerhours.....minutes [2]

20 The diagram shows the cross-section, *OABC*, of a prism. It is a sector of circle with radius 7 cm. Reflex angle $AOC = 220^{\circ}$.



(a) Find the area of the cross-section OABC.

(b) The length of the prism is 15 cm. Find the volume of the prism.

21 Solve the following equations.

(a) 10y-6=27-y

Answer $y = \dots$ [1]

(b)
$$\frac{10-3s}{4} = -14$$

22 The dot diagram shows the number of dancers from each class in a school.

 Without

 Without

	Answerclasses [1]	
(b)	Find the number of classes with no dancers.	
	Answerclasses [1]	
(c)	Gordon claims that the dancers are evenly distributed in all the classes. Do you agree with his claim? Give a reason for your answer.	

23 The diagram shows triangle ABC, where BC = 8 cm, AC = 10 cm and $\sin \angle ACB = 0.8$. ACD is a straight line.



(a) Find the area of triangle ABC.

(b) Hence, find the shortest distance from B to AC.

(c) Explain why when you divide the shortest distance in (b) by the length of *BC*, it will result in the same value as $\sin \angle ACB = 0.8$.

24 Harry claims that the following 3 numbers could possibly be the lengths of a right-angled triangle. Justify, with clear working, his claim.

```
36,77,85
```

25 Jesslyn wants to deposit \$10 000 in a bank. The bank pays a compound interest of 3.5% per annum. Calculate the interest she would earn from the bank after 4 years.

Answer \$ [3]

Tuition

26 The diagram shows a solid square pyramid with a length of 20 cm and height, h cm.



Given that the volume of the pyramid is 2880 cm^3 , find the height, h, of the pyramid.

Answer h = [2]



The diagram above shows a hex nut.

Each side of the hex nut is of length 8 cm and the diameter of the circle is 5 cm. Calculate the area of the shaded region.

END OF PAPER

Class	In
	1

Name

BUKIT MERAH SECONDARY SCHOOL



PRELIMINARY EXAMINATION 2022 SECONDARY 4 NORMAL (ACADEMIC)

MATHEMATICS SYLLABUS A

Paper 2

Candidates answer on the Question Paper.

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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 number of marks for this paper is 60.

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			
Section A			
Section B			
Total			

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Setter: Mr Eric Yong

[Turn over

4045/02 22 August 2022

2 hours

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Section A (52 marks) Answer all the questions in this section.

1 (a) Write 0.0003056 in standard form.

(b) At a certain time, the number of cells in an organism is 50 billion. The number of cells doubles every week.Find the number of cells after 3 weeks. Write your answer in standard form.

2 (a) Express $28\frac{1}{3}$ % as a fraction in its lowest term.

 (b) An open container is completely filled with water. After 10 hours, 10% of the water evaporated. After another 6 hours, a further 8% of the remaining water evaporated. Calculate the percentage of water left in the container after 16 hours.

Answer% [2]

- 3 The ratio of boys to girls in a group is 5 : 6. The number of girls in the group is 624.
 - (a) How many boys are there?

Answerboys [1]

(b) When some more boys joined the group, the ratio of boys to girls became 3 : 2. How many boys joined the group?

Answerboys [2]

4 (a) The price of a spherical hanging lamp, \$p, is directly proportional to the square of its radius, r cm.
 Given that a lamp of radius, 25 cm, costs \$120, write an equation connecting p and r.

(b) 2 teachers take 9 hours to mark a set of exam papers. Assuming that all the teachers mark at the same rate, how many hours will it take 3 teachers to mark the same set of exam papers?

Answerhours [2]

- 5 A bag contains 4 green discs, 5 blue discs and 3 red discs. A disc is drawn at random from the bag.
 - (a) Write down the probability that a red disc is drawn.

(b) How many green discs must be added so that the probability of getting a green disc is 0.5?

6 The diagram below shows a rectangular wooden window frame with a glass panel. The wooden frame measures 120 cm by 90 cm. A wooden frame of uniform width, x cm, surrounds the glass panel.



(a) Write down, in terms of x, the length and width of the glass panel.

Answer Length =.....

Width =.....[2]

(b) Given that the area of the glass panel is 4000 cm², form an equation in x and show that it reduces to $x^2 - 105x + 1700 = 0$.

Answer

(c) Hence, solve the equation $x^2 - 105x + 1700 = 0$ to find the values of x.

- - -

(d) Find the length and width of the glass panel, in cm.

[2]

7 The diagram shows a sketch of a field PQRS.



(a) Make an accurate scale drawing of the field. Use a scale of 1 cm to represent 10 m.

Answer (a), (b)

(b)	A tree is to be planted in the field.	
	It is found on the perpendicular bisector of RQ and on the bisector of angle PQR .	
	Construct and label the position of the tree as T on your scale drawing.	[3]

8 Two identical dice are thrown.

The product of the two numbers is recorded.

(a) Complete the table below to show the possible products. *Answer*

×	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9			
4						
5						
6						

[1]

- (b) Find the probability that the product is
 - (i) 12,

(ii) a prime number,

(iii) a perfect square.

9 (a) Write 540 as a product of its prime factors.

	Answer	[1]
(b)	What is the largest perfect square that is a factor of 540?	
	Answer	[1]
(c)	$240 = 2^4 \times 3 \times 5$. Write down the lowest common multiple (LCM) of 240 and 540	

Write down the lowest common multiple (LCM) of 240 and 540. Give your answer as a product of its prime factors.

10 The variables of x and y are connected by the equation $y = 12 - x - \frac{6}{x}$.

x	1	2	2.5	3	4	5	6	7	8	9
y	5	7	7.1	7	6.5	р	5	4.1	3.25	2.33

(a) Find the value of p.

(b) On the grid opposite, draw the graph of $y = 12 - x - \frac{6}{x}$ for $0 < x \le 9$. Use a scale of 2 cm to represent 1 unit on the horizontal x-axis and the vertical y-axis. [3]

(c) By drawing a tangent, find the gradient of the curve at x = 3.

(d) Use your graph to find the values of x when y = 6.

Answer x = [2]

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[1]

The parking charges at a HDB carpark are shown below. 11

		Electronic Parkin (Per Minute Charging	g System – Whole Day)							
		Monday to Saturday								
		7am to 10.30pm	\$0.60 per 30 minutes							
	S.	10.30pm to 7am	\$0.60 per 30 minutes							
		Sunda	y & Public Holiday							
		7am to 10.30pm	No Charge							
		10.30pm to 7am	\$0.60 per 30 minutes							
		*	Tuition							
			IUIUI							
(a) Moni	ca parked her car at	this carpark on Friday	for 35 minutes.							
Show	that the parking ch	arge incurred is \$0.70.	with							
Answer			ARSUN							
Люнст										

(b) Calculate the parking fee incurred for parking a car at the HDB carpark from Saturday 7.00 pm till Monday 8.45 am.

(c) On a Tuesday, Natalie wants to shop at ABC Shopping Centre and she estimates that she would be there from 3.15 pm till 7.45 pm. She has two carparks to choose from to park her car.



Option A: HDB carpark **Option B:** ABC Shopping Centre Carpark

Which option should she choose?

Give a reason for your choice. Show your working.

Answer Natalie should choose Optionbecause......[3]

Section B (8 marks)

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



(a) In the diagram, O is the centre of the circle through the points A, B, C, D and E. TAG is a tangent at A and AC intersects BD at F.

Given that $\angle ACD = 50^{\circ}$ and $\angle CAB = 30^{\circ}$, find

(i)
$$\angle AOD$$
,

(ii) $\angle AED$,

(iii) $\angle OAC$,

(iv) $\angle BAT$.

(b) The diagram shows the path ABC of an aeroplane. The bearing of B from A is 036°. AB = 160 km, angle $ABC = 77^{\circ}$ and angle $BCA = 55^{\circ}$.



(i) Find the bearing of A from C.

(ii) Find the length of BC.

13 The graph below shows the cumulative frequency of the monthly allowance of 120 students for the month of April.



- (a) Use your graph to estimate
 - (i) the median amount,

Answer \$..... [1]

(ii) the interquartile range.

Answer \$..... [2]

(b) Find the value of x if 40% of the students were given at least x of allowance.

Answer $x = \dots$ [2]

(c) The box and whisker plot below shows the monthly allowance of the students for the month of May.



Answer \$..... [2]

(ii) Make one comparison about the monthly allowance of students for April and May.

END OF PAPER

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BMSS4NA Paper 1 Prelim 2022 Marking Scheme

la	3.5	B1
16	0.03075	B1
2	$a = 184\%, b = 1.843, c = \frac{3\pi}{5}, d = 1.8$	B2 Any error deduct
20	1 4-22 1 21-22 2 2-2/22 1 2-1	
Ja	$14ab^{2} + 21a^{2}b = 7ab(2b + 3a)$	BI
36	$2(x^2-9y^2)$	M1
	=2(x+3y)(x-3y)	A1
4a	p = -2	
	a = -6	BT
4h	r - 4.45	T:1
		2
	x = -0.449	51
Da	180(10-2)	[v]i
	– 1440°	Al,
-		
26	Extenor angle = 18°	MI (Accept
		indetica ang le
		netiod)
	No of sides = $360/18 = 20$	(A1)
ď	Matthew's age = $(p+3)$ years old	L tori
	Joelle's age = $p+3-7 = (p-4)$ years old	$\prod^{1} \Psi^{11}$
	Average age = $\frac{p + (p + 3) + (p - 4)}{3}$	Mi
	36-1	
	$=\frac{2P-1}{2}$	A1
(a)	3	
A.	$\frac{2(2-x)-(x-1)}{2}$	M1
	10	
	5-3x	
		A1 ,
8a	1:75 000	BIL
8h		MI
	1 cm^2 : $\frac{1}{16} \text{ km}^2$. 6760
	10	<u>A</u> 1
) 10~	10 cm 9.029 km	Total Values at
78	$\angle BDC = 180^{\circ} - 00^{\circ} - 55^{\circ}$ (Int angles)	
	= 85°	provide reason)
- A.	$\angle BDE = 85^\circ - 35^\circ = 50^\circ$	A1
9ь	$\angle DAC = 50^{\circ}$ (Alt. angles)	M1 (must
	and the second sec	provide reason)
	$\angle BAD = 60^\circ - 50^\circ = 10^\circ$	AI
10a	1 2 n 3	BI
2.7 2		180 F
	X	

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à

10%		B/1
100		<u>А</u> 1
	(-10-5x)	
11	2(n+q) = 3-n	MI
1.1		
	3p = 3 - 2q	
	-3-2q	AL
	r <u>3</u>	
12a	p+2	B1
		BI
-	2203 T 1	
12b	2002	MI
	Tuition	
	$_2$ 1 UIUOII	
	No, since $n = 166 - 15$ not a whole number.	1.5
12-	- With a	101
12g		
13b	7.5	Mi
	$\tan 23^{\circ} = \frac{1}{RD}$	
	tan 23°	
	$CD = \frac{7.5}{-7.5}$	
	tan 23°	191.A
	=10.2cm	a1
1.4	$2^{2}+12^{2}=0$	TM11
14		[1911] Elimination/Cuba
	-4y = 2	titution method
		didnon merida
	x = 5	A1
		-3.00°)
	$y = -\frac{1}{2}$	Al
15		B1
	$m = \frac{1}{2}$	
		B1
16a	The second second second second	MI
The State	4 (4-1), +(3-(-1)),	
	= Sunits	Al
16b	4	B1
's	-3	
16c		
	Carthours 1003	a tha an an
		MI
	3 5	
	$y = \frac{1}{\sqrt{2}} x - \frac{1}{\sqrt{2}}$	A1
	4 4) 4 ,	
		<u>500</u>

17a	a=8	
	b = -5	
		Bl
17ь	1 514 11 52 11011 101	ML
	$x = \frac{-(-5)\pm q(-5)^2 - 4(8)(-10)}{2}$	
	2(8)	
	= 1.47 or - 0.848	A1
18	4 km/h	BI
19	2.15pm London time is 9.15pm SG time	Ml
	9.15pm - 9.35 am = 11 hr 40 min	A1
20a	$Area = \frac{220}{2} \times \pi(7)^2$	MI
	360 360	A 7
	$=94.1cm^{2}$	
20Ъ	Volume	
	= 94.073×15	MI
	$= 1410 cm^3$	£1
21a	y = 3	BI
21b	10 - 3s = -56	NU
	s = 22	Å1
22a	18 Tuition	Bi
22b	8 410011	Bl
.22c	No, there is a significant number of classes which have no	Bi
22-	dancers. VVILLCA	A #1
238	$Area = -(10)(8) \sin \angle ACB$	1/11
	2	h 1
	= 32cm ²	Al
23Ь	$\frac{1}{-x}hx10=32$	Mi
	2	- ×
	h = 6.4cm	A1
23c	Shortest distance = opposite and BC = hypotenuse with	
	respect to $\angle ACB$. When shortest distance is divided by BC ,	
	It is equivalent to $\sin \angle ACB$.	
24	85° = 7225	ML
	$36^2 + 77^2 = 7225$	1011
	Since $25^2 - 36^2 \pm 77^2 - 7335$ the 3 numbers could be	6 Å
	lengths of a right-angled triangle.	nu¦⊱
25	(35) ⁴	
197	$A = 10000 \left(1 + \frac{3}{100} \right) = \11475.23	MI
	Interest = 11475.23-10000	MI
	=\$1475.23	A1
25	$A = 10000 \left(1 + \frac{3.5}{100}\right)^4 = \11475.23 Interest = 11475.23 - 10000 = \$1475.23	MI MI A1

26	$2880 = \frac{1}{3}(20)(20)h$ h = 21.6cm	M1 A1
27	Area of one triang $le = \frac{1}{2}(8)(8)\sin 60^\circ = 32\sin 60^\circ \text{ cm}^2$ Area of hexagon = $6(32\sin 60^\circ) = 166.28 \text{ cm}^2$ Area of circle = $-\pi(2.5)^2 - 6.25\pi \text{ cm}^2$ Area of shaded region = $=166.28 - 6.25\pi = 147 \text{ cm}^2$	M1 141 A1

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BMSS4NA Paper 2 Prelim 2022 Marking Scheme

la	3.056×10 ⁻⁴	B1
1Ъ	50×10 ⁹ ×2 ³	M1
	-4×10^{11}	A1
2a	17	B1
26	92% ×98%	M1
-20	- 82.8%	A1
3a	<u>624×5</u>	
	- 520	E1.
Зь	$\frac{624\times3}{-936} = 936 \text{ boys}$	Mi
	$\frac{2}{936-520} = 410$ boys ition	Al
4a	$p = kr^2$ 120 = $k(2.5)^2$ With	
	k = 0.192	Mi
	$p = 0.192r^2$	A1
4 0	9×2	Mi
	3	4 ·
	=6	
୍କର		
50	$\frac{x+4}{12+x} = 0.5$ x+4= 6+0.5x	MI
65	x = 4	[A1]
0a	Width = $90 - 2\pi$ or $2(45 - x)$	BI
60	(120 - 2x)(90 - 2x) = 4000	M1
	$10800 - 240x - 180x + 4x^2 = 4000$	
	$x^2 - 105x + 1700 = 0$	AI
бс	$x^{2} - 105x + 1700 = 0$	
	(x-85)(x-20)=0	MI
	Accept quadratic formula	11 × 1
	x = 85	Al
60	x = 20	
	Width = 50 cm	BI

7a 7b	P	S	X		T		3		K	B1 correct lengths for sides (must include construction marks) B1 correct angles B1 Perpendicular Bisector B1 Angle Bisector B1 Correct position of T
8a		×	1	2	3	4	5	6		B1
		1	1	2	3	4	5	6		
		2	2	4	6	8	10	12		
		3	3	6	9	12	15	18		
		4	4	8	12	16	20	24		
		5	5	10	15	20	25	30		
		6	6	12	18	24	30	36		
8bi	$\frac{1}{9}$									B1
8bii	$\frac{1}{6}$									B1
8biii	2		<u>.</u>							B1
9a	$\frac{9}{2^2 \times 3^3 \times 4^3}$	5								B1
9b	36									B1
9c	$2^4 \times 3^3 \times 3^3$	B1								
10a	<i>p</i> = 5.8									B1

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10b		B3 (deduct 1 mark for each error in labelling
	Tuition	of axes and curve, plotting of points, smooth curve)
1.0c	$-\frac{1}{2} \pm 0.1$	B1
	3	B1 for tangent drawn on graph
10d	1.25 ± 0.1 or 4.75 ± 0.1	B1 for each answer
11a	$\frac{35 \times 0.6}{30} = \0.70	B1 (working)
11b	Saturday 7 - 10 30 pm $\frac{210 \times 0.60}{20}$	
	= \$4.20 Saturday 10:30 pm - 7am: \$4 Sunday 7am - 10.30 pm: free Sunday 10:30 pm - Monday 7am: \$4 Monday 7am - 8.45 am: 105×0.60 Monday 7am - 8.45 am: 30	B1
	= \$2.10 Total = \$4.20 + \$4 + \$4 + \$2.10 = \$14.30	B1 B1

BP~183

11c	270×0.60	
	Option A: 30	
	-\$5.40	BI
	Option B: \$1.20×2+\$2.50 =\$4.90	B1
	Option B because the parking fee is lower lition	161
12ai	100°	El
12aii	130° WILD	81
12aiii	20°	81
12aiv	40°	B1
12bi	$\angle BAC = 180^{\circ} - 77^{\circ} - 55^{\circ} = 48^{\circ}$	
	$\angle N_1 CA = 180^\circ - 36^\circ - 48^\circ = 96^\circ$	Mil
	Bearing $= 360^{\circ} - 96^{\circ} = 264^{\circ}$	Af
12bii	BC 160	MI
	sin 48° sin 55°	
	BC - 145km	A1
13ai	\$115	B1
1386	132 50-95	MI
1.200	\$27.50 \$27.50	AT
	= \$21.00	
13Ъ	0.6×120 = 72	MI
	x = 120	A1
13ci	170-75	MI
	- \$95	A1
13cü	The IQR for May is higher so the monthly allowances if students are less consistent.	BI