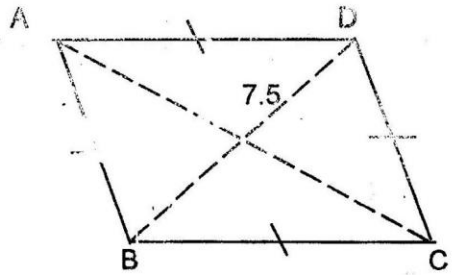
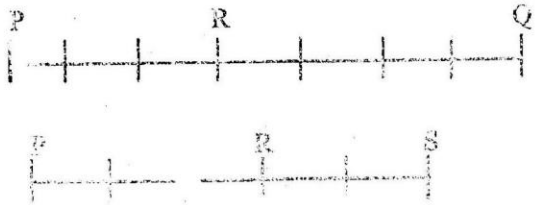
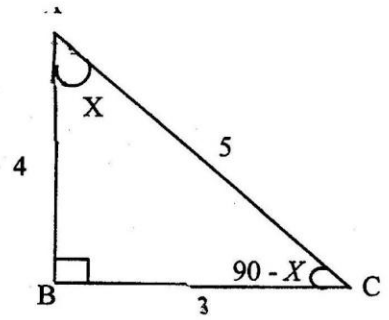
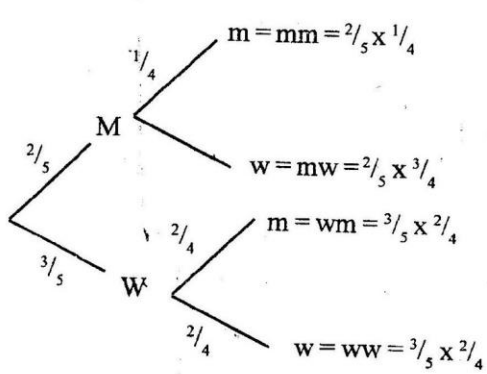
MARKING SCHEME 2006 PAPER 1

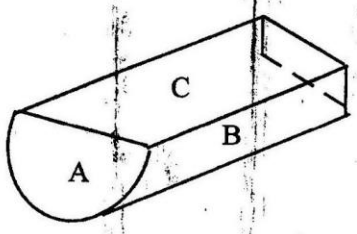
SOLUTION	MARKS	ALT. METHOD
1. $\dfrac{{}^{3}/_{4} + 1^{3}/_{7} \div {}^{4}/_{7} \times 2^{1}/_{3}}{(1\,{}^{3}/_{7} - {}^{5}/_{8}) \times {}^{2}/_{3}} = \dfrac{{}^{3}/_{4} + 1^{3}/_{7} \times {}^{7}/_{4} \times {}^{7}/_{3}}{(1\,\frac{24-35}{56}) \times {}^{2}/_{3}}$	M1	
Num. ${}^{3}/_{4} + {}^{12}/_{7} \times {}^{7}/_{4} \times {}^{7}/_{3} = {}^{31}/_{4}$	M1	
Deno. ${}^{45}/_{56} \times {}^{2}/_{3} = {}^{15}/_{28}$		
${}^{31}/_{4} \times {}^{28}/_{15} = 14\,{}^{7}/_{15}$	A1	
2. 2 | 1470 | 7056 | 735 | 3528 2 | | 1764 2 | | 882 2 | | 441 3 | 735 | 441 3 | 245 | 147 5 | 49 | 49 7 | 7 | 7 7 | 1 | 1	M1	1470 $= 2 \times 735$ $= 2 \times 3\ \ 245$ $= 2 \times 3 \times 5 \times 49$ $= 2 \times 3 \times 5 \times 7 \times 7$ $= \mathbf{2 \times 3 \times 5 \times 7^2}$
1470 $= 2 \times 3 \times 5 \times 7 \times 7$ $= \mathbf{2 \times 3 \times 5 \times 7^2}$ 7056 $= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 7$ $= \mathbf{2^4 \times 3^2 \times 7^2}$	B1	7056 $= 3528 \times 2$ $= 2 \times 2 \times 1764$ $= 2 \times 2\ \ 2 \times 882$ $= 2 \times 2 \times 2 \times 2 \times 441$ $= 2 \times 2 \times 2 \times 2 \times 3 \times 147$ $= 2^4 \times 3 \times 3 \times 49$ $= 2^4 \times 3^2 \times 7 \times 7$ $= \mathbf{2^4 \times 3^2 \times 7^2}$
$\dfrac{1470^2}{\sqrt{7056}} = \dfrac{2^2 \times 3^3 \times 5^2 \times 7^4}{3 \times 5^2 \times 7^3}$ $= \mathbf{3 \times 5^2 \times 7^3}$ **Ans.**	A1	

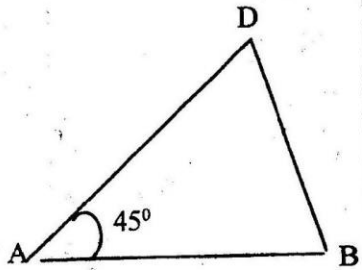
3.		M1	
	AD $= \sqrt{7.5^2 + 4^2}$	M1	
	$= \sqrt{72.25}$		
	$= 8.5$		
	Perimeter $= 8.5 \times 4$	A1	
	$= 34cm$		
4.	$\frac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2} = \frac{(3t)^2 - (5a)^2}{6t^2 + 9at + 10at + 15a^2}$	B1 M1	
	$= \frac{(3t + 5a)(3t - 5a)}{(3t + 5)(2t + 3a)} = \frac{3t - 5a}{2t + 3a}$	A1	
5.	$6x = 360^0$	B1	
	$X = 60^0$		
	$(180 - 60)\, n = 360$	M	
	$120n = 360$		
	$n = 3$	A1	
6.	 $\frac{1}{2}$ = $\frac{3}{7}$	B1	

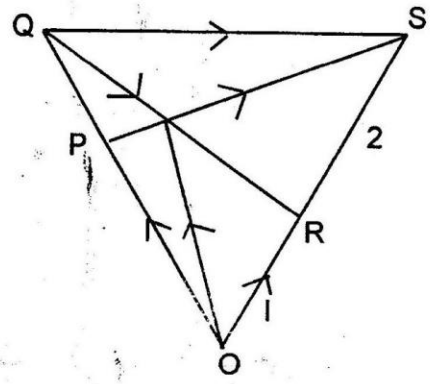
$\overrightarrow{PR} = {}^{3}/_{5}\,PS$ But $\overrightarrow{PR} = \overrightarrow{PR}$ ${}^{3}/_{7}\ \overrightarrow{PQ} = {}^{3}/_{5}\overrightarrow{PS}$ $\overrightarrow{PS} = {}^{5}/_{7}\ \overrightarrow{PQ}$ $\lvert PS \rvert = {}^{5}/_{7} \times 8 = {}^{40}/_{7}$ But $\overrightarrow{RS} = {}^{2}/_{5}\overrightarrow{PS}$ $\lvert RS \rvert = {}^{2}/_{5} \times {}^{40}/_{7}$ $= 2$	1Mk 1M A1	
7.  $\sin(90-x) = \frac{AB}{AC}$ $\sin(90-x) = {}^{8}/_{10} = {}^{4}/_{5}$ $\tan x\ \frac{BC}{AB}$ $= 0.75$	B1 M1 A1	

8 	B1	
$MM = {}^{2}/_{20}$ $MW = {}^{6}/_{20}$ $WM = {}^{6}/_{20}$ $WW = {}^{6}/_{20}$	M1	
a) P(mm or ww) = P(mm) + P(ww) $= {}^{2}/_{20} + {}^{6}/_{20} = {}^{2}/_{5}$ **Ans.**	A1	
b) P(MW OR WM) = P(MW) + P(WM) $= {}^{6}/_{20} + {}^{6}/_{20}$ $= {}^{3}/_{5}$ **Ans.**	A1	
9. L.C = 1cm A-E = 0.5 Limits of A are 3.5 nd 4.5 Limits of 6 are 5.5 and 6.5 Min. Area = ½ x 3.5 x 5.5 = 9.625 Max. Area = ½ x 4.5 x 6.5 = 14.625 W[illegible] Area [illegible] 6 [illegible]		M1

Workig Area - Min. Area = 12 - 9.625 = 2.375 Max Area - Working Area = 14.625 - 12 = 2.625 Absolute Error in Area $= \frac{2.375 + 2.625}{2}$ **= 2.5**	M1	
b) % Error = $\frac{A.E}{A.M} \times 100$ $= \frac{2.5}{12} \times 100 = 20^5/_6\%$	A1	
10. $P^2 = (P - q)(P - r)$ $P^2 = P^2 - Pr - Pq + qr$ $= - Pr - Pq + qr$	B1	
$Pr + Pq = qr$ $P(r + q) = qr$	M1	
$P = \frac{qr}{q + r}$	A1	
11. $7y - 3x + 30 = 0$ At y - intercept the value of $x = 0$	B1	
Therefore $7y = -30$ $y = -^{30}/_7 = -4^2/_7$	M1	
The coordinates are $(0, -4^2/_7)$	A1	

12.  Area A $= \pi r^2$ $= {}^{22}/_{7} \times 4.2 \times 4.4$ $= 55.44cm^2$ Area B $= 2\pi rh \times {}^{1}/_{2}$ $= {}^{22}/_{7} \times 4.2 \times 150$ $= 1980cm^2$ Area C $= 2 \times 4.2 \times 150$ $= 1260cm^2$ Total Area $= 55.44 + 1980 + 1260$ $= \mathbf{3295.44cm^2}$	B1 M1 M1 A1	**Surface Area of cylinder** $= {}^{2}/_{2}\pi rh + \pi r^2 + 2rh$ $= {}^{22}/_{7} \times 4.2 \times 150 + {}^{22}/_{7} \times 4.2 \times 4.2 + 2 \times 4.2 \times 150$ $= \mathbf{3295.44cm^2}$
13. $A = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$, $B \begin{pmatrix} X \\ Y \\ Z \end{pmatrix}$ and. $T = \begin{pmatrix} 2 \\ 0 \\ 1.5 \end{pmatrix}$ Mid point - AB= $T = \left[\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right]$ $\left[\frac{1 + x}{2}, \frac{y - 1}{2}, \frac{1 + z}{2}\right] \equiv (2,0,1.5)$ $X = 3, y = 1$ and $z = 2$ Hence $B \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix}$ **B = 3i + j** Ans.	M1 B1 A1	

14. a) $12 \sin 30^0 = 12 \times {}^1/_2$ $= 6cm$ $<ADB = 6$ $\frac{8}{\text{Sin D}} = \frac{6}{\text{Sin } 45^0}$ $\text{Sin D} = \frac{8 \sin 4.5}{6}$ $= 70^0 30^1$ 	A1 M1 A1	
15. i) $I = \frac{PRT}{100}$ $= {}^5/_{100} \times 2 \times p$ $= 0.1p$ ii) A $= P(1 + 0.05)^2$ $= 1.1025p$ Interest $= 0.1025p$ Difference in interest $= 0.1025p - 0.1p$ $210 = 0.0025p$ Therefore $P = \frac{210}{0.0025} = 82{,}000/=$	B1 M1 M1 A1	
16 $\int a\,dt = \int (25 - 9t^2)\,dt$ $= 25t - 3t^3 + c$ $4 = 25t - 3t + c$ when $t = 0$ $4 = c$ Hence $V = 25t - 3t^2 + 4$ b) $V = 25 \times 2 - 3 \times 2^2 + 4$ $= 50 + 4 - 12$ $= 42ms^{-1}$	B1 M1 A1 A1	

Q17	The speed of the car is $(x + 20)$ km/h	B1	
	Time taken by lorry $= {}^{280}/_{x}$ hrs.	M1	
	Time taken by the car $= {}^{280}/_{x+20}$ hrs		
	${}^{280}/_{x} - {}^{280}/_{x+20} = {}^{7}/_{6}$		
	$\dfrac{280(x+20) - 280x}{x(x+20)} = {}^{7}/_{6}$		
	$7x^2 + 140x = 33600$		
	$x^2 + 20x - 4800 = 0$		
	$x^2 - 60x + 80x - 4800 = 0$	M1	
	$x(x - 60) + 80(x - 60) = 0$		
	$(x - 60)(x + 80) = 0$		
	$x = -80$ or $x = 60$	A1	
b)	Time taken by the lorry $= 12.15$	A1	
	$= 4$ hrs		
	Distance covered by lorry = speed x time		
	$= 60 \times 4$	M1	
	$= 240$km		
	Time taken by the car $= \dfrac{\text{distance}}{\text{Time}} = \dfrac{240}{100} = 2.4$ hrs	M1	
	Time left town M = 12.15 - 2 hrs 24min		
	= 9.51 a.m	A1	
18.			

a)	$\overrightarrow{PS} = -\overrightarrow{PO} + \overrightarrow{OS}$	M1	Hence QR $\uparrow\uparrow$ QT	
	$= -2p + 3r$		Q is common point	
	$= 3r - 2p$		Hence Q,T,R are Collinear	A1
	$\overrightarrow{OT} = {}^1/_7\, OS + {}^6/_7\, OP$		b) ii) $\overrightarrow{QT} : \overrightarrow{TR}$	
	$= {}^1/_7 \times 3\underset{\sim}{r} + {}^6/_7 \times 2\underset{\sim}{p}$	A1	$\overrightarrow{QT} = {}^3/_7\underset{\sim}{r} - {}^9/_7\underset{\sim}{p}$	
	$= {}^3/_7\underset{\sim}{r} + {}^{12}/_7\underset{\sim}{p}$		$\overrightarrow{TR} = \overrightarrow{OT} + \overrightarrow{OR}$	B1
			$= -{}^3/_7\underset{\sim}{r} - {}^{12}/_9\underset{\sim}{p} + r$	
			$= {}^4/_7\underset{\sim}{r} - {}^{12}/_7\underset{\sim}{p}$	
	$QT = QP + PT$		Hence $\overrightarrow{QT} : \overrightarrow{TR}$	
	$= -{}^1/_3(3\underset{\sim}{p}) + 1/7\,(3\underset{\sim}{r} - 2p)$		${}^3/_7\underset{\sim}{r} - {}^9/_7\underset{\sim}{p} : {}^4/_7 - {}^{12}/_7 p$	
	$= {}^3/_7 r - {}^9/_7 p$		$\Rightarrow {}^3/_7\underset{\sim}{r} : {}^4/_7\underset{\sim}{r}$	
		A1	3 : 4 OR	
b) i)	$\overrightarrow{QT} = {}^3/_7\underset{\sim}{r} - {}^9/_7\underset{\sim}{p}$		$-{}^9/_7\underset{\sim}{p} : -{}^{12}/_7\underset{\sim}{p}$	
	$\overrightarrow{QR} = \underset{\sim}{r} - 3\underset{\sim}{p}$		3 : 4	
	QR $\uparrow\uparrow$ QT if QR = KQT		Hence QT : TR = 3:4	A1
	$\underset{\sim}{r} - 3\underset{\sim}{p} = K\,({}^3/_7\underset{\sim}{r} - {}^9/_7\underset{\sim}{p})$	M1		
	$r = {}^3/_7 kr$			
	$k = {}^7/_3$			
	Also $-3\underset{\sim}{p} = -{}^9/_7 pk$			
	$k = {}^7/_3$			
19.	Cross sectional area = ½ bh + l x b	B1		
	= ½ x 25 x 1.8 + 25 x 1	M1		
	= <u>47.5m²</u>			
	Volume = 47.5 x 10			
	= **475m³**	A1		

b i) Volume A ½ x 25 x 1.8 x 10

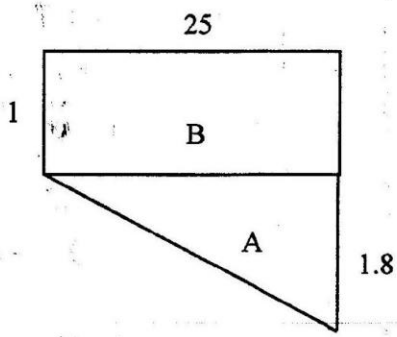
= 225 B1

Volume B = 10 x 1 x 25

= 250 M1

Total volume = 250 + 225

= 475m³ A1



B2

ii) 225m³ = 9 hours

Therefore 250m³ = $\frac{250 \times 9}{225}$

= 10 hours A1

20. See graph next page

y_1	y_2	y_3	y_4	y_5	y_6
2	5	9	14	20	27

mid ordinate

Area = $h(y_1 + y_2 + y_3 + y_4 + y_5 + y_6)$

$= 1(2 + 5 + 9 + 14 + 20 + 27)$

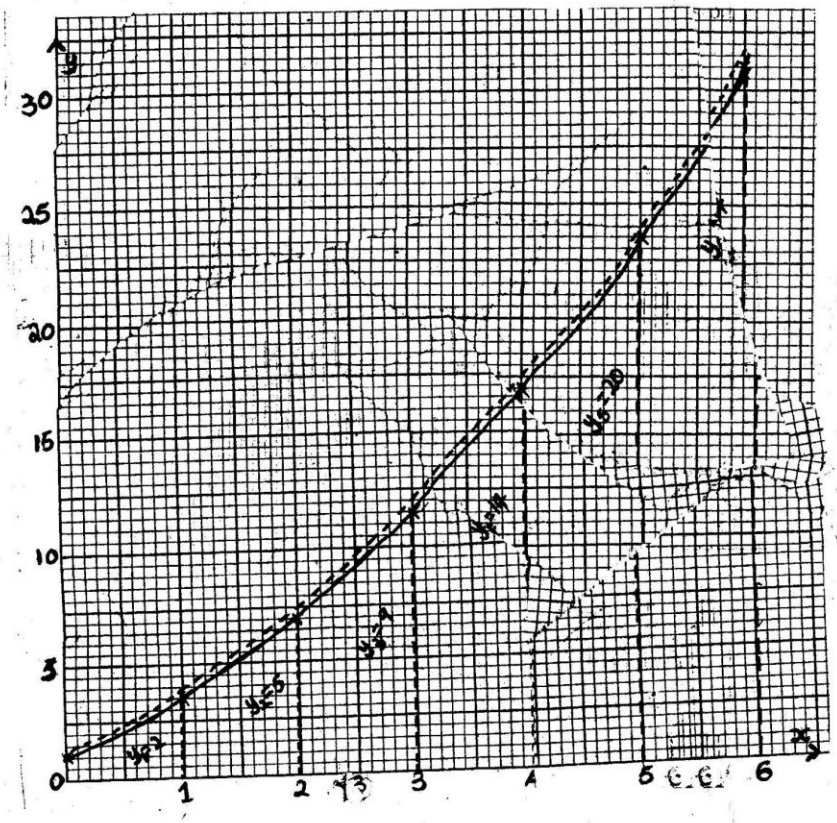
$= 77cm^2$

b) Error = $78cm^2 - 77cm^2$

= 1cm

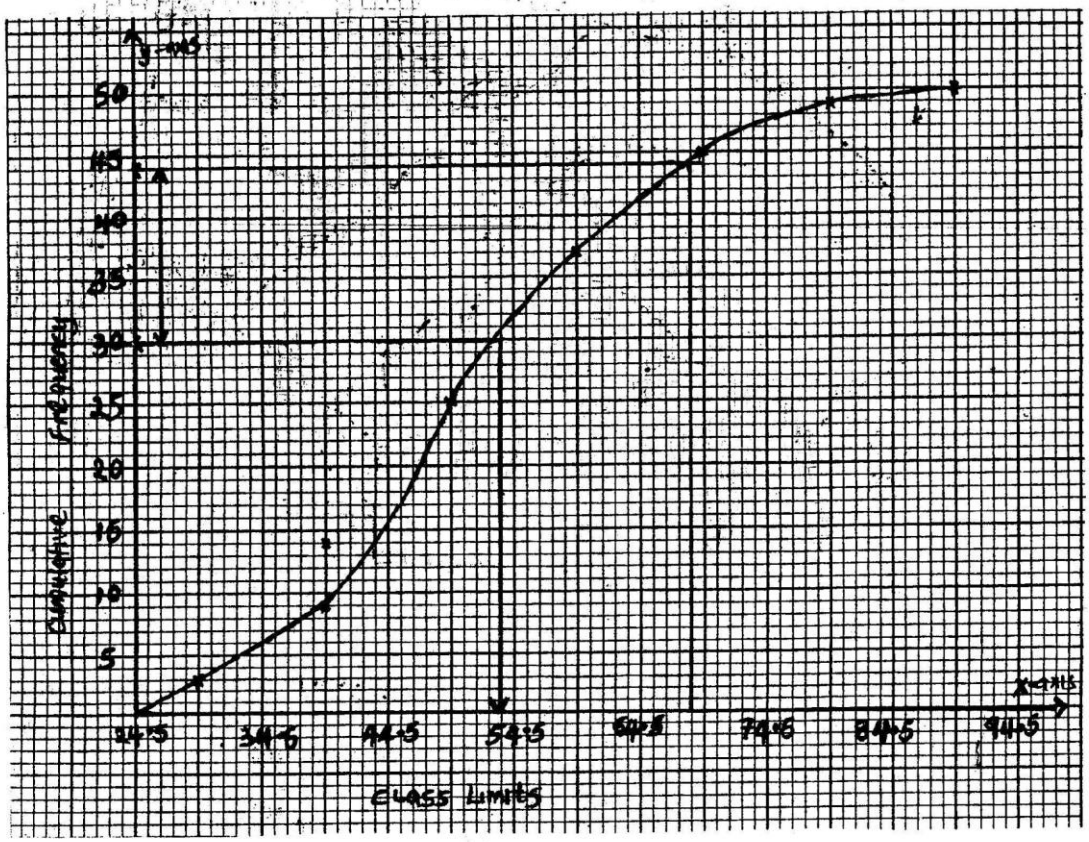
% Error = $^1/_{78} \times 100$

= $12\ ^{32}/_{39}$% or 12.82



21 a) $^{dy}/_{dx} = 0$ at turning points		b) $^{dy}/_{dx} = 4x - 3$	
Hence $4x - 3 = 0$		and $^{dy}/_{dx} = 7$	
$x = ¾$	A1	Therefore $4x - 3 = 7$	M1
Min. value = y at min. point		$x = {}^{5}/_{2}$	B1
Hence at minimum point $x = ¾$	M1		
and $y = {}^{-1}/_{8}$	B2	subst. for x	
$= (4x - 3)\,dx$		$y = 6$	
$y = 2x^2 - 3x + c$ subst. $x = ¾$		Hence the point is (2.5, 6)	A1
$c = 1$ $y = {}^{1}/_{8}$			
Hence $y = 2x^2 - 3x + 4$	A1		

Mass (g)	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75 - 74	85 - 94
No of potatoes	3	6	16	12	8	4	1
C.F.	3	9	25	37	45	49	50



23. $\cos x^0 = 3/5$

i) Hence TL = 3

BL = 4

$BT = \sqrt{4^2 + 3^2}$

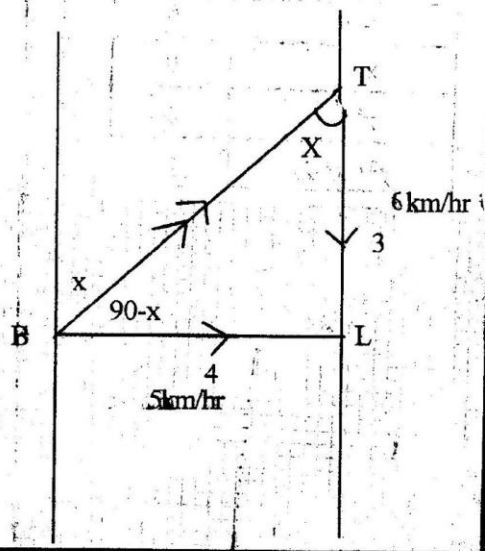
$= 5$

Revolving speed

$|BT| = \sqrt{6^2 - 5^2}$

$= \sqrt{36 - 25}$

$= 3 km/hr$



M1

A1

ii) $\cos x^0 = 3/5 = 0.6$

$= 53.1^0$

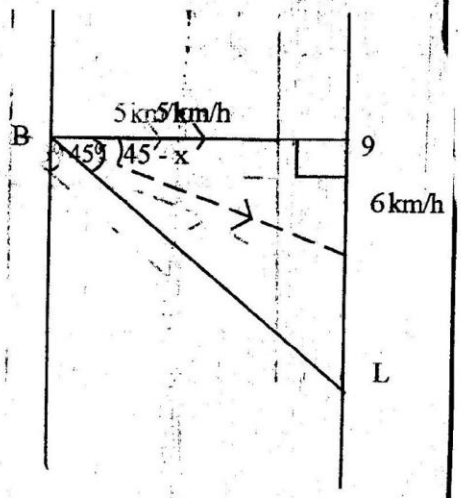
B1

A1

b) Resultant speed $= \sqrt{25 + 36}$

$= \sqrt{61}$

$= 7.8 km/hr$



M1

$\cos \theta = 5/7.8$

$= 0.64$

$\theta = 50.2^0$

But θ $45 \pm x$

$x = \pm 5$

Possible course $= 135 - 5$

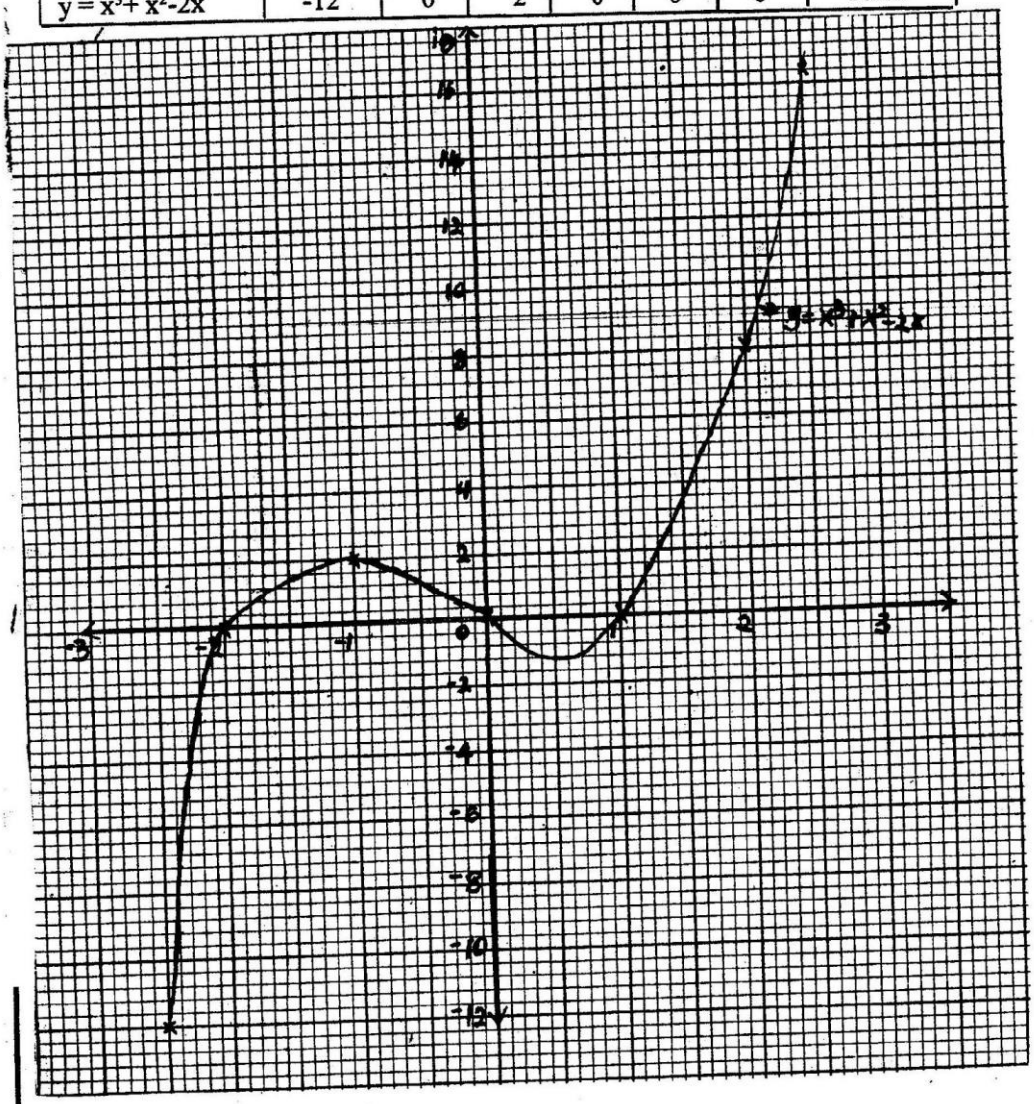
$= 130^0$

M1

A1

x	-3	-2	-1	0	1	2	2.5
-2x	6	4	2	0	-2	-4	-5
x^2	9	4	1	0	1	4	6.25
x^3	-27	-8	-1	0	1	8	15.625
$y = x^3 + x^2 - 2x$	-12	0	2	0	0	8	16.88

M2



24.

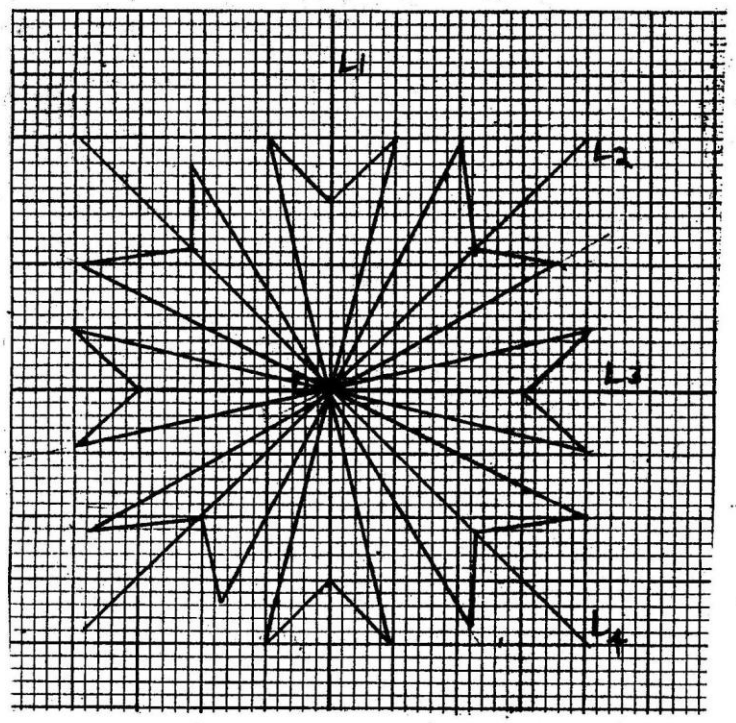
i) $X < -2$ — M1 A1

b) (-2,0) and (1, 0) — A2

MARKING SCHEME 2005 PAPER 2

SOLUTION	MARKS	ALT. METHOD
1. $\dfrac{243 \times 3^{2y}}{729 \times 3^{3y} \div 3^{(2y-1)}} = 81$		
$= \dfrac{3^5 \times 3^{2y}}{3^6 \times 3^y \div 3^{2y-1}} = 3^5$	M1	
3^{5+2y}		
$3^{6+y-(2y-1)}$		
$= \dfrac{3^{5+2y}}{3^{7-y}} = 3^5$		
$= 3^{-2+3y} = 3^5$	M1	
Hence $3y - 2 = 5$		
$3y = 7$		
$y = 7/3 = 2\,1/3$	A1	
2. $\dfrac{\sqrt{63} + \sqrt{72}}{\sqrt{32} + \sqrt{28}} \times \dfrac{(\sqrt{32} - \sqrt{28})}{(\sqrt{32} - \sqrt{28})}$		
Deno => $32 - \cancel{\sqrt{32}\sqrt{28}} + \cancel{\sqrt{28}\sqrt{32}} - 28$		M1½
=> 4		
Num => $\sqrt{63}\sqrt{32} - \cancel{\sqrt{63}\sqrt{28}} + \sqrt{(72 \times 32)} - \sqrt{72 \times 28}$		
=> $\sqrt{9 \times 7 \times 16 \times 2} - \sqrt{9 \times 7 \times 7 \times 4} + \sqrt{9 \times 4 \times 2 \times 16 \times 2} - \sqrt{9 \times 4 \times 2 \times 7 \times 4}$		
=> $12\sqrt{14} - 42 + 48 - 12\sqrt{14} = 6$		
$6/4 = 1\,1/2$		A 1½
3. Men: $7/9 \times 45 = 35$		Alternatively:
Wom: $2/9 \times 45 = 10$	M1	$4/9\,(45 + x) = (10 + x)$
Let the No. be x		$4(45 + x) = 9(10 + x)$
Men: $5/9\,(45 + x) = 35$	M1	$180 + 4x = 90 + 9x$
$225 + 5x = 315$		$5x = 90$
$x = 18$	A1	$x = 18$

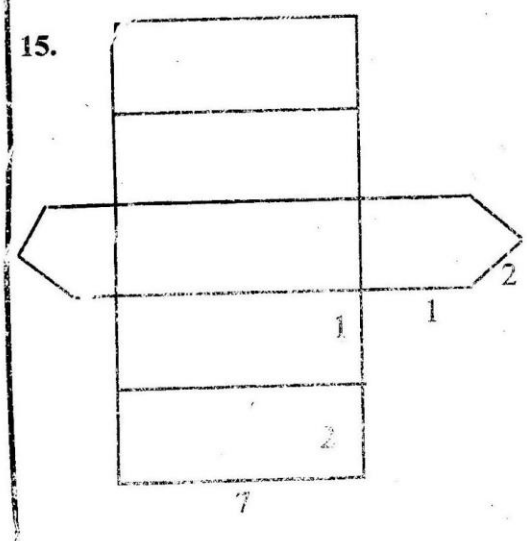
4.



5. $x/_3 = 16/_{3x}$ $3x^2 = 48$ $x^2 = 16$ $x = 4$	B1 A1	$16/_{3x} = x/_3$ $x \times 16/_x = x \times x$ $x = \sqrt{16}$ $= 4$
6. In 1 hr: $1/_3 + 1/_6$ of water = ½ of tank is filled $½ - 1/_8 = 4 - 1/_8 = 3/_8$ 3/8 is filled in 1 hr. All pipes open ½ of the tank = ½ x 1 ÷ 3/8 $= ½ \times 8/_3 = 4/_3$ = 1 hr and 20 minutes Total time taken = 2 hrs and 20 min	M1 M1 B1 A1	In I hr: $1/_3 + 1/_6 - 1/_8 = {}^{8+4-3}/_{24}$ Filled in 1 hr. $= 9/_{24} = 3/_8$ $½ \times 8/_3 = 4/_3 = 1^1/_3$ hrs Total time $= 1 + 1^1/_3$ $= 2^1/_3$ hrs

7. $\text{Log}_2 (x^2 - 9) = 3 \log_2 + 1$ $\text{Log}_2 (x^2 - 9) = \log_2 (3) + \log_2 {}^2$ $\text{Log}_2 (x^2 - 9) = \log 2 (8 \times 2)$ $X^2 - 9 = 16$ $X^2 = 25$ $X = \pm 5$	M1 M1 B1 A1	$\text{Log}_2 (x^2 - 9) = 3 \log_2 {}^2 + \log_2$ $\text{Log}_2 (x^2 - 9) = \log_2 16$ $X^2 - 9 = 16$ $X = \pm 5$
8. Volume scale factor $= \frac{4752}{1408}$ $= 3.376$ $\text{v.s.f} = (\text{l.s.f})^3$ $\text{l.s.f} = \sqrt[3]{3.376}$ $= 1.5$ Area scale factor $= (\text{l.s.f})^2$ $= 1.5^2$ $= 2.25$ Area of larger cylinder $= 352 \times 2.25$ $= 792\text{cm}^2$	M1 M1 M1 A1	$\text{l.s.f} = (\text{v.s.f})^{1/3} = (\text{A.s.f})^{1/2}$ $(\text{l.s.f})^2 = (\text{A.s.f})$ $(\text{L. s. f})^3 = (\text{v.s.f})$ $= 3.776$ $\text{l.s.f} = (3.376)^{1/3}$ $= 1.5$ $\text{A.s.f} = (1.5)^2$ $= 2.25$ Area of larger cylinder = Area of smaller x A.s.f $= 352 \times 2.25$ $= 792\text{cm}^2$
9. $\cos 2x^\circ = 0.870$ $2x^\circ = 36.2^\circ, 143.8, 216.2^\circ$ 323:8, 396:2, 503.8, 576.2, 683.8 Hence $x^0 = 18:1, 71:9, 108:1, 161:9$ 198:1, 251:9, 288:1, 341:9	B1 M1 M1 A1	
10. 120,000 – 15,000 = 105,000 Commission = 105,000 x $^5/_{100}$ = 5,250 Discount = 120, 000 x $^5/_{200}$ = 3,000 Total earnings = 9000 + 2250 = 11,250/=	M1 M1 A1	

11. $\frac{9 + 8.2 + 6.7 + 5.4 + 4.7}{5} = A$ $\frac{8.2 + 6.7 + 5.4 + 4.7 + k}{5} = B$ $A - B = 0.6$ $6.8 - \frac{(25 + k)}{5} = 0.6$ $34 - (25 + k) = 3.0$ $9 - k = 3.0$ $k = 6$	B1 M1 A1	
Q12 Gradient of $L_1 = \frac{6 - 0}{0 - 4} = \frac{3}{2}$ $\frac{y - 6}{x - 0} = \frac{3}{2}$ $2y - 12 = 3x$ $y = {}^3/_2x + 6$ At p; $L_1 = L2$ ${}^3/_2x + 6 = 2x - 2$ $1.5x = 2x - 8$ $= 16$ subst. $y = 30$	M1 M1 A1	Gradient of $L_1 = \frac{0 - 6}{-4 - 0}$ $= {}^3/_2$ y intercept = 6 Therefore $y = mx + c$ general eq. $y = {}^3/_2x + 6$ At p; $L_1 = L_2$ ${}^3/_2x + 6 = 2x - 2$ $x = 16$ Sub. $y = 30$
13. $(3x - y)^4 \Rightarrow (3x)^4y^0, (3x)^3y^1, (3x)^2y^2$ $(3x)^1y^3, (3x)^0y^4$ $\Rightarrow 81x^4 = 27x^3y, 9x^2y^2$ $3xy^3, y^4$ With coeff. $(3x - y)^4 = 81x^4 - 4 \times 27x^3y +$ $6 \times 9 \times - 4 \times 9x\,y^3 + y^4$ $= 81x^4 - 108x^3y + 54x^2y^2 - 36xy^3 + y^4$ $x = 2$ and $y = 0.2$ $(6 - 0.2)^4 = 81 \times 2 - 108 \times 2 \times$ $0.2 + 54 \times 2^2 \times 0.2^2$ $= 162 - 43.2 + 86.4$ $= 205.2$	B1 M1 M1 A1	$(3x - y)^4 = 81x^4 - 108x^3y + 54x^2y^2$ $-36xy^3 + y^4$ $(6 - 0.2)^4 = (3 \times 2 - 0.2)$ $\Rightarrow x = 2$ and $y = 0.2$ $(6 - 0.2)^4 = 162 - 43.2 + 86.4$ $= 205.2$

14.	$2 = \frac{500k}{5^3}$ $2 = 4k$ $k = ½$ $d = \frac{m}{2r^3}$ $20 = \frac{540}{2r^3}$ $r^3 = 27$ $r = 3$	M1 A1	$2 = \frac{500k}{5^3}$ $k = ½$ $d = \frac{m}{2r^3}$ $r^3 \; m$ $2d$ sub $r^3 = \frac{540}{20}$ $3 = r$
15.		B1 M1 A1	
16.	$\frac{ds}{dt} = 0$ at maximum $= 29.4 - 9.8t$ $9.8t = 29.4$ $t = 3$ hence $S = 29.4 \times 3 - 4.9 \times 3^2$ $= 44.1$	B1 M1 A1	

17. $^{dy}/_{dx} = x^2 + 2x - 3$

at turning points; $^{dy}/_{dx} = 0$

$x^2 + 2x - 3 = 0$

$x^2 - x + 3x - 3 = 0$

$x(x-1) + 3(x-1) = 0$

$(x-1)(x+3) = 0$

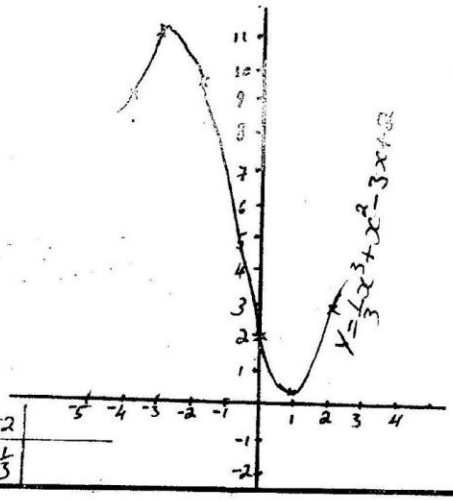
$x = 1$ or -3

Subst $y = {}^1/_3$ or 11

The turning points are $(1, {}^1/_3)$ and

(-3, 11)

x	1	$\frac{1}{3}$	0	2	4	-2
y	$\frac{1}{3}$	1	2	$2\frac{2}{3}$	$8\frac{2}{3}$	$9\frac{1}{3}$



18. $\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} 2 & 2 & 4 \\ 0 & 4 & 4 \end{bmatrix} = \begin{bmatrix} 2a & 2a+4b & 4a+4d \\ 2c & 2c+4d & 4c+4d \end{bmatrix}$ B1

$\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 2a & 2a+4b & 4a+4d \\ 2c & 2c+4d & 4c+4d \end{bmatrix} = \begin{bmatrix} -2c & -2c-4d & -4c-4d \\ -2a & -2a-4b & -4a-4d \end{bmatrix}$ M1

$\begin{bmatrix} 0 & -4 & -4 \\ -2 & -10 & -12 \end{bmatrix} = \begin{bmatrix} -2c & -2c-4d & -4c-4d \\ -2a & -2a-4d & -4a-4d \end{bmatrix}$ M1

$-2c = 0 \Rightarrow c = 0$ $\quad -4d = -4$ $\quad -2a - 4b = -10$

$-2a = 2 \Rightarrow a = 1$ $\quad d = 1$ $\quad -2 - 4b = 10$

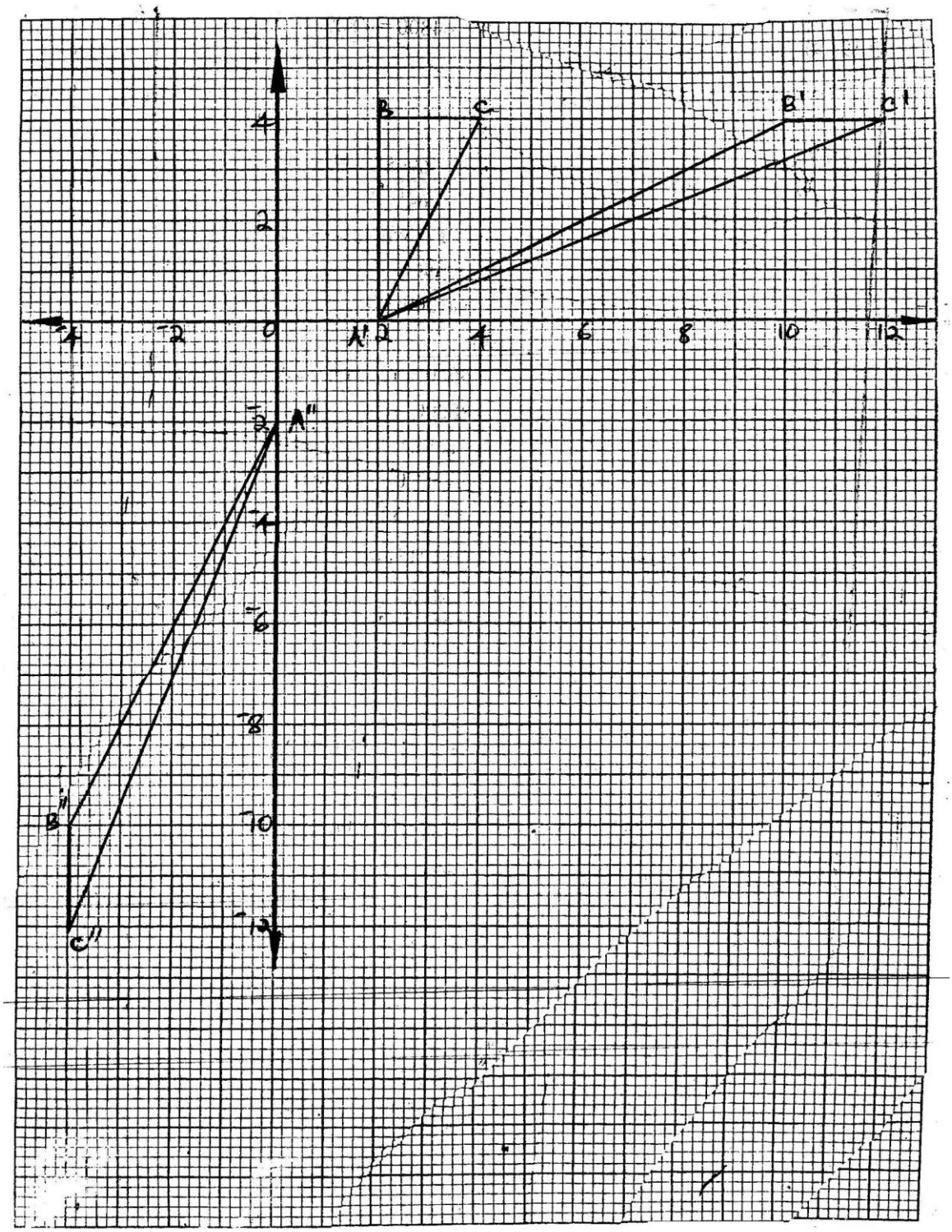
$b = 2$ M1

Hence $R = \begin{bmatrix} a & b \\ C & d \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$

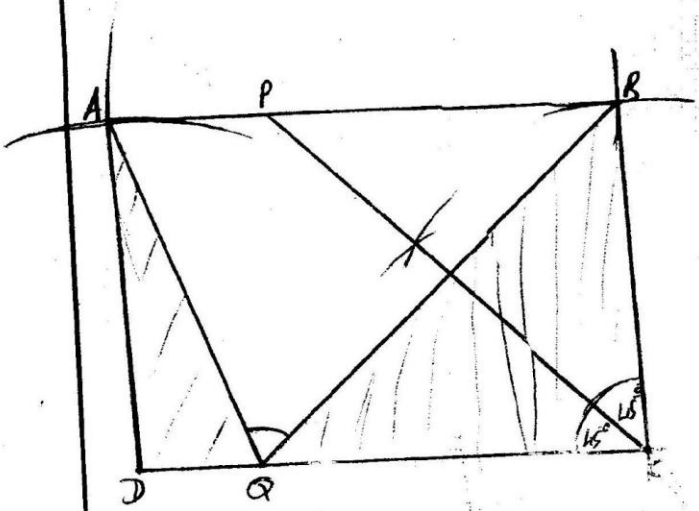
b) $\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & 2 & 4 \\ 0 & 4 & 4 \end{bmatrix} = \begin{bmatrix} 2+0 & 2+8 & 4+8 \\ 0+0 & 0+4 & 0+4 \end{bmatrix} = \begin{array}{c} \begin{array}{ccc} A^1 & B^1 & C^1 \end{array} \\ \begin{bmatrix} 2 & 10 & 12 \\ 0 & 4 & 4 \end{bmatrix} \end{array}$

c) Shear x-axis invariant and B(2,4) —— B'(10,4) or M1

C(4,4) —— C'(12,4) A1

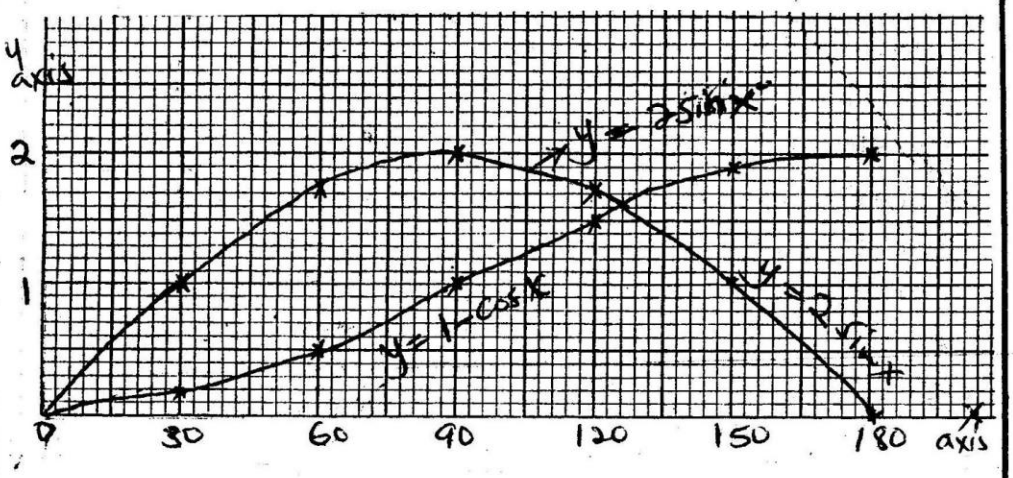

B
C
B'
C'
A'
A''
B''
C''
4
2
0
-2
-4
-6
-8
-10
-12
-4
-2
2
4
6
8
10
12

Q 19 a)	c.d = 64800 – 60000 = 69600 – 64800 = 4800	M1
	a = 60000	B1
	n^{th} term = a + (- 1)d	
	= 60000 + (n – 1) 4800	
b)	Common ratio = $\frac{64800}{60000} = \frac{69984}{64800} = 1.08$	M1
	nth term = ar^{n-1} where a = 60000	A1
	r = 108	
	= $60000(1.08)^{n-1}$	
	7th term:	
	Abdi = 60000 + (7 – 1) 4800	M1
	= 88800	
	Amoit = ar^{n-1}	
	= 60000 $(1.08)^6$	M1
	= 95213	B1
	Difference = 95213 - 88800	
	= sh 641	
20.		
	P lies on any point long cp	Rect 3 mks A1
	$AQB \leq 60^0 \leq 90^0$	
	b Q lies on the unshaded region	drawing M2 A1



21.

x^0	0	30	60	90	120	150	180
$2 \sin x^0$	0	1	1.732	2	1.732	1	0
$1 - \cos x^0$	0	0.134	0.5	1	1.5	1.866	2



c i) 129^0

ii) $0 \leqslant x \leqslant 129^0$

22.

a) $x^2 = y^2 + z^2 - 2xy \cos x$

$= 40000 + 40000 - 2 \times 40000 \cos 50$

$= 80000 - 51424$

$x^2 = 28576$

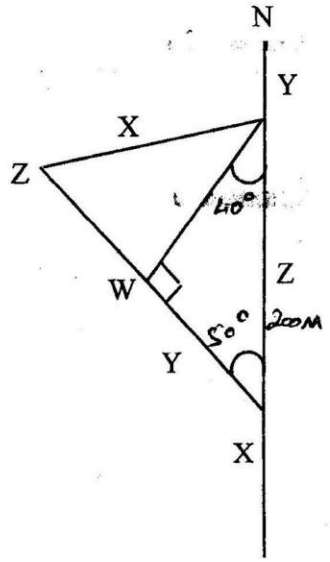
$x = 169.04$

$zy = x = 169.04$

sin rule $\dfrac{y}{\sin y} = \dfrac{x}{\sin x}$

$\dfrac{200}{\sin y} = \dfrac{169}{\sin 50}$

$\sin y = \dfrac{200 \sin 50}{169}$



M1

$\sin y = 0.90656$

$y = 65^0$

bearing z from y = $(180 + 65)^0$

$= 245^0$

A1

b) wy = 200 — M1

sin 50 sin 90

$wy = \frac{\sin 50 \times 200}{\sin 90}$

= 0.90656 x 200

wy = 181/m — A1

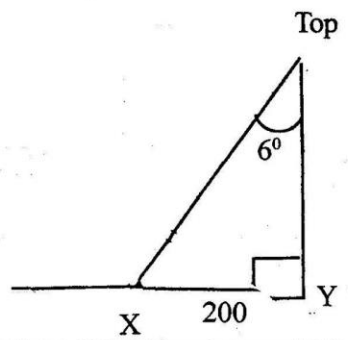
c) TYX = ⊾ (right angled triangle) — B1

XTY = 6^0 (given) — M1

therefore XYT = (90 – 6)

= 84^0 — A1

Angle of elevation of the top = 84^0



23. $PH^2 = \sqrt{4.5^2 + 8^2}$

$= \sqrt{20.25 + 64}$ — A1

= 9.2

fc $= \sqrt{FH^2 + hc^2}$

$= \sqrt{9.2^2 + 6^2}$

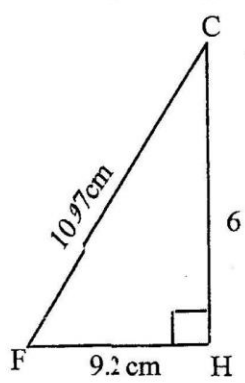
= 10.97cm — A1

b) — A1

i) tan θ = 6/9.2

tan θ = 0.6522

θ = 33^0



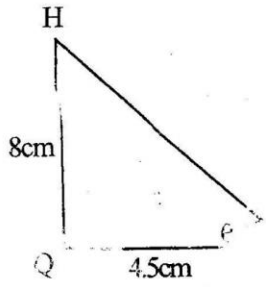
ii) — B

tan θ = 8/4.5

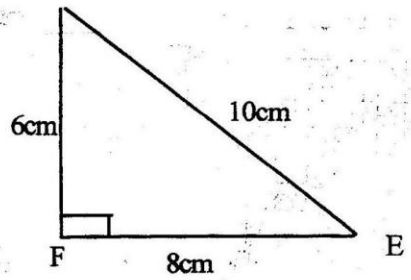
A1

tan θ 1.7750

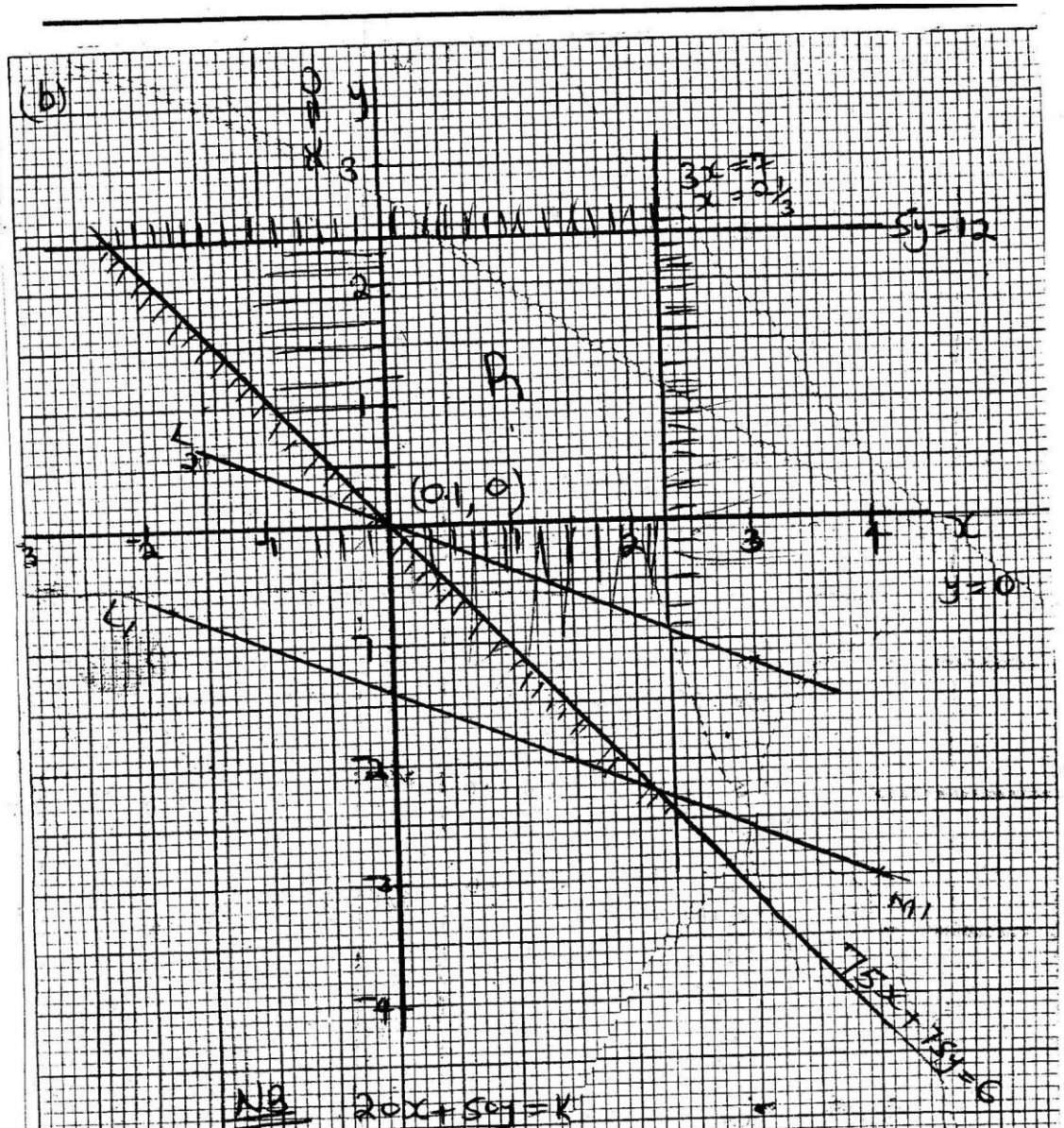
θ = 60.60°



A1

c)  Cosine rule $6^2 = 10^2 + 8^2 - 2 \times 8 \times 10 \cos \theta$ $36 = 100 + 64 - 160 \cos \theta$ $36 = 164 - 160 \cos \theta$ $\cos \theta = {}^{128}/_{16}$ $\theta = 0.8$ $= 36^0.9^1$	M1 A1	$\tan è = {}^{6}/_{8}$ $= 0.75$ $= 36^0.9^1$
24 a) i) $= 75x + 75y \geqslant 6$ $= 25x + 25y \geqslant 2$ ii) $75x \leqslant 175$ $3x \leqslant 7$ iii) $75y \leqslant 180$ $5y \leqslant 12$ iv) $y > o$ v) $x > 0$ b) See diagram next page c) i) lowest cost $= 20x + 50y$ at (0.1, 0) $c = 20 \times 0.1 + 50 \times 0$ $c = 2/=$ ii) Max cost $= 20 \times 2.3 \quad 50 \times 2.4$ $c = 46 + 120$ $c = 166/=$	M1 M1 M1 4 mks A1	Line 1 = **M1** Line 1 = **M1**

(b)



NB $20x + 50y = K$

$K = -70$

Take point $(-1, -1)$

when $x = 4$

$20x + 50y = -70$

$y = -3$

draw line L_1

Draw a parallel to L_1