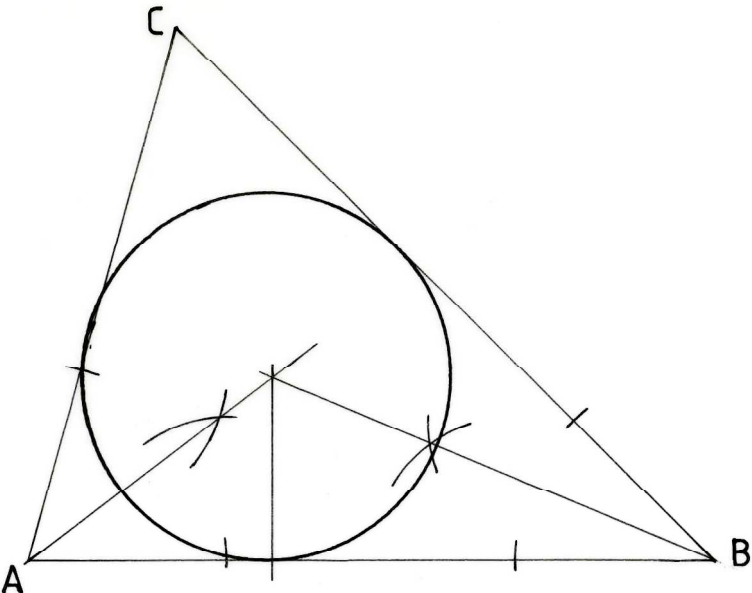
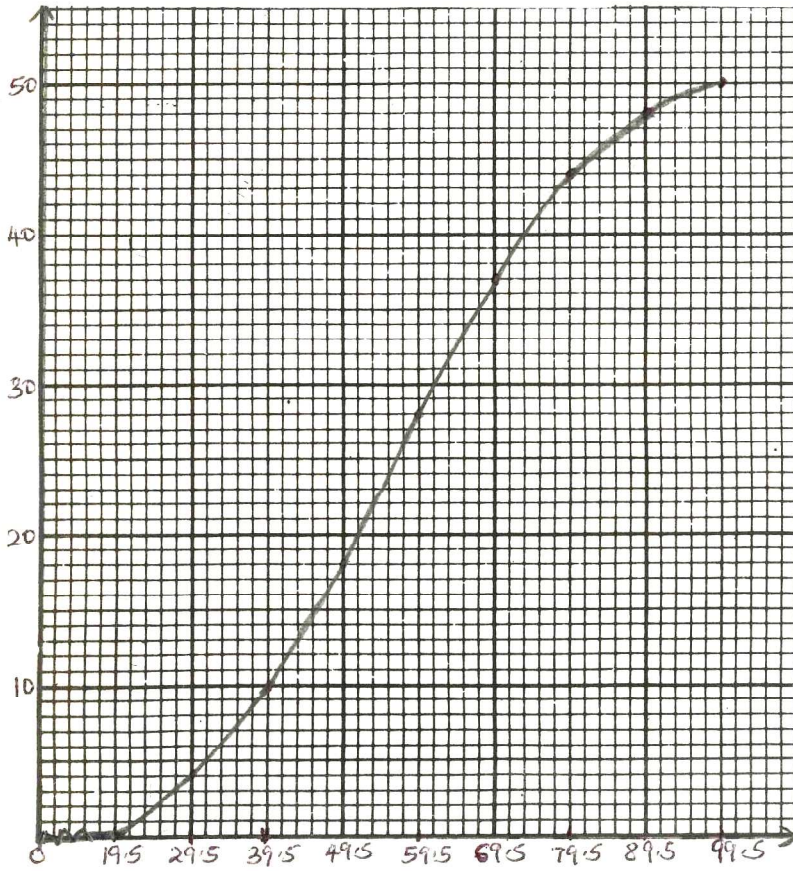


4.3.4 Mathematics Alternative B Paper 2 (122/2)

1.	$\frac{4.957}{0.2638 - 0.0149} = \frac{4.96}{0.263 - 0.015}$ $= 20$	B1 B1 2	
2.	$AB = \begin{pmatrix} 2 & 4 \\ 3 & 0 \end{pmatrix} \begin{pmatrix} 2 & 3 \\ 1 & 1 \end{pmatrix}$ $= \begin{pmatrix} 8 & 10 \\ 6 & 9 \end{pmatrix}$ $AB - 5B = \begin{pmatrix} 8 & 10 \\ 6 & 9 \end{pmatrix} - \begin{pmatrix} 10 & 15 \\ 5 & 5 \end{pmatrix}$ $= \begin{pmatrix} -2 & -5 \\ 1 & 4 \end{pmatrix}$	B1 M1 A1 3	✓ Substraction and multiplication by 5
3.	$A: B: C \quad A: B: C$ $4: 3 \quad \Rightarrow \quad 4: 3$ $1: 2 \quad \quad \quad 3: 6$ <p>combined ratio A:B:C = 4:3:6</p> <p>mass of type C = $\frac{6}{13} \times 52$</p> $= 24$	B1 M1 A1 3	
4.	<p>(a) $\frac{ar^5}{ar^3} = \frac{96}{24}$</p> $r^2 = 4 \rightarrow r = \pm 2$ <p>(b) when</p> $r = 2 \Rightarrow a \times 2^3 = 24 \Rightarrow a = \frac{24}{8} = 3$ <p>when</p> $r = -2 \Rightarrow a \times (-2)^3 = 24 \Rightarrow a = \frac{24}{-8} = -3$	M1 A1 B1 B1 4	

9.	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ $= \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 1 & 1 & -1 \\ 3 & 7 & 4 \end{pmatrix}$ $= \begin{pmatrix} -3 & -7 & -4 \\ -1 & -1 & 1 \end{pmatrix}$ <p>∴ coordinates: $R'(-3, -1)$, $S'(-7, -1)$ and $T'(-4, 1)$</p>	M1 M1 A1	
10.	$2x^2 + 8x = 15$ $x^2 + 4x = 7.5$ $x^2 + 4x + \left(\frac{4}{2}\right)^2 = 7.5 + \left(\frac{4}{2}\right)^2$ $x + 2 = \sqrt{11.5}$ $= \pm 3.4$ $= 1.4 \text{ or } -5.4$	M1 M1 A1	
11.	 <p style="text-align: right;">radius = 2.4 ± 0.1</p>	B1 B1 B1	bisecting 2 or 3 angles constructing radius and completing circle
		3	

12.	<p>Fraction of food per person per day $\frac{1}{2000 \times 90}$</p> <p>Fraction for 2000 persons for 20 days</p> $= 2000 \times \frac{20}{2000 \times 90}$ $= \frac{2}{9}$ <p>Remaining fraction of food = $\frac{7}{9}$</p> <p>No of days to feed 2000 + 500 persons</p> $= \frac{7}{9} \div \frac{1 \times 2500}{180000}$ $\frac{7}{9} \times \frac{72}{1} = 56$	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>4</p>	
13.	$\cos P = \frac{75^2 + 80^2 - 40^2}{2 \times 75 \times 80}$ $= \frac{10425}{12000} = 0.86875$ <p>$P \simeq 30^\circ$</p> $\frac{SR}{\sin 68} = \frac{40}{\sin 30} \implies SR = \frac{40 \sin 68}{\sin 30^\circ}$ $= 74 \text{ m}$	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>	
14.	<p>1st bracket $\rightarrow 10164 \times \frac{10}{100} = 1016.4$</p> <p>2nd bracket $\rightarrow (19740 - 10164) \times \frac{15}{100} = 1436.4$</p> <p>3rd bracket $\rightarrow (21820 - 19740) \times \frac{20}{100} = 416$</p> <p>Net tax = $(1016.4 + 1436.4 + 416) - 1162$</p> $= 1706.8$	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>4</p>	
15.	$2p + 3r = 66 \dots (i)$ $7p + 2r = 129 \dots (ii)$ $4p + 6r = 132 \dots (iii)$ $21p + 6r = 317 \dots (iv)$ <hr/> $17p = 255$ $p = 15$	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>	



cf: 4, 10, 18, 28, 37, 44, 48, 50

B1	can be implied
P1	
C1	
3	

17.	(a) 300000×0.18 $= 54000$	M1 A1	or equivalent $134000 \times 2 + 148208 - 300000$ $= 116208$	
	(b) (i) $300000 + 54000 - 134000$ $= 220000$	M1 A1		
	(ii) $220000 \times 1.18 - 134000$ $= 125600$	M1 A1		
	(c) 125600×1.18 $= 148208$	M1 A1		
	(d) Total interest charged: $(300000 + 220000 + 125600) \times 0.18$ $= 54000 + 39600 + 22608$ $= 116208$	M1 A1		
	10			
18.	(a) (i) $U_{10} = 10^2 - 10 + 3$ $= 93$	M1 A1		
	(ii) $U_{30} - U_{20} = (30^2 - 30 + 3) - (20^2 - 20 + 3)$ $= 873 - 383$ $= 490$	M1 A1		
	(iii) $n^2 - n + 3 = 243$ $n^2 - n - 240 = 0$ $(n + 15)(n - 16) = 0$ $n = -15$ or $n = 16$ $n = 16$	M1 M1 A1		
	(b) (i) Number after t hours $= 180 \times 3^t$	B1		
	(ii) Number to the nearest million after 20 hours 180×3^{12} $= 95659380$ $= 96000000$	M1 A1		
		10		

19. (a) Modal class: 4 - 5

(b) $\frac{8}{36} \times 360^\circ$
 $= 80^\circ$

(c) mid values

0.5, 1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5

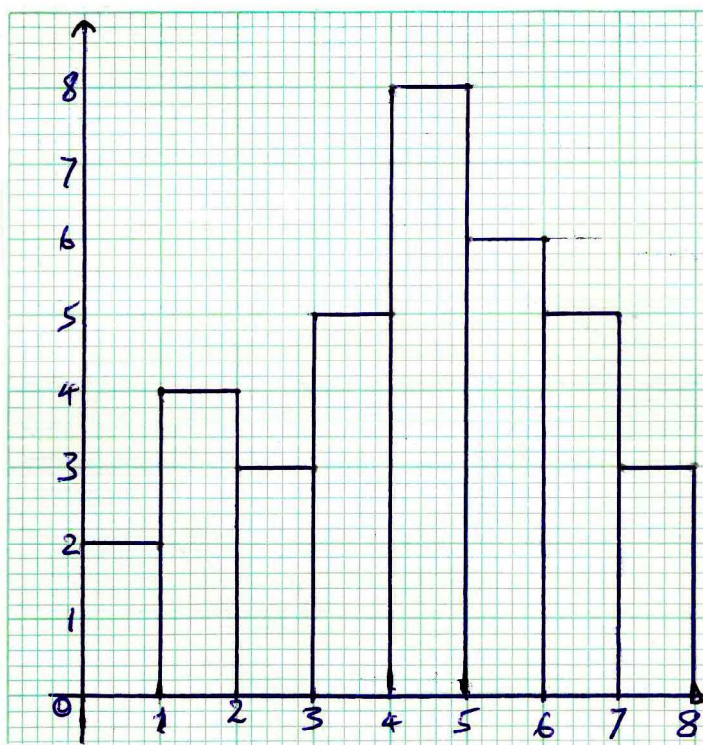
$fx = 1, 6, 7.5, 17.5, 36, 33, 32.5, 22.5$

$\sum fx = 1 + 6 + 7.5 + 17.5 + 36 + 33 + 32.5 + 22.5$

$\therefore \text{mean} = \frac{156}{36}$

$= 4\frac{1}{3}$

(d)



B1

M1

A1

M1

M1

M1

A1

S1

✓ scale and labelling

B2

8 bars ✓
(allow B1 for 5 - 7 bars ✓)

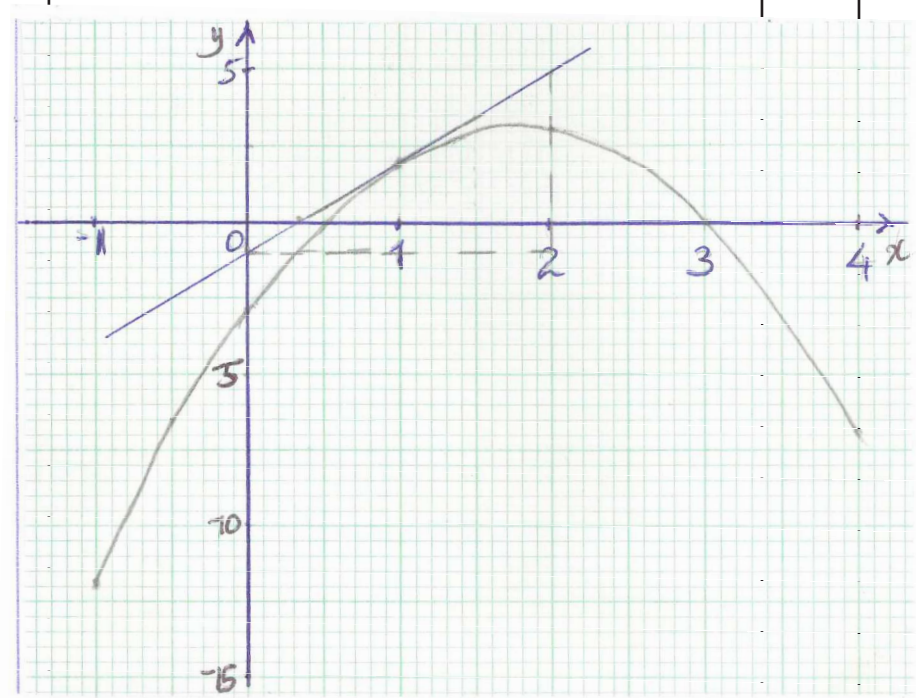
10

20. (a)

x	-1	0	1	2	3	4
y	-12	-3	2	3	0	-7

B2

(b)



(c) (i) Roots of equation
 $x = 0.5$
 or
 $x = 3$

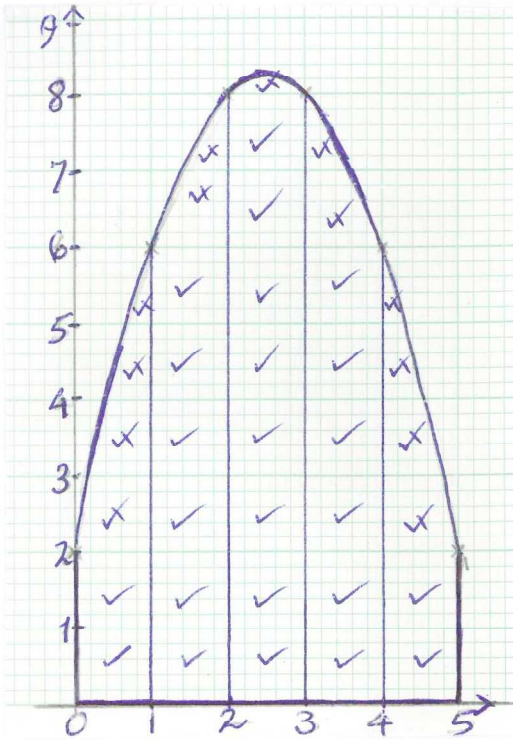
(ii) tangent line ✓ drawn
 gradient: $\frac{5 - -1}{2 - 0}$
 $= 3$

S1
 P1
 C1
 B1
 B1
 B1
 M1
 A1
 10

21.	<p>(a) (i) $\underline{AB} = \underline{OB} - \underline{OA} = 3i + 5j - (-2i + j)$ $= 3i + 5j + 2i - j$ $= 5i + 4j$</p> <p>(ii) $\underline{CD} = \underline{OD} - \underline{OC} = 2i - 4j - (-8i - 12j)$ $= 2i - 4j + 8i + 12j$ $= 10i + 8j$</p> <p>(b) mid point of vector AD $= \frac{1}{2} \left\{ \begin{pmatrix} -2i \\ j \end{pmatrix} + \begin{pmatrix} 2i \\ -4j \end{pmatrix} \right\} = \frac{1}{2} \begin{pmatrix} 0 \\ -3j \end{pmatrix}$ $= \begin{pmatrix} 0 \\ -1.5j \end{pmatrix}$ \therefore coordinates of mid point is $(0, -1.5)$</p> <p>(c) $\underline{BC} = \underline{OC} - \underline{OB} = -8i - 12j - (3i + 5j)$ $= 11i - 17j$ $\therefore \underline{BC} = \sqrt{11^2 + 17^2}$ $= \sqrt{121 + 289} \simeq 20.2$</p>	M1 A1 M1 A1 M1 A1 M1 A1 10	
22.	<p>(a) (i) Longitude difference = $12^\circ + 60^\circ$ $= 72^\circ$ Distance PR = $\frac{72}{360} \times 2 \times \frac{22}{7} \times 6370$ $= 8008 \text{ km}$</p> <p>(ii) Time difference = $\frac{72}{15} \text{ h}$ $= 4 \text{ h } 48 \text{ min}$ Local time at Q: $= 9.00 \text{ pm} - 4 \text{ h } 48 \text{ min}$ $= 4.13 \text{ pm}$</p> <p>(b) Distance travelled in 2 h $= 1001 \times 2 = 2002 \text{ km}$ $\therefore \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 6370 = 2002$ $\theta = \frac{2002 \times 360 \times 7}{2 \times 22 \times 6370}$ $= 18^\circ$ Position of T: $(18^\circ\text{N}, 60^\circ\text{W})$</p>	M1 M1 A1 M1 M1 A1 A1 B1 M1 A1 B1 10	

23.	(a) (i) $R \propto \frac{C^2}{T} \implies R = \frac{kC^2}{T}$	B1	
	$R = 30, C = 6 \text{ and } T = 2.4$		
	$\implies 30 = \frac{k6^2}{2.4}$	M1	
	$k = \frac{30 \times 2.4}{36} = 2$	A1	
	(ii) $\therefore R = \frac{2C^2}{T}$	B1	
	(b) (i) when $R = 40$ and $C = 8$		
	$T = \frac{2 \times 8^2}{40}$	M1	
	$= 3.2$	A1	
	(ii) New $R = \frac{2 \times (0.9 \times 8)^2}{1.08 \times 3.2}$	M1	
	$= 30$	A1	
% change in R			
$= \frac{40 - 30}{40} \times 100$	M1		
$= 25\%$	A1		
	10		

24.



$$(a) (i) 24 + \frac{1}{2}(13) = 30\frac{1}{2}$$

$$(ii) \frac{1}{2} \times 1 \{2 + 2 + 2(6 + 8 + 8 + 6)\}$$

$$= \frac{1}{2}(60)$$

$$= 30 \text{ cm}^2$$

$$(b) (i) \% \text{ error} = \frac{30\frac{5}{6} - 30}{30\frac{5}{6}} \times 100$$

$$= 2\frac{26}{37}$$

$$= 2.7$$

$$(ii) 1 \text{ cm} \equiv 120 \text{ m}$$

$$1 \text{ cm}^2 \equiv 14400 \text{ m}^2$$

$$\therefore 30\frac{5}{6} \text{ cm}^2 \equiv \frac{144000}{10000} \times \frac{185}{6}$$

$$= 44.4 \text{ ha}$$

M1

whole square and part square

A1

B1

ordinates 2, 6, 8, 8, 6, 2
substitution into formula
simplification

M1

A1

M1

A1

B1

M1

A1

10