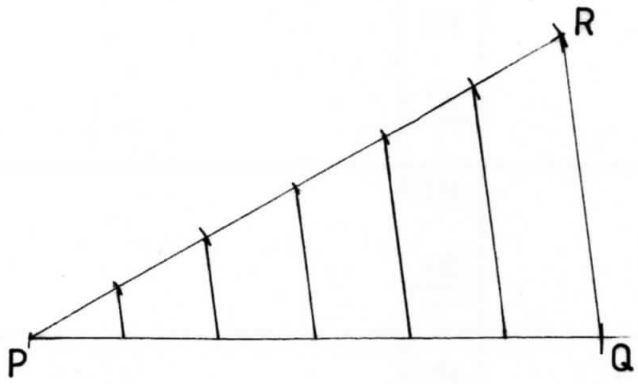
5.2 MATHEMATICS ALTERNATIVE B (122)

5.2.1 Mathematics a lternative b (122/1)

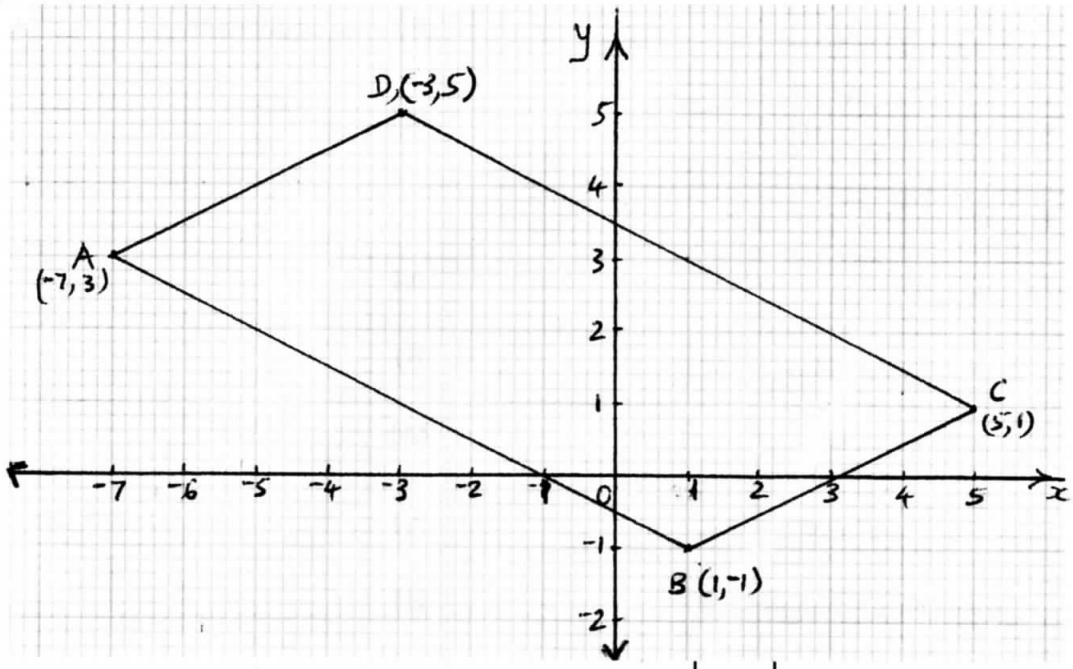
1.	- 3^ 5 - + 7h÷+ 2^ 3 + - 6h =- 3^- 12h÷2-^ 9 h = 36 ÷- 18 =- 2	 M1 M1 A1 3	
2.	(a) Number is 7532 (b) Total value of hundreds digit = 500	B1 B1 2	
3.	$\frac{2}{3}$ # $\frac{27}{5}$ - $2\frac{3}{10}$ = $\frac{18}{5}$ - $\frac{23}{10}$ = $\frac{13}{10}$ $\frac{3}{5}$ ' $4\frac{1}{2}$ + $1\frac{3}{5}$ = $\frac{3}{5}$ # $\frac{2}{9}$ + $\frac{8}{5}$ = $\frac{26}{15}$ 、 $\frac{13}{10}$ $\frac{26}{15}$ = $\frac{13}{10}$ # $\frac{15}{26}$ = $\frac{3}{4}$	M1 M1 A1 3	
4.	Nekesa: Mwita: Auma = 600 : 750 : 650 = 12 : 15 : 13 Amount Mwita got more than Nekesa = $\frac{15}{40}$ # 1200 - $\frac{12}{40}$ # 1200 = 450 - 360 = 90	B1 M1 A1 3	= $\frac{3}{40}$ # 1200 = 90
5.	h = 3r - 1 (h= 3 # 2 - 1= 5 、 $\frac{7r^2 + 2rh}{\sqrt{4h - 2r}}$ = $\frac{7 \# 2^2 + 2\# 2 \# 5}{\sqrt{4 \# 5 - 2\# 2}}$ = $\frac{28 + 20}{\sqrt{16}}$ = $\frac{48}{4}$ = 12	 M1 M1 A1 3	

6.	Area of each face $= \frac{1176}{6} = 196$ Length of side $\sqrt{196}$ $= 14$	M1 M1 A1 3	
7.		B1 B2 3	Line, PR, drawn and divided into six (6) equal parts. Joining QR and drawing five lines parallel to QR intersecting with PQ.
8.	$\sin x = \frac{3}{5}$ *and* $\cos = \frac{4}{5}$ $\therefore 2\sin x - \cos x = 2 \times \frac{3}{5} - \frac{4}{5}$ $= \frac{6}{5} - \frac{4}{5} = \frac{2}{5}$	B1 M1 A1 3	
9.	$5x + 6x(10) = 2600$ $5x + 60x = 2600$ $x = \frac{2600}{65}$ $= 40$ Total number of coins: $= 40 + 6 \times 40 = 280$	M1 M1 A1 B1 4	
10.	$\frac{3^{-2} \times 81^{\frac{3}{2}}}{4^{-3} \div 8^{\frac{1}{3}}} = \frac{3^{-2} \times 3^{2\times 3}}{\frac{1}{2^6} \div 2}$ $= 3^4 \times 2^7$ $= 10368$	M1 M1 A1 B1 4	√ powers of 3 √ powers of 2

11.	Marked price $= 5750 \times 1.12 = 6440$ $\%\ \text{discount} = \dfrac{6440 - 6118 \times 100}{6440}$ $= 5\%$	M1 M1 A1 3	
12	$9a^2 - \dfrac{16}{b^2c^2} = (3a)^2 - \dfrac{4^2}{(bc)^2}$ $= \left(3a + \dfrac{4}{bc}\right)\left(3a - \dfrac{4}{bc}\right)$	M1 A1 2	
13.	(a) $\begin{array}{c\|ccc} & 12 & 28 & 54 \\ \hline 2 & 6 & 14 & 27 \\ 2 & 3 & 7 & 27 \\ 3 & 1 & 7 & 9 \\ 3 & 1 & 7 & 3 \\ 3 & 1 & 7 & 1 \\ 7 & 1 & 1 & 1 \end{array}$ The height (LCM) $= 2^2 \times 3^3 \times 7$ $= 756$ (b) Number of books $= \dfrac{756}{12} = 63$	M1 M1 A1 B1 4	√ factorization
14.	Let number of sides ben $\therefore (2n - 4) \times 90 = 1260$ $2n \times 90 = 1260 + 360$ $n = \dfrac{1620}{180} = 9$ Size of each angle $= \dfrac{1260}{9} = 140°$	M1 A1 B1 3	

15	L.S.F = $\frac{7.5}{5}$ = 1.5 $\therefore$ A.S.F = 1.5^2 = 2.25 Area of smaller triangle = $\frac{22.5}{2.25}$ = 10 cm^2	B1 M1 A1 3	
16.	$r^2 \times \frac{22}{7} \times \frac{45}{360} = 77$ $r = \sqrt{\frac{77 \times 360 \times 7}{45 \times 22}}$ = 14 Circumference = $2 \times 14 \times \frac{22}{7}$ = 88 cm	M1 A1 M1 A1 4	
17.	(a) (i) Volume of prism = Area of crosssection # L = ; 1.4 # 0.8 - $\frac{1}{2}$ # $\frac{22}{7}$ # ^0.7 h# 2 = 0.35 # 2 = 0.7 m^3 (ii) Total S.A = 0.8 # 2# 2 + 2 # 1.4 + 0.7 # $\frac{22}{7}$ # 2 + 0.35 # 2 = 6 + 4.4 + 0.7 = 11.1 m^2 (b) = $\frac{6 \times 100}{6 + 4.4 + 2 \times 0.35 h}$ = 54.05405405 % = 54.1%	M1 M1 M1 A1 M1 M1 M1 A1 M1 A1 10	Multiplication by length rectangular triangular cross section

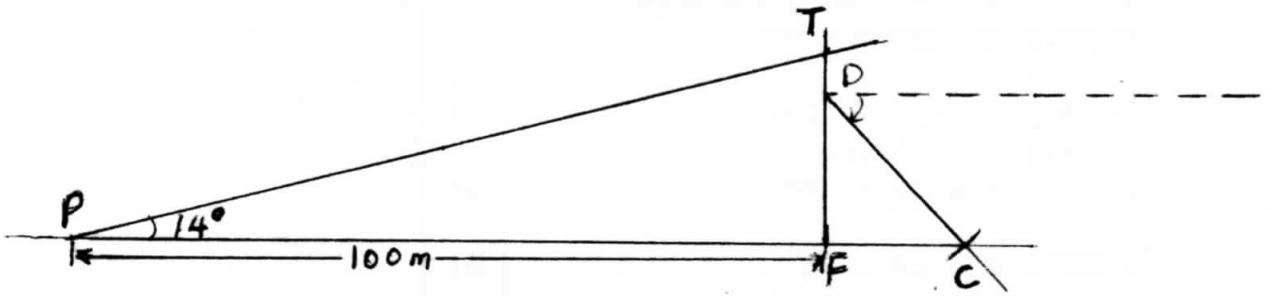
18.



(a)	B1 B1	plotting vertices A, B and C. identifying vertex D (-3, 5) and competing parallelogram.
(b) (i) grad AB $= \frac{3 - -1}{-7 - 1}$	M1	
$= -\frac{1}{2}$	A1	
(ii) $\frac{y-3}{x--7} = -\frac{1}{2}$ or $\frac{y--1}{x-1} = -\frac{1}{2}$	M1	
$y = -\frac{1}{2}x - \frac{7}{2} + 3$ or $y = -\frac{1}{2}x + \frac{1}{2} - 1$		
$y = -\frac{1}{2}x - \frac{1}{2}$	A1	
(c) (i) Let grad L be m		
$\therefore -\frac{1}{2}m = -1$ ($m = 2$	B1	
equation of line $\frac{y-3}{x-1} = 2$	M1	
$y - 2x = 1$	A1	
(ii) y - intercept: when $x = 0$		
$y = 2 \# 0 + 1 = 1$		
$\therefore$ co-ordinates ^0, 1 h	B1	
	10	

19.	(a) $\left(x-\frac{1}{2}\right)(x+1)=0$	B1	or equivalent
	$x^2+x-\frac{1}{2}x-\frac{1}{2}=0$	M1	
	$x^2+\frac{1}{2}x-\frac{1}{2}=0$		
	$2x^2+x-1=0$	A1	
	(b) (i) $(2y+1)(y)=55$	B1	
	$(2y+11)(y-5)=0$	M1	
	$y=-5\frac{1}{2}$ or $y=5$	A1	
	$\therefore$ price of one mango Sh 5	B1	
	(ii) no. of mangoes Karau got		
	mangoes bought $=\frac{95+55}{5}=30$	M1	
	$\therefore$ extra mangoes $=\frac{30}{6}=5$	A1	
	Total mangoes = 30 + 5 = 35	B1	
		10	

20.

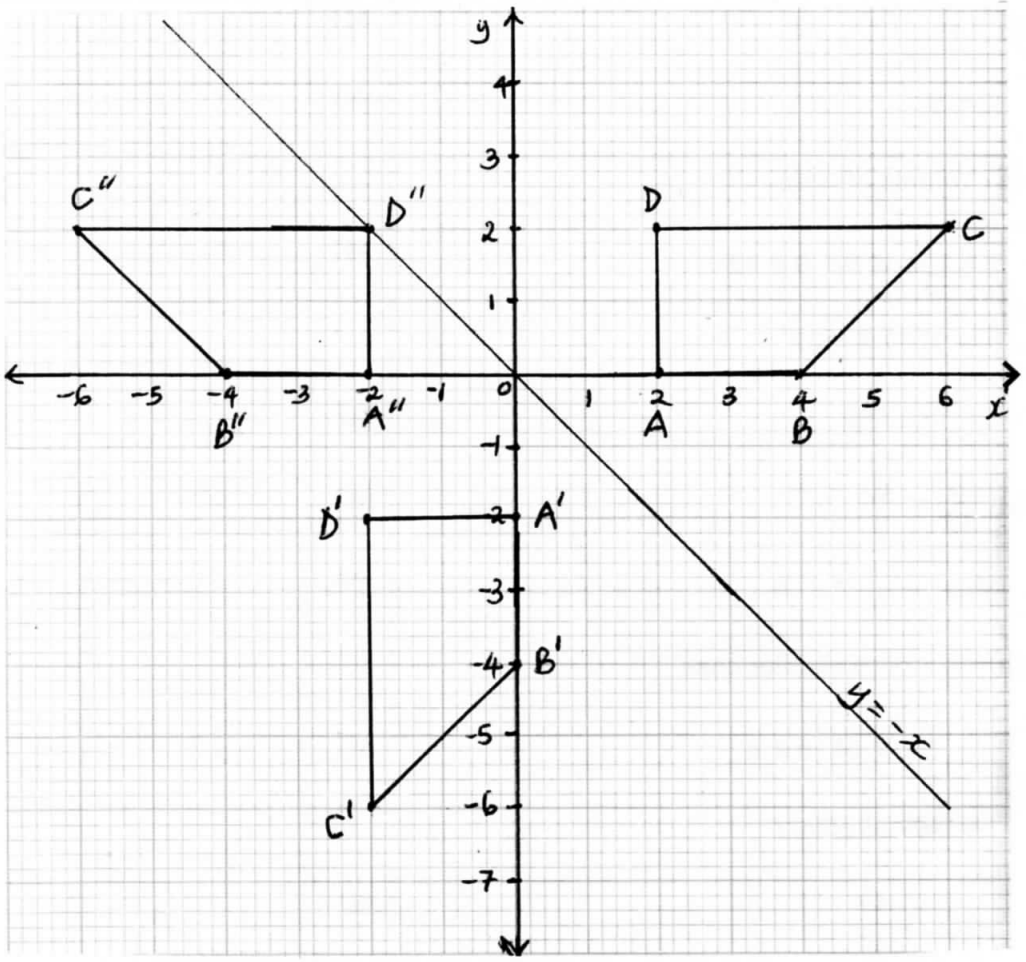


(a) √ use of scale	B1	
angle of elevation 14° √ drawn	B1	
completion of scale drawing	B1	
(b) height of mast → 2.5 ± 0.1	B1	
$= 2.5 \times 10$		
$= 25$ m	B1	
(c) position of cable drawn	B1	√ positions of C and D
	B1	cable CD shown
(d) (i) ∠ of depression of C from D		
$48° \pm 1°$	B1	
(ii) Distance from P to C		
$(10 + 1.8 \pm 0.1) \times 10$	M1	
$= 118 \pm 1\,m$	A1	
	10	

21.	(a) + ROP = 2 # 64° = 128° angle subtended at centre is twice angle subtended at O circumference.	B1 B1	allow other valid reasons
	(b) + PSR = 180° - 64° = 116° opposite angles of cyclic quadrilateral add up to 180°.	B1 B1	
	(c) + ORP = 90° - 64° = 26° angle in semicircle (+ QRP) = 90° and base angles of isosceles triangle equal.	B1 B1	
	(d) + TRP = 64° angle in alternate segment.	B1 B1	
	(e) + RTP = 180 - 2^64 h= 52° + TRP = 64° angle in alternate segment and sum of angles in triangle PRT = 180°.	B1 B1	
		10	

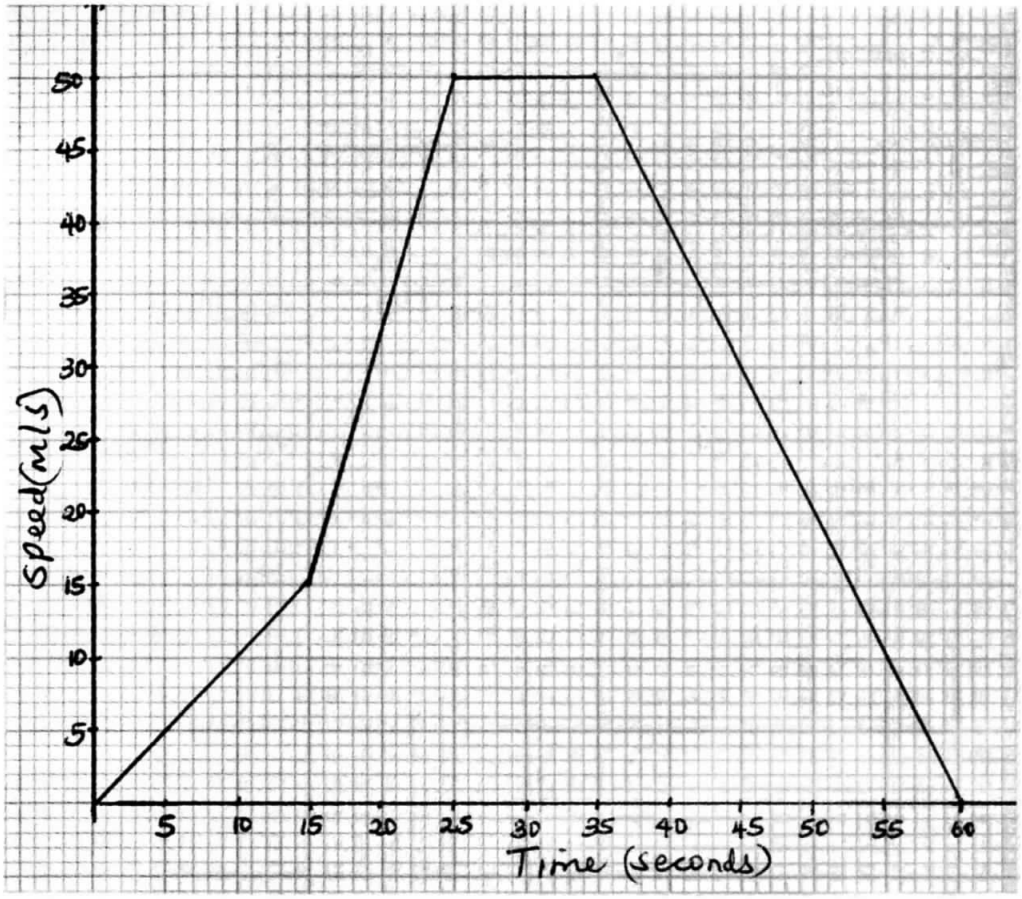
22.	(a) (i) $r = \sqrt{15^2 - 12^2}$	M1	
	$= 9$	A1	
	(ii) Volume of cone:		
	$= \frac{1}{3}r \# 9 \# 9 \# 12$	M1	
	$= 1017.87602$		
	$- 1017.88$	A1	
	(b) (i) $\frac{h}{12} = \frac{6}{9}$	M1	
	$h = \frac{12 \# 6}{9} = 8$	A1	
	(ii) volume of smaller cone		
	$= \frac{1}{3}r \# 6 \# 6 \# 8$	M1	
	$= 301.5928947$		
	$- 301.59$	A1	
	(iii) Volume of frustum		
	$1017.88 - 301.59$	M1	
	$= 716.29$	A1	
		10	

23



(a) (i) trapezium ABCD √ drawn	B1	
(ii) line of reflection $y = -x$ drawn	B1	may be implied by √ image
trapezium A'B'C'D' √ drawn	B1	
(iii) points A"B"C"D" plotted	B1	
trapezium A"B"C"D" drawn	B1	
(b) transformation which maps A"B"C"D" onto ABCD		
reflection	B1	
on line $x = 0$	B1	or y - axis
(c) directly congruent pair A'B'C'D' and A"B"C"D"	B1	
oppositely congruent pairs ABCD and A'B'C'D'	B1	
ABCD and A"B"C"D"	B1	
	10	

24



(a) √ scale	S1	
acceleration parts	B1	
constant speed	B1	
deceleration	B1	
(b) (i) deceleration $= \frac{50}{25}$	M1	
$= 2\ m/s^2$	A1	
(ii) Total distance		
$= \frac{1}{2}(15 \times 15) + \frac{1}{2}(15 + 50) \times 10 + 10 \times 50 + \frac{1}{2}(25 \times 50)$	M1	or equivalent
$= 112.5 + 325 + 500 + 625 = 1562.5$	A1	
(iii) Average speed		
$= \frac{1562.5}{60}$	M1	
$= 26.0416 = 26.0\ m/s$	A1	
	10	

5.2.2 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 A: B: C 4: 3 $\Longrightarrow$ 4: 3 1: 2 3: 6 combined ratio A:B:C = 4:3:6 mass of type C $=\frac{6}{13}\times 52$ $=24$	B1 M1 A1 3	
4.	(a) $\frac{ar^5}{ar^3}=\frac{96}{24}$ $r^2=4\longrightarrow r=\pm 2$ (b) when $r=2\Longrightarrow a\times 2^3=24\Longrightarrow a=\frac{24}{8}=3$ when $r=-2\Longrightarrow a\times(-2)^3=24\Longrightarrow a=\frac{24}{-8}=-3$	M1 A1 B1 B1 4	

5.	(a) 	+	1	2	3	4	5	6
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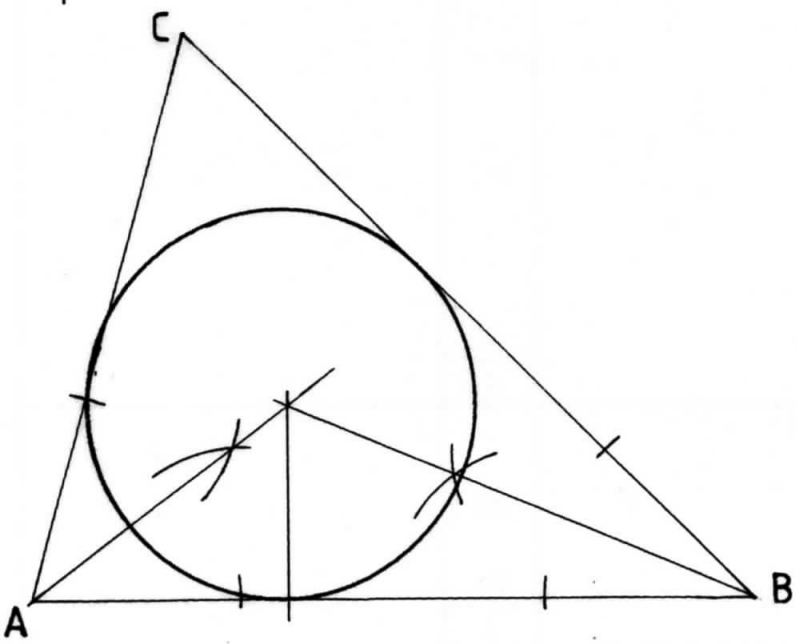
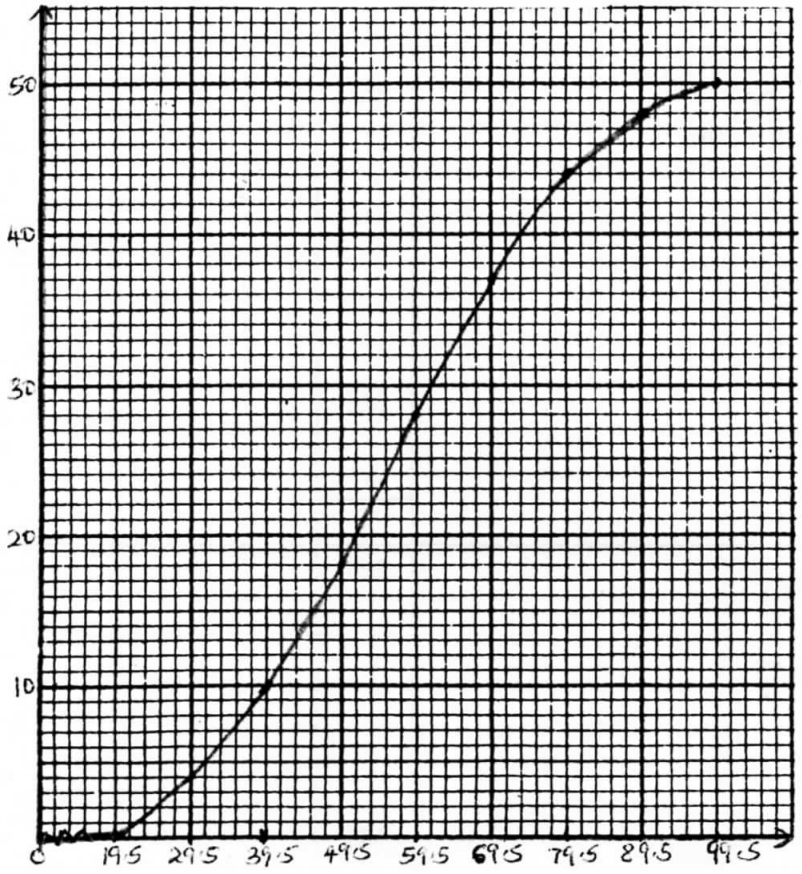
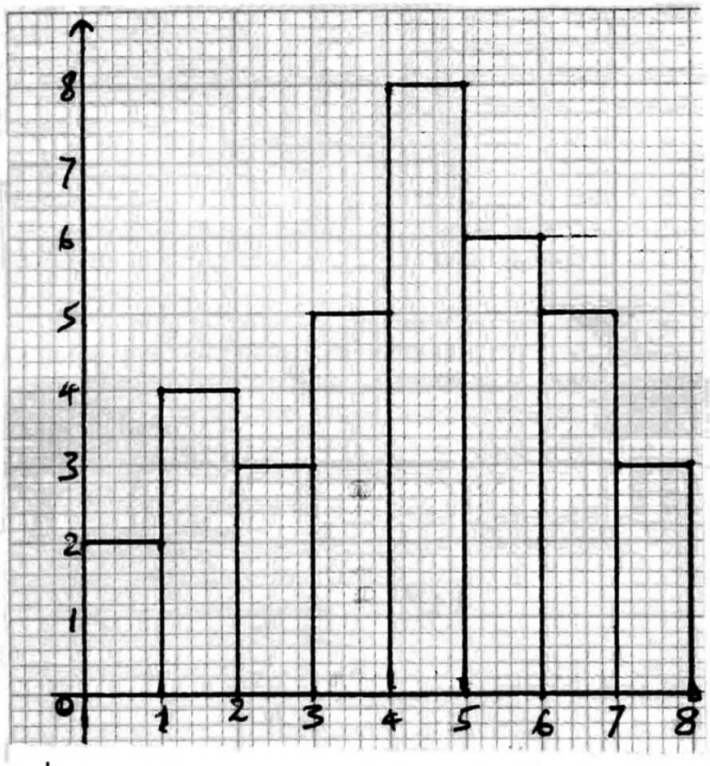
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12 | (b) $P(6 < x < 10)$ $= \frac{15}{36} = \frac{5}{12}$	B2 B1 3	√ probability space
6.	(a) $\underset{\sim}{OB} = \begin{pmatrix}2\\5\end{pmatrix} + \begin{pmatrix}4\\4\end{pmatrix}$ $= \begin{pmatrix}6\\9\end{pmatrix}$ (b) co-ordinates of M $\underset{\sim}{OM} = \underset{\sim}{OA} + \frac{3}{4}\underset{\sim}{AB}$ $= \begin{pmatrix}2\\5\end{pmatrix} + \frac{3}{4}\begin{pmatrix}4\\4\end{pmatrix}$ $= \begin{pmatrix}2\\5\end{pmatrix} + \begin{pmatrix}3\\3\end{pmatrix} = \begin{pmatrix}5\\8\end{pmatrix}$ $\therefore$ coordinates of M are (5, 8)	M1 A1 M1 A1 4	
7.	Let angle APT = $x°$ $\therefore 3x + 75 = 180°$ $x = 35°$ angle BAP = angle BPR = $2 \times 35°$ $= 70°$	B1 B1 2	
8.	$2\cos(x - 30)° = -0.9$ $\cos(x - 30)° = -0.45$ $(x - 30)° = \cos^{-1} - 0.45$ $= 116.74°$ $x = 146.74°$	M1 A1 B1 3	

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

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

16			
	cf: 4, 10, 18, 28, 37, 44, 48, 50	B1 P1 C1 3	can be implied

17.	(a) 300000×0.18 $= 54000$ (b) (i) $300000 + 54000 - 134000$ $= 220000$ (ii) $220000 \times 1.18 - 134000$ $= 125600$ (c) 125600×1.18 $= 148208$ (d) Total interest charged: $(300000 + 22000 + 125600) \times 0.18$ $= 54000 + 39600 + 22608$ $= 116208$	M1 A1 M1 A1 M1 A1 M1 A1 10	or equivalent $134000 \times 2 + 148208 - 300000$ $= 116208$
18.	(a) (i) $U_{10} = 10^2 - 10 + 3$ $= 93$ (ii) $U_{30} - U_{20} = (30^2 - 30 + 3) - (20^2 - 20 + 3)$ $= 873 - 383$ $= 490$ (iii) $n^2 - n + 3 = 243$ $n^2 - n - 240 = 0$ $(n + 15)(n - 16) = 0$ $n = -15$ *or* $n = 16$ $n = 16$ (b) (i) Number after t hours $= 180 \times 3^t$ (ii) Number to the nearest million after 20 hours 180×3^{12} $= 95659380$ $= 96000000$	M1 A1 M1 A1 M1 M1 A1 B1 M1 A1 10	

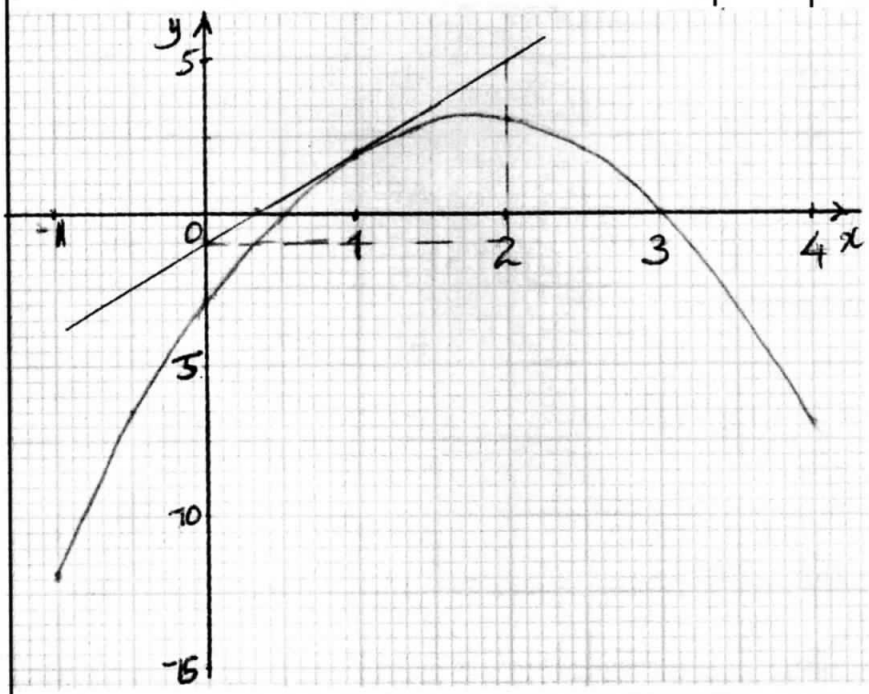
19.	(a) Modal class: 4 - 5	B1	
	(b) $\frac{8}{36} \times 360°$	M1	
	$= 80°$	A1	
	(c) mid values		
	0.5, 1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5	M1	
	$fx = 1, 6, 7.5, 17.5, 36, 33, 32.5, 22.5$		
	$\sum fx = 1 + 6 + 7.5 + 17.5 + 36 + 33 + 32.5 + 22.5$	M1	
	$\therefore \text{mean} = \frac{156}{36}$	M1	
	$= 4\frac{1}{3}$	A1	
	(d) 	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)



S1

P1

C1

(c) (i) Roots of equation

$x = 0.5$

or

$x = 3$

B1

B1

(ii) tangent line √ drawn

B1

gradient: $\frac{5 - -1}{2 - 0}$

M1

$= 3$

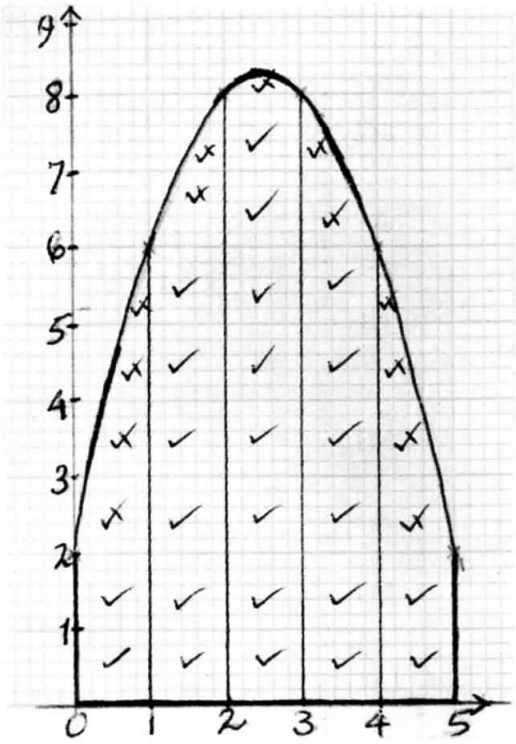
A1

10

21.	(a) (i) $\underset{\sim}{AB} = \underset{\sim}{OB} - \underset{\sim}{OA} = 3i + 5j - (-2i + j)$ $= 3i + 5j + 2i - j$ $= 5i + 4j$	M1 A1	
	(ii) $\underset{\sim}{CD} = \underset{\sim}{OD} - \underset{\sim}{OC} = 2i - 4j - (-8i - 12j)$ $= 2i - 4j + 8i + 12j$ $= 10i + 8j$	M1 A1	
	(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)	M1 A1 B1	
	(c) $\underset{\sim}{BC} = \underset{\sim}{OC} - \underset{\sim}{OB} = -8i - 12j - (3i + 5j)$ $= 11i - 17j$ $\therefore \lvert\underset{\sim}{BC}\rvert = \sqrt{11^2 + 17^2}$ $= \sqrt{121 + 289} \simeq 20.2$	M1 M1 A1	
		10	
22.	(a) (i) Longitude difference = 12° + 60° = 72° Distance PR $= \frac{72}{360} \times 2 \times \frac{22}{7} \times 6370$ = 8008 km	M1 M1 A1	
	(ii) Time difference = $\frac{72}{15}$ h = 4 h 48 min Local time at Q: = 9.00 pm - 4 h 48 min = 4.13 pm	M1 M1 A1	
	(b) Distance travelled in 2 h $= 1001 \times 2 = 2002$ 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° Position of T: (18°N, 60°W)	B1 M1 A1 B1	
		10	

23.	(a) (i) $R \propto \frac{C^2}{T} \Longrightarrow R = \frac{kC^2}{T}$	B1	
	R = 30, C = 6 and T = 2.4		
	$\Longrightarrow 30 = \frac{k6^2}{2.4}$	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) $24 + \frac{1}{2}(13) = 30\frac{1}{2}$ — M1 A1 — whole square and part square

(ii) $\frac{1}{2} \times 1\{2 + 2 + 2(6 + 8 + 8 + 6)\}$ — B1 — ordinates 2, 6, 8, 8, 6, 2

$= \frac{1}{2}(60)$ — M1 — substitution into formula

$= 30 \text{ cm}^2$ — A1 — simplification

(b) (i) $\%\text{ error} = \frac{30\frac{5}{6} - 30}{30\frac{5}{6}} \times 100$ — M1

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

$= 2.7$ — A1

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

$1 \text{ cm}^2 \equiv 14400 \text{ m}^2$ — B1

$\therefore 30\frac{5}{6} \text{ cm}^2 \equiv \frac{144000}{10000} \times \frac{185}{6}$ — M1

$=44.4 \text{ ha}$ — A1

10


Manyam
Franchise