MIRROR JET PP2
MARKING SCHEME.

1

$$\frac{1}{\cos 75} = \frac{4}{\sqrt{6}-\sqrt{2}}$$

$$\therefore \frac{4(\sqrt{6}+\sqrt{2})}{(\sqrt{6}-\sqrt{2})(\sqrt{6}+\sqrt{2})} \longrightarrow M_1$$ Multiplication by conjugate

$$= \frac{4\sqrt{6}+4\sqrt{2}}{6-2} \longrightarrow M_1$$ Opening Brac

$$\frac{4\sqrt{6}+4\sqrt{2}}{4}$$

$$= \sqrt{6}+\sqrt{2} \longrightarrow A_1$$ Simplified.

3 mks

2.

$$\frac{64w^2\pi^2}{M^2} = \frac{G-hN}{N} \longrightarrow M_1$$ Removing Sq. root.

$$64w^2\pi^2 N = GM^2 - M^2hN$$

$$64w^2\pi^2 N + M^2hN = GM^2$$

$$N(64w^2\pi^2 N + M^2h) = GM^2 \longrightarrow M_1$$ factorizing N out.

$$N = \frac{GM^2}{64w^2\pi^2 N + M^2h} \longrightarrow A_1$$

3 MKS

3.

W. Area $= 29.7 \times 13.4$
$= 397.98$

Min. Area $= 29.7 \times 13.35$
$= 396.495$

Max Area $= 29.7 \times 13.45$
$= 399.465$

A.E $= 399.465 - 396.495$

$= 1.485^2$ $\longrightarrow B_1$

R.E $= \frac{1.485}{397.9} = 3.7313$ $\longrightarrow M_1$

$= 3.731$ to 4 s.f $\longrightarrow A_1$

follow through any other method used.

4. $P = mQ^2 + nR$

$10 = 36m + 7n$ ---x1

$-4 = 9m + 5n$ ---x4

$10 = 36m + 7n$

$-16 = 36m + 20n$ ⟶ M1 Solving simultaneous eq.

$26 = -13n$

$n = -2$

and $m = \frac{2}{3}$ ⟶ A1 for both the unknown

$\therefore P = \frac{2}{3}Q^2 - 2R$ ⟶ B1

3mk

5. $\frac{(2 \times 3500) + (3 \times 4000)}{5}$ ⟶ M1

$= 3800$ ⟶

$\left(\frac{126 \times 3800}{100}\right)$ ⟶ M1

$= 4788$ ⟶ A1

3mks

6. $\log_{10}\left\{\frac{x+4}{150x}\right\} = -2$ ⟶

$10^{-2} = \frac{x+4}{150x}$ ⟶ M1 for log form to index form

$\frac{1}{100} = \frac{x+4}{150x}$

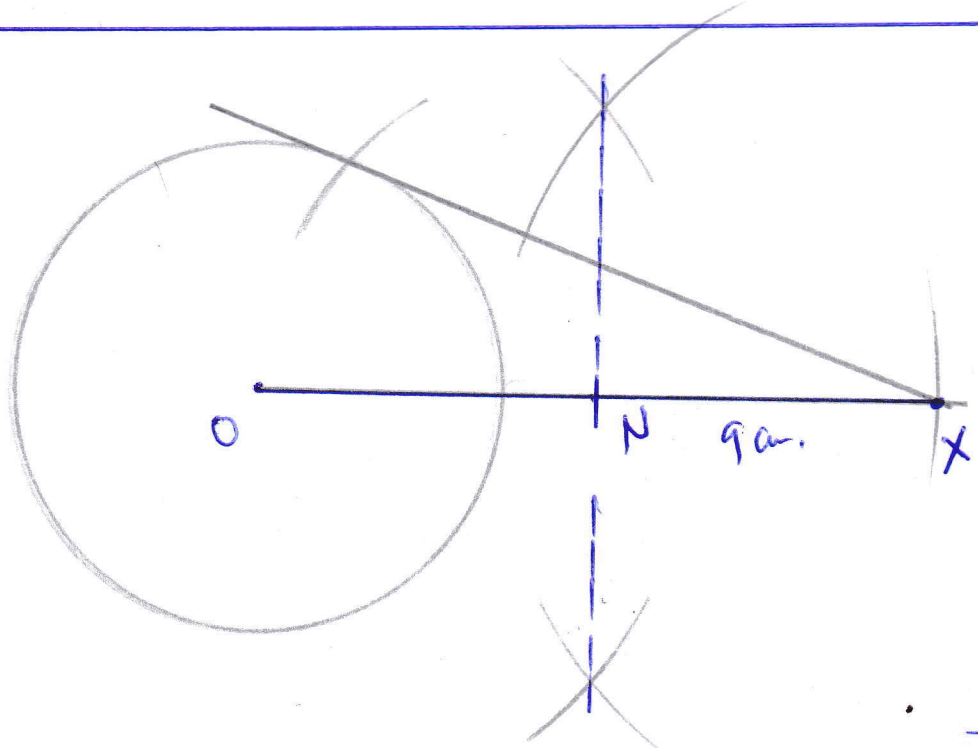
$150x = 100x + 400$ ⟶ M1

$50x = 400$

$x = 8$ ⟶ A1

3mks

7.



B1 Locating X accurately and joining O to X.

B1 Bisecting OX to locate point on OX.

B1 Drawing the tangent

3mks.

8 (a) $2^6 + 2^5(-\frac{1}{3}x) + 2^4(-\frac{1}{3}x)^2 + 2^3(-\frac{1}{3}x)^3 + \cdots$

1 6 15 20.

$= 64 - 64x + \frac{80}{3}x^2 - \frac{160}{27}x^3 + \cdots$

or

$64 - 64x + 26.67x^2 - 5.926x^3$

B1 Allows for ~~1 st~~ any.

(b) $1.9 = 2 - \frac{1}{3}x$

$x = 0.3$.

$64 - (64 \times 0.3) + \frac{80}{3}(0.09) - \left(\frac{160}{27}(0.027)\right)$ M1 Substituting for x.

$= 64 - 19.2 + 2.4 - 0.16$

$= 47.04$ → A1

3mks.

9. (a) $4 + 1 - (4 \times 2) + (10 \times -1) + c = 0$

$c = 13.$ ⟶ B1

(b) $x^2 - 4x + (-2)^2 + y^2 + 10y + (5)^2 = -13.$

$(x-2)^2 + (y+5)^2 = -13 + 4 + 25$ ⟶ M1

$(x-2)^2 + (y+5)^2 = 16$

$C(2, -5)$

$r = 4$ units. ⟶ A1

Check for any method used.

for both

(10) Amplitude $= 1.5$ ⟶ B1

Period $= 360 \div \frac{9}{5}$

$= 200°$ ⟶ B1

Phase Angle $= 20°.$ ⟶ B1

3 marks

(11) Gross tax $= 24000 + 1500$

$= 39000$ k.

1st slab ⇒ 24000×0.1 ⟶ M1

$= 2400$ k

2nd slab ⇒ $x \cdot 0.25 = 1500$ ⟶ M1

$x = 6000$ k.

Monthly Income, $6000 + 24000$

$= 30,000$ k ⇒ A1

12. (i) $AC^2 = \sqrt{8^2+6^2}$

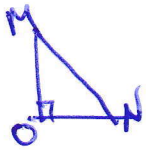
$AC = 10\text{cm}$.

$OT^2 + OC^2 = CT^2$

$OT^2 = 15^2 - 5^2$

$OT = \sqrt{200}$

$= 10\sqrt{2}$ or 14.14 cm ⟶ B1

(ii) 

$OM = \frac{1}{3} \times 14.14$

$= 4.714$ ⟶ B1

$\tan\theta = \frac{4.714}{4}$ ⟶ M1

$\theta = 49.68°$ ⟶ A1

04 mks.

13. $\underset{\sim}{OR} = 2\begin{pmatrix}\frac{2}{3}\\ 1\end{pmatrix} + -3\begin{pmatrix}3\\ -4\\ -3\end{pmatrix}$

$\underset{\sim}{OR} = \begin{pmatrix}-5\\ -6\\ 11\end{pmatrix}$.

$\underset{\sim}{QR} = \begin{pmatrix}-5\\ -6\\ 11\end{pmatrix} - \begin{pmatrix}3\\ -4\\ -3\end{pmatrix}$

$= \begin{pmatrix}-8\\ -2\\ 14\end{pmatrix}$ ⟶ B1

$|\underset{\sim}{QR}| = \sqrt{64+4+196}$ ⟶ M1

$= \sqrt{264}$

$= 16.25$ units. ⟶ A1

14. $y = 2x^3 - 6x^2 + x - 3$

$\frac{dy}{dx} = 6x^2 - 12x + 1$ ⟶ M1

at $x = 1$

$\frac{dy}{dx} = -5$.

Grad of Normal $= \frac{1}{5}$.

at $x = 1$, $y = -6$ ⟶ $(1, -6)$.

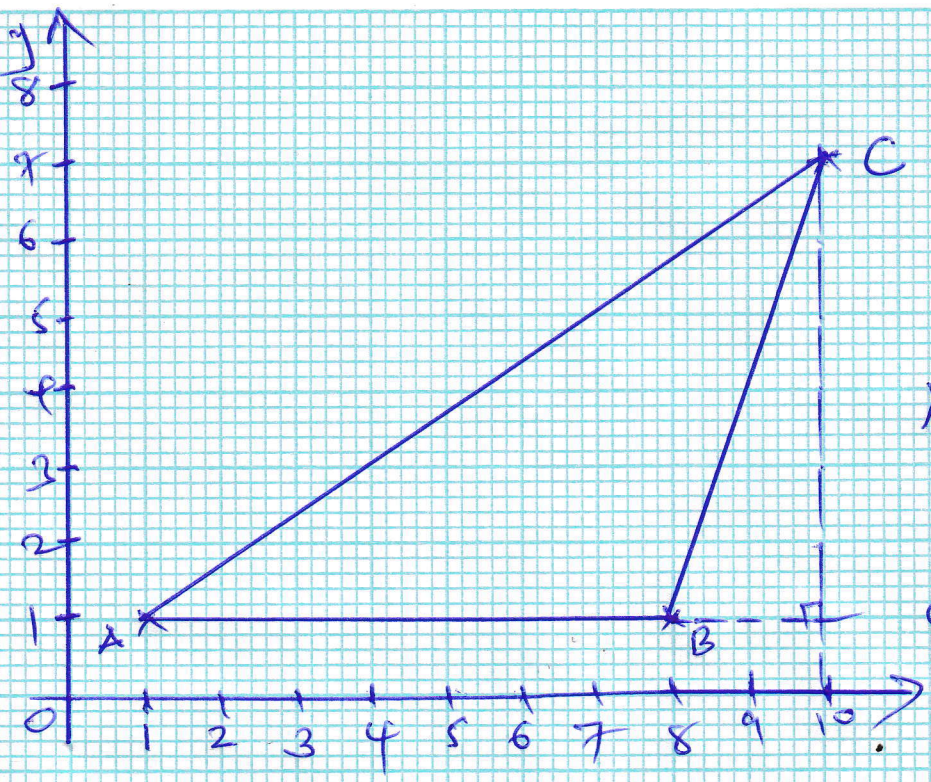
$\frac{y+6}{x-1} = \frac{1}{5}$ ⟶ M1

$5y + 30 = x - 1$

$y = \frac{1}{5}x - \frac{31}{5}$ or $x - 5y - 31$ or $y = 0.2x - 6.2$ } A1 Allow for any.

03.

15.



B_1 - The figure

Area $= \frac{1}{2} \times 7 \times 6$ → M

$= 21$ sq. units

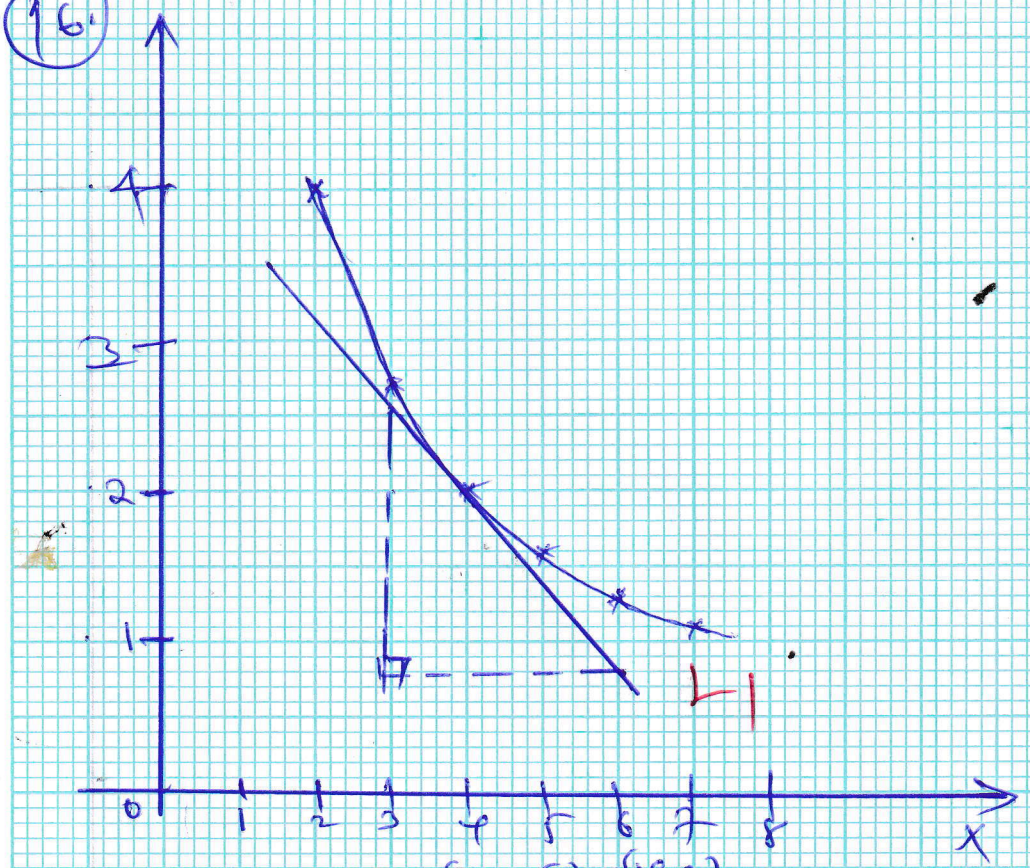
$\det = -7$

$\frac{21}{x} = -7$ → M1

$x = 3$ sq. units

A1

16.



(3, 2.5) – (4, 2)

Grad = $\left(\frac{2-2.5}{4-3}\right)$ ⟶ M_1

$= \left(\frac{-0.5}{1}\right)$

$= -0.5$ ⟶ A_1

SECTION II

17. (a) $a \cdot ar \cdot ar^2 = 64$ → M1

$a^3r^3 = 64$

$r^3 = \frac{64}{a^3}$ → M1

$r = \frac{4}{a}$ → A1 seeing cube not both sides.

(b)(i) $a + ar + ar^2 = 14$

$a + a\left(\frac{4}{a}\right) + a\left(\frac{4}{a}\right)^2 = 14$ → M1

$a + 4 + \frac{16}{a} = 14$

$a^2 - 10a + 16 = 0$

$a(a-2) - 8(a-2) = 0$ → M1

$(a-2)(a-8) = 0$

$a = 2, \quad a = 8$ → A1

$r = 2, \quad r = \frac{1}{2}$ A1

for $a=8$, $r=\frac{1}{2}$: 8, 4, 2 → B1

for $a=2$, $r=2$: 2, 4, 8 → B1

(b)(ii) 5th term is: ar^{n-1}

$\frac{1}{2}$ and 32

$\therefore \frac{1}{2} \times 32$ → M1

$= 16.$ → A1

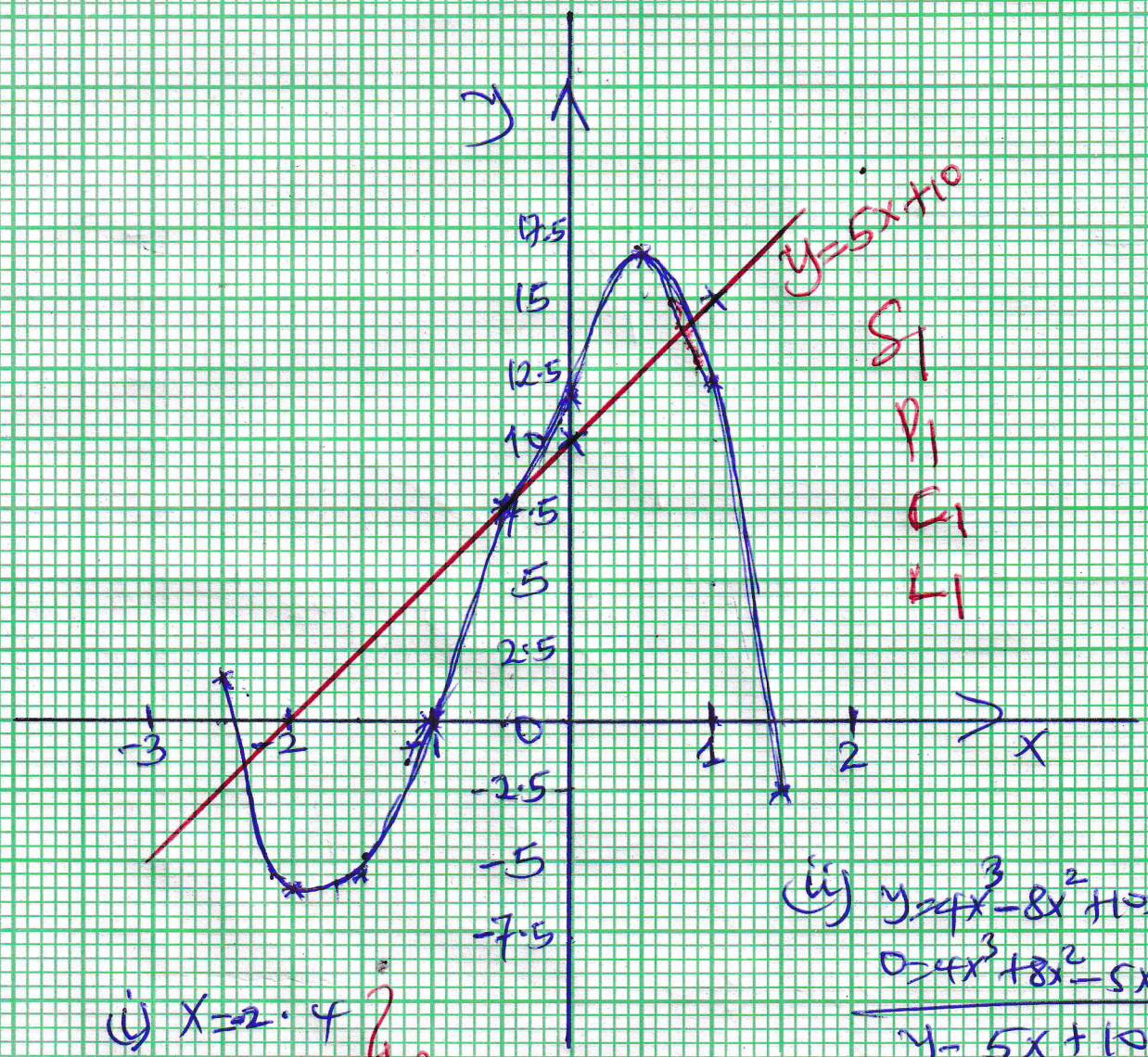
Tomes.

18

x	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5
$y=14+10x-8x^2-4x^3$	1.5	-6	-5.5	0	7.5	14	16.5	12	-2.5

B_1 for atleast 7 values correct

B_2 for all correct



S_1

P_1

C_1

L_1

(ii) $x=-2.4$
$x=-1$
$x=1.4$ } B_1

(ii) $y=4x^3-8x^2+10x+14$

$0=4x^3+8x^2-5x-4$

$y=5x+10$

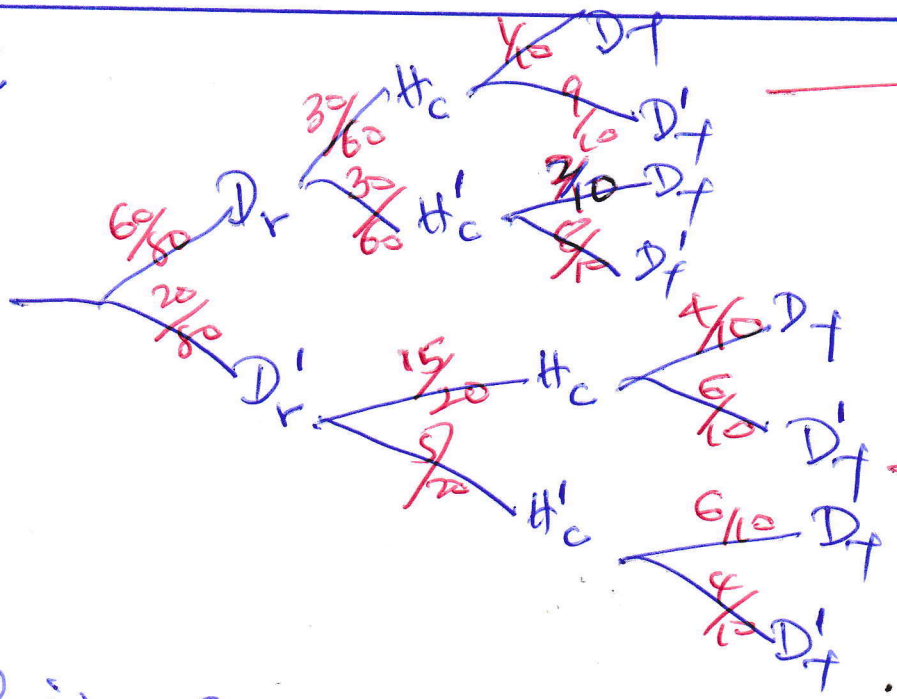
x	0	1
y	10	15

$x=-2.3 \rightarrow B_1$

$x=-0.5 \rightarrow B_1$

$x=0.8 \rightarrow B_1$

(19) (a)



B1

B1

(b) i) $\frac{6}{8} \times \frac{3}{6} \times \frac{1}{10}$

$= \frac{3}{80}$ → B1

ii) $\frac{3}{80} + \left(\frac{1}{2} \times \frac{1}{5}\right)$ → M1

$= \frac{19}{40}$ → A1

iii) $\frac{3}{80} + \frac{19}{40} + \left(\frac{1}{4} \times \frac{3}{4} \times \frac{3}{5}\right) + \left(\frac{1}{4} \times \frac{1}{4} \times \frac{3}{5}\right)$ → M1

$= \frac{3}{80} + \frac{19}{40} + \frac{3}{40} + \frac{3}{80}$ → M1

$= \frac{50}{80}$

$= \frac{5}{8}$ → A1

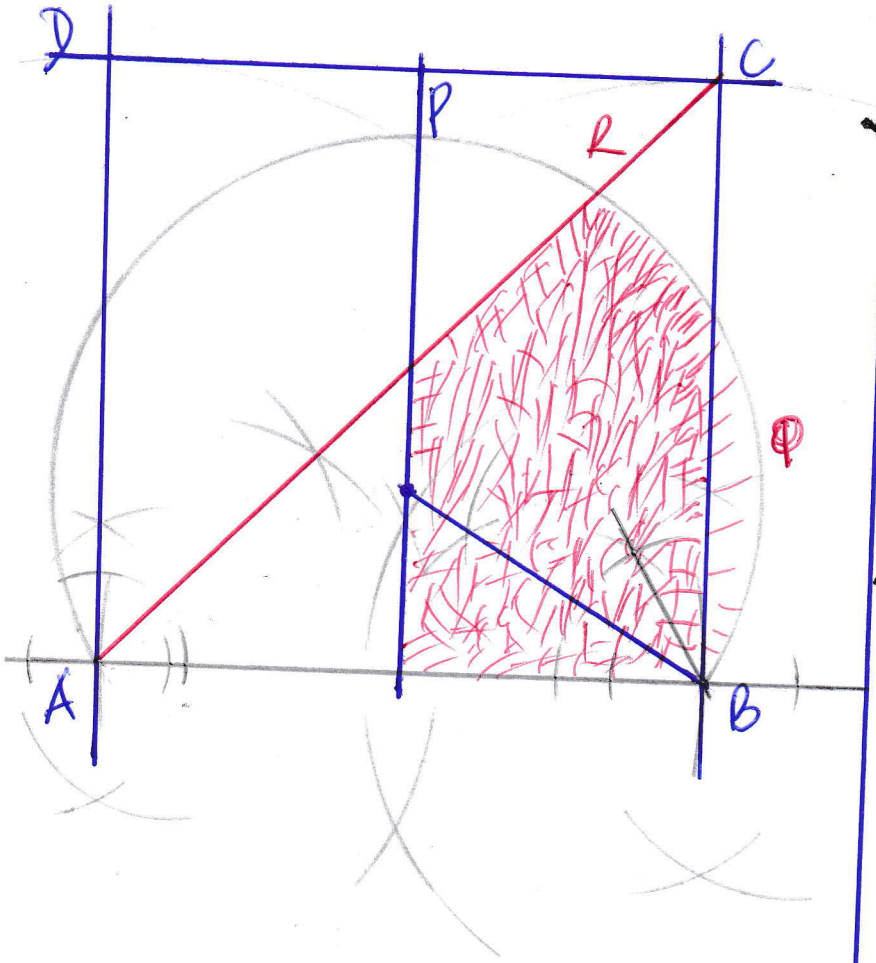
iv) $\left(\frac{1}{4} \times \frac{3}{4} \times \frac{3}{5}\right) + \left(\frac{1}{4} \times \frac{1}{4} \times \frac{3}{5}\right)$ → M1

$\frac{9}{80} + \frac{3}{80}$

$= \frac{11}{80}$. → A1

(10 mks)

20



B_1 — 90° construction at A & B.

B_1 — for bisector AR and BR

B_1 — complete figure.

B_1 — for locus P.

B_2 for locus Q ($\angle = 60°$). (the circle drawn).

B_1 for locus R (Bisector of $\angle BAD$)

B_1 for (ii) ATB

B_1 for (iii) for T

B_1 for near. the shad part.

10.

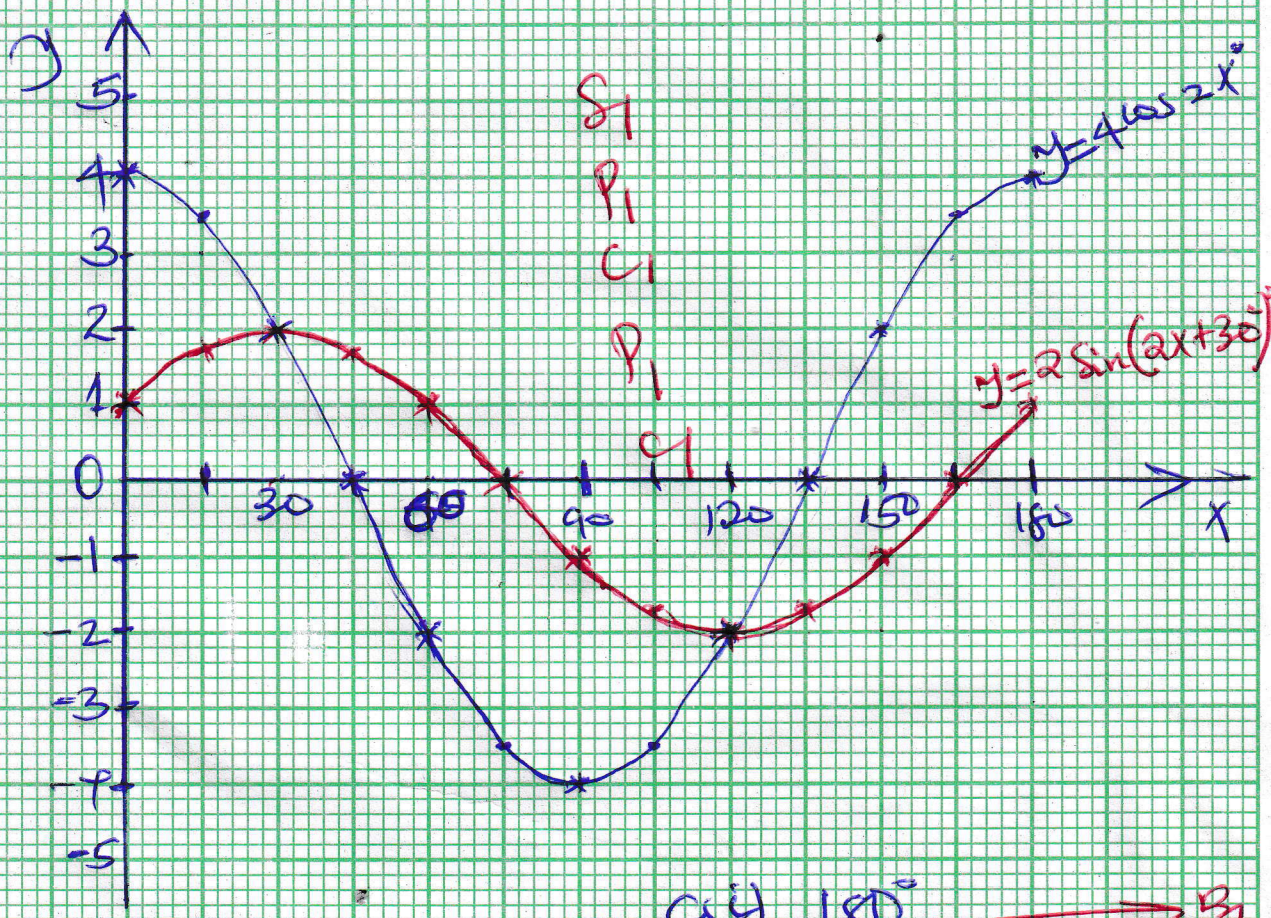
(21)

x°	0	15	30	45	60	75	90	105	120	135	150	165
$y=4\cos 2x$	4	3.86	2	0	-2	-3.86	-4	-3.86	-2	0	2	3.86
$y=2\sin(2x+30)$	1	1.73	2	1.73	1	0	-1	-1.73	-2	-1.73	-1	0

B_1 for correct 6

B_2 for all

180°
4
1



(i) 180° ——→ B_1

(ii) $75^\circ \leq x \leq 165^\circ$ ——→ B_1

(iii) $30^\circ, 120^\circ$ y ——→ B_1

(22) @ A(40°N, 30°W), B(40°N, 30°E) → B1

C(40°S, 30°E), D(40°S, 30°W) → B1

(b) $\left(\frac{60}{360} \times 2 \times \frac{22}{7} \times 6370 \cos 40\right) \times 2$ + → M1

$\left(\frac{80}{360} \times 2 \times \frac{22}{7} \times 6370\right)$ → M1

$2(5112.07)$ + (8897.78) → M1 M1

= 19121.92 km. → A1

(c) $\left(\frac{240}{60}\right)$ = 4 hrs.

= 1200 noon.

Distance = 5112.07.

Speed = 720 km/h.

$T = \frac{5112.07}{720}$ = 7 hrs 6 mins. → M1

1200 hrs + 7.06 → M1

= 1906 hrs.

= 07 06 pm. → A1 Any can apply.

10 mks.

23.

class	f	X	(X-A)=d	fd	d^2	fd^2	cf
10-19	2	14.5	-40	-80	1600	3200	2
20-29	6	24.5	-30	-180	900	5400	8
30-39	10	34.5	-20	-200	400	4000	18
40-49	16	44.5	-10	-160	100	1600	34
50-59	24	54.5	0	0	0	0	58
60-69	20	64.5	10	200	100	2000	78
70-79	12	74.5	20	240	400	4800	90
80-89	8	84.5	30	240	900	7200	98
90-99	2	94.5	40	80	1600	3200	100
	Σf = 100			Σfd = 140		Σfd^2 = 31400	

B1 B1 B1

(a) $\bar{x} = 54.5 + \frac{140}{100}$ → M1

$= 55.9$ → A1

(b) $Q_3 = 59.5 + 10\left(\frac{75-58}{20}\right)$

$= 68$ → B1 (correct value of Q3)

$Q_1 = 39.5 + 10\left(\frac{25-8}{16}\right)$

$= 43.875$ → B1 (correct value of Q_1)

Quartile dev. $= \frac{68-43.875}{2}$ → M1

$= 12.0625$ → M1

(c) $sd = \sqrt{\frac{31400}{100} - \left(\frac{140}{100}\right)^2}$ → M1

$= \sqrt{314 - 1.96}$

$= 17.66$ → A1

24

(a) (i) $x + y \leq 40$ B_1

x	0	40
y	40	0

(ii) $3x + 5y \leq 150$ B_1

x	0	50
y	30	0

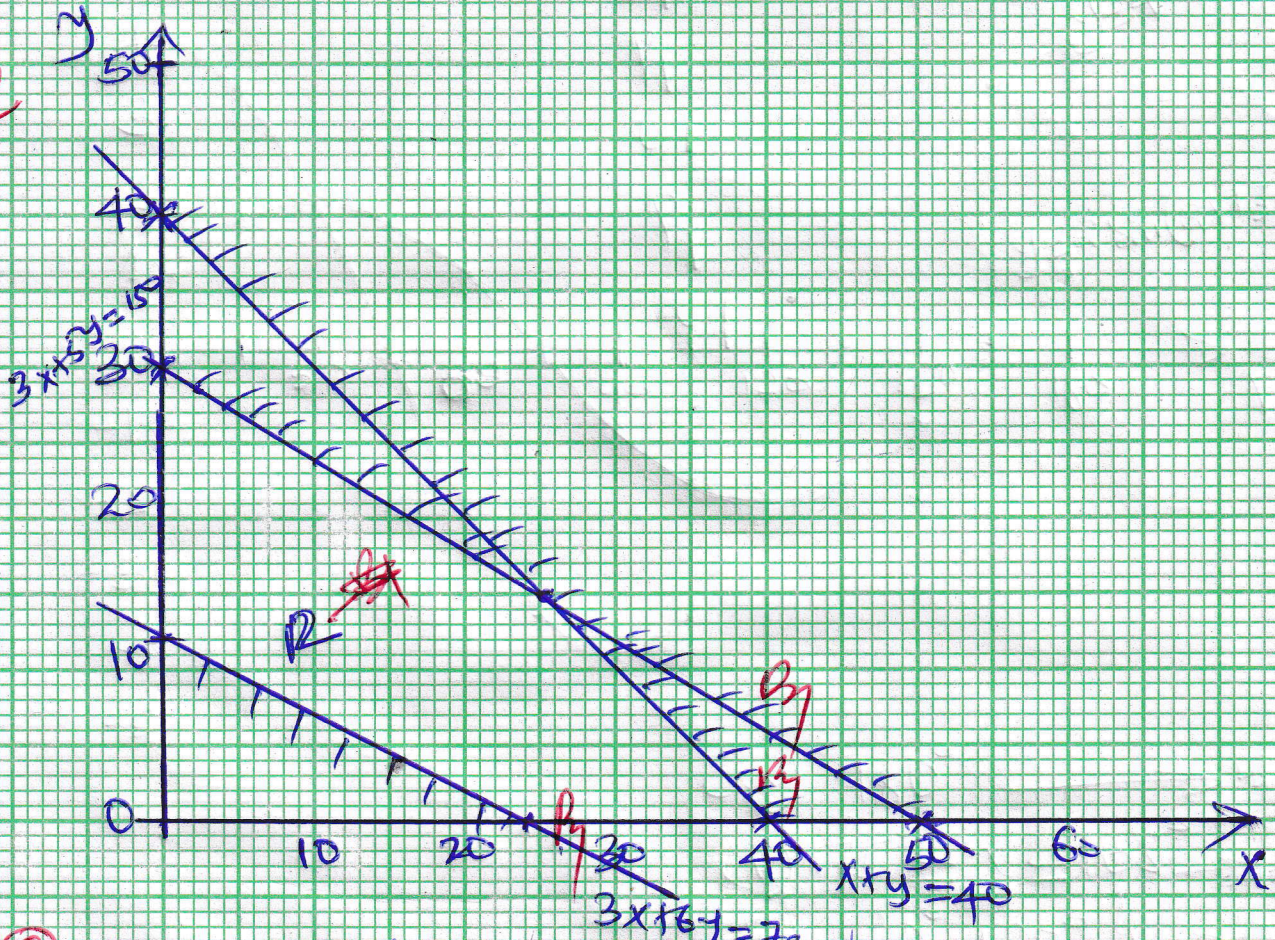
(iii) $3x + 6y \geq 72$ B_1

x	0	24
y	12	5

(iv) $x \geq 0, y \geq 0$ B_1

Objective function; $3500x + 4000y = K$.

(b)



(c)

(x, y)	(25, 15)	(35, 5)	(30, 10)	(20, 18)
cost	147500	142000	145000	142000

B_1 (or objective func. use)

B_1 { 25 acres of maize, 15 acres of wheat

Max Profit = 147500 K. B_1