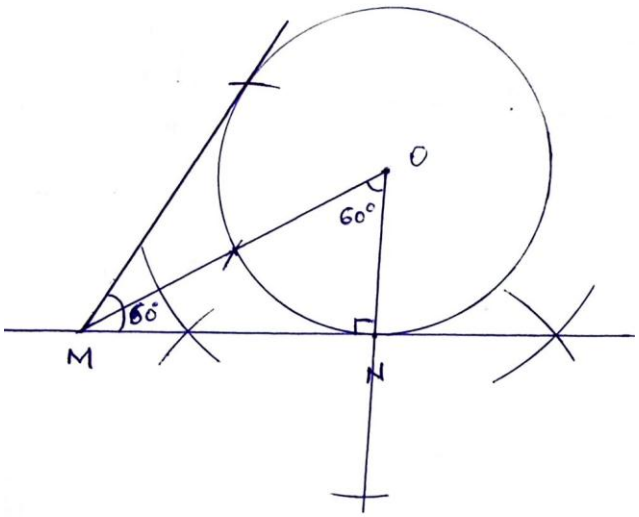
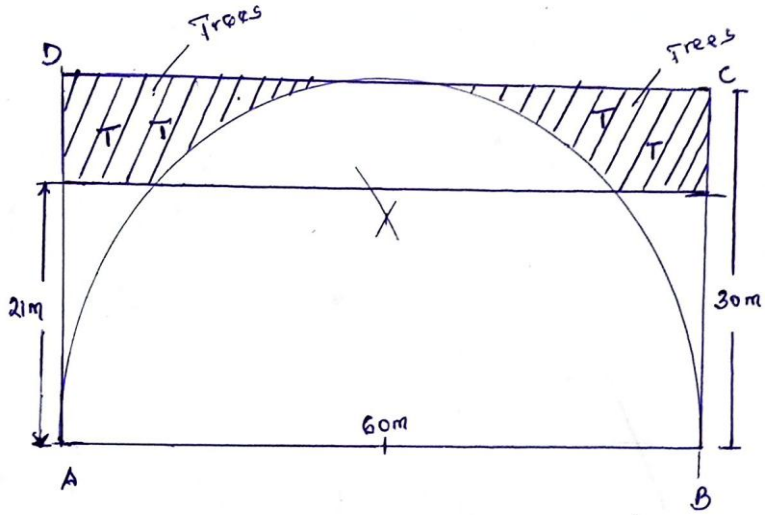
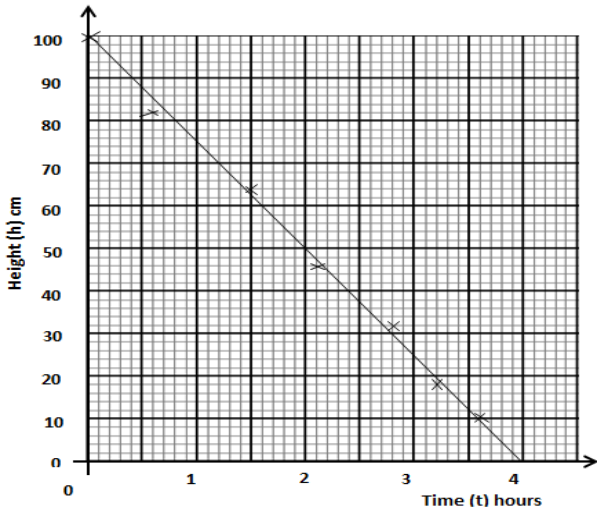
Marking scheme math paper 2 2020

	Content	Marks
1	Maize : Millet 60 : 90 85 $maize : millet = \Delta millet : \Delta maize$ $(90-85):(85-60)$ $=1:5$ $maize = \frac{1}{6}X\ 100\%$ $= 16\frac{2}{3}\ \%$	
2	a, ar, ar^2 $a + ar = 20 \ldots\ldots i$ $ar + ar^2 = 30 \ldots ii$ $\frac{ar(1+r)}{a(1+r)} = \frac{30}{20}$ $r = 1.5$	
3	$\frac{1}{\sin 75} = \frac{4}{(\sqrt{6}+\sqrt{2})} \cdot \frac{(\sqrt{6}+\sqrt{2})}{\sqrt{6}-\sqrt{2}}$ $\frac{4\sqrt{6}-4\sqrt{2}}{4}$ $= \sqrt{6}-\sqrt{2}$	
4	a. $1-5\left(\frac{3x}{10}\right)+10\left(\frac{3x}{10}\right)^2-10\left(\frac{3x}{10}\right)^3+5\left(\frac{3x}{10}\right)^4-\left(\frac{3x}{10}\right)^5$ $1-1.5x+0.9x^2-0.27x^3+0.0405x^4-0.00243x^5$ b. $0.97^5 = \left(1-\frac{3}{10}x\right)^5$ $x = 0.1$ $1-1.5x+0.9x^2\ but\ x=0.1$ $1-1.5(0.1)+0.9(0.1)^2$ =0.859	
5	$\measuredangle EOF =$ $EO = OF = \sqrt{5^2+8.5^2}$ $= 9.8615$ $a^2 = b^2+c^2-2bc\ cos\ A$ $15^2 = 9.8615^2+9.8615^2-2x9.8615^2\cos A$ $\cos A = -0.156822$ $A = 99.02$	
6	$y = cx^n$ $c = \frac{320}{16^n} = \frac{256}{64^n}$ $\frac{2^{4n}}{2^{6n}} = \frac{32}{256}$ $2^{-2n} = 2^{-3}$ $n = 1.5$	

7	Construction  	
8	$0.5\log_2 9 + \log_2(5x-4) = 7$ $\log_2 3 + \log_2(5x-4) = 7\log_2 2$ $\log_2 3(5x-4) = \log_2 2^7$ $15x = 140$ $x = 9\frac{1}{3}$	
9	Construction  	

10	$\begin{pmatrix}1 & 1\\ -1 & 2\end{pmatrix}\begin{pmatrix}1 & -1\\ 2 & 3\end{pmatrix}=\begin{pmatrix}3 & 2\\ 3 & 7\end{pmatrix}$ $inverse = \frac{1}{15}\begin{pmatrix}7 & -2\\ -3 & 3\end{pmatrix}$ $= \begin{pmatrix}\frac{7}{15} & \frac{2}{15}\\ -\frac{1}{5} & \frac{1}{5}\end{pmatrix}$	
11	a)  b) Slope=$\frac{(50-0)cm}{(2-4)hr}$ $=-25cm/hr$	
12	$0 = \frac{\sum fd}{f}$ $\frac{-3+d}{6} = 0$ $d = 3$ Var =$\frac{\sum fd^2}{\sum f}$ $= \frac{16+25+9+4+1+d^2}{6}$ $= \frac{55+d^2}{6}$ $= \frac{(55+3^2)}{6}$ $= 10\frac{2}{3}$	
13	$P = cash\ price - deposit$ $27500 - 17250 = 10250$ $A = PR^n = instalments$ $10250R^6 = 6x2100$ $R^6 = \frac{12600}{10250}$ $R = 1.035006\ but\ R = 1 + r$ $r = 3.500\%\ pm$	

14	$sin^2\theta - cos^2\theta = -\frac{1}{2}$ but $sin^2\theta + cos^2\theta = 1$ $1 - 2cos^2\theta = -0.5$ $2cos^2\theta = 1.5$ $cos\theta = \pm 0.8666$ $\theta = 30 \ \& \ 330 \ or \ 150 \ \& \ 210$	
15	$\overline{PQ} = \begin{pmatrix} -1 \\ 1 \\ -3 \end{pmatrix} + \begin{pmatrix} 3 \\ 3 \\ 1 \end{pmatrix}$ $= \begin{pmatrix} 2 \\ 4 \\ -2 \end{pmatrix}$ $\overline{QR} = \begin{pmatrix} -3 \\ -3 \\ -1 \end{pmatrix} + \begin{pmatrix} 6 \\ 9 \\ -2 \end{pmatrix}$ $= \begin{pmatrix} 3 \\ 6 \\ -3 \end{pmatrix}$ $\overline{PQ} = k\,\overline{QR}$ $\begin{pmatrix} 2 \\ 4 \\ -2 \end{pmatrix} = k \begin{pmatrix} 3 \\ 6 \\ -3 \end{pmatrix}$ $k = \frac{2}{3}$ $\overline{PQ} = \frac{2}{3}\overline{QR}$ PQ is // to QR hence P, Q and R are collinear	
16	$v = t^2 - 4t + 6$ $s = \int t^2 - 4t + 6 \ dt$ $= \int_0^4 t^2 - 4t + 6 \ dt$ $= \left[\frac{t^3}{3} - 2t^2 + 6t\right]_0^4$ $= (\frac{4^3}{3} - 2(4)^2 + 6(4)) - (0)$ =13.333 m	

17	a. In 1 hr P=$\frac{1}{5}$ $Q = \frac{3}{10}$ $\therefore P \& Q \; in \; 1\; hr \rightarrow \frac{1}{2}$ $? \rightarrow 1$ $= 2\; hours$ b. $if \;\; 1\; hr \rightarrow \frac{1}{2}$ $40\; min \rightarrow ?$ $\frac{40}{60} x \frac{1}{2} = \frac{1}{3} of \; land$ $remaining \rightarrow \frac{2}{3} \; of \; land$ $1\; hr\; Q \rightarrow \frac{3}{10}$ $? \leftarrow \frac{2}{3}$ $\frac{2x10}{3x3} x \; 1hr$ $=2\frac{2}{9} hrs$ $total\; time = 2\frac{2}{9} hrs + 40\; min$ $= 2hrs\; 53 \min 20sec$ $\approx 2\; hrs\; 53 \min or\; 2.889\; hrs$ c. $1\; hr\; PQR = \frac{5}{6} \; of \; land$ $1\; hr\; PQ = \frac{1}{2} \; of \; land$ $\therefore 1\; hr\; R = \frac{5}{6} - \frac{1}{2} = \frac{1}{3} of \; land$ $1\; hr\; R = \frac{1}{3} of \; land$ $1hr\; 12\; min = ?$ $= \frac{1\; hr\; 12 min}{1\; hr} \; x \; \frac{1}{3}$ $= \frac{2}{5} \; of \; land$ $amount\; paid = \frac{2}{5} x \; 20000$ $= sh\; 8000$	

18	a. I) $ti = Bs + allowances$ $= 40000 + 11090 + 7000$ $= sh\ 58090\ pm$ $1st\ slab\ 11189x\ 10\% = sh\ 1118$ II) $2nd\ slab\ 10534x15\% = sh\ 1580.1$ $3rd\ slab\ 10534x20\% = sh\ 2106.8$ $4th\ slab\ 10534x25\% = sh\ 2633.5$ Bal =58090-42782=15308 $5th\ slab\ 15308x\ 30\% = sh\ 4592.4 +$ $gross\ tax = sh\ 12\ 030.80$ b. $relief = gross\ tax - net\ tax$ $= 12030.80 - 10750.80$ $= 1280$ c) i) 11180x150%x 10%=16770x10%=1677 $1 - 16770 \quad 10\%$ ii) $16771 - 27304 \quad 15\%$ $27305 - 37838 \quad 20\%$ $37839 - 48372 \quad 25\%$ $over 48372 \quad 30\%$ $(58090 - 48372)x30\% = sh2915.40$	
19	a) i) 1 pen =$\frac{180}{2x-1}$ ii) 1 pencil =$\frac{200}{3x+1}$ b) $\frac{180}{2x-1} - \frac{200}{3x+1} = 4$ $6x^2 - 36\,x - 96 = 0$ $x^2 - 6x - 16 = 0$ $(x+2)(x-8) = 0$ $x = -2\ or\ x = 8$ c) Pen = $\frac{180}{2x-1}\ but\ x = 8$ $\frac{180}{2\,x\,8-1} = sh\ 12$ $new\ pen\ price = 1.25x12 = sh\ 15$ $pencil = sh\ 8$ Let no of pens be m and pencils be n $n + m \quad = 46$ $15n - 8m \quad = 0$ $\begin{pmatrix} 1 & 1 \\ 15 & -8 \end{pmatrix}\begin{pmatrix} n \\ m \end{pmatrix} = \begin{pmatrix} 46 \\ 0 \end{pmatrix}$ solving using Cramer's rule $\Delta = -23$ $n = \frac{\begin{vmatrix} 46 & 1 \\ 0 & -8 \end{vmatrix}}{-23}$	

$n = -\frac{46\,x - 8}{-23} = 16\ pens$

$m = \frac{\begin{vmatrix} 1 & 46 \\ 15 & 0 \end{vmatrix}}{-23}$

$m = -\frac{46x15}{-23}$

$m = 30\ pencils$

20 a) (i) $\theta = 75 + 15 = 90$

$\frac{90}{360} x 2x \frac{22}{7}\ x6370 \cos\alpha = 5005$

$\cos\alpha = 0.500$

$\alpha = 60$

$B(60\ N, 75W)$

ii) $speed\ x\ time = \frac{\theta}{360} x2\pi R$

$910\ x\ 3hr40min = \frac{\theta}{360} 2\ x \frac{22}{7} x6370$

$\theta = 30$

$new\ latitude = 60N - 30 = 30\ N$

$C(30\ N, 75\ W)$

b) local time C when departing from A(07 20hr)

$1^0 = 4\ min$

$90^0 = ?$

$\frac{90}{1} x4\ \text{min} = 6\ hrs$

$time\ in\ c\ when\ departing\ from\ A$

$= 07\ 20\ hrs - 6\ hrs$

$= 01\ 20\ hrs$

$arrival\ time = departure\ time + travelling\ time$

$= 01\ 20hrs + 33min + 1\frac{1}{2} hrs + 3hr\ 40min$

$= 07\ 03\ hrs\ or\ 7.03\ am$

21 a. $Y < 2X \ldots i$

$X \leq 6 \ldots ii$

$8X + 15Y \geq 240 \ldots iii$

But Y=2y and X=3x

$y < 3x \ldots i$

$x \leq 2 \ldots ii$

$4x + 5y \geq 40 \ldots iii$

$x > 0\ \&\ y > 0$

b.

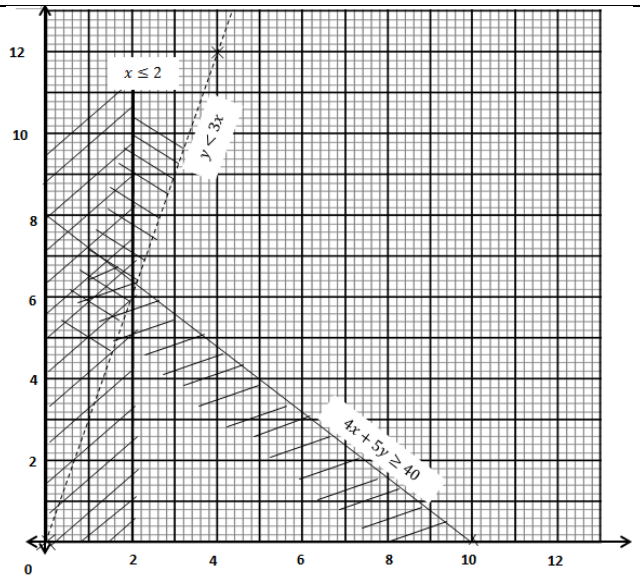
$y \leq 3x \ldots i$

x	0	4
y	0	12

$4x + 5y \geq 40 \ldots iii$

x	0	10
y	8	0

Graph



c. $c = 5000x + 12\,500y$

$$(9,2), (6,4), (3,6)$$

$$5000\ x\ 9 + 12500\ x2 \quad = 70000$$

$$c = \ 5000x\ 6 + 12500x4 \quad = 80000$$

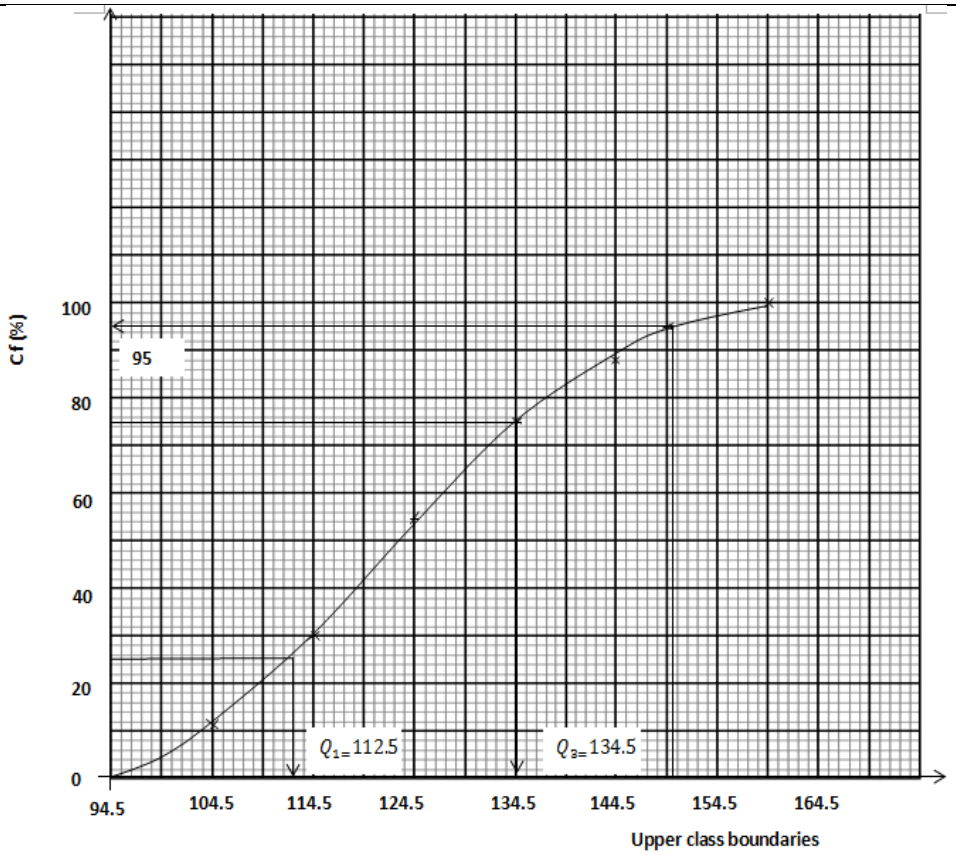
$$5000x3 + 12500x6 \quad = 90000$$

$$\therefore no\ of type\ A\ lorries = 9\ \&\ type\ B = 2$$

22 a.

class	f	cf	Cf%
95-104	7	7	11.67
105-114	11	18	30.00
115-124	15	33	55.00
125-134	12	45	75.00
135-144	8	53	88.33
145-154	4	57	95.00
155-164	3	60	100.00

Graph



b. $Q_1 = 112.5$ & $Q_3 = 134.5$

Interquartile range $= Q_3 - Q_1$

$= 134.5 - 112.5$

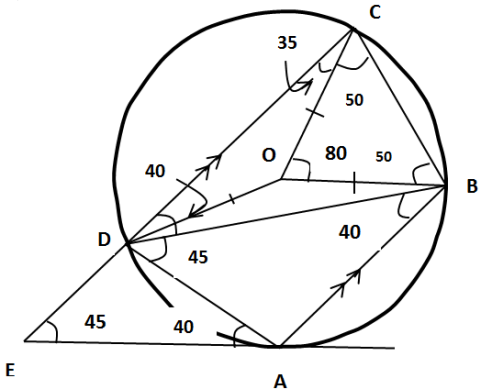
$= 22$

c) more than 150→ $100\% - 95\% = 5\%$

$\therefore no. = 5\%\ x60$

$= 3$

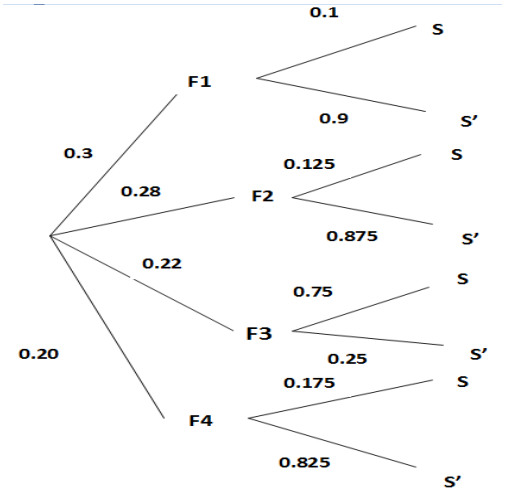
23 a)



i. $\measuredangle ADB = 45$

ii. $\measuredangle OCD = 35$

b) 8.4 x 3.5=AE^2

	AE=± 5.422 $\therefore AE = 5.422 \approx 5.4$ $r = \frac{2.45}{cos35}$ $= 2.991$ $\approx 3.0\ cm$	
24	 a) P(F4)=$\frac{40}{200} = 0.2$ b) P(s)=$p(F1\ s\ or\ F2\ s\ or\ F3\ s\ or\ F4\ S)$ $= 0.3x0.1 + 0.28x0.125 + 0.22x0.75 + 0.4x0.175$ $= 0.265$ b) i) $P(F1\ \&F4) = 2(0.3x0.2)$ $= \frac{3}{25}\ or\ 0.12$ ii) $P(F1s\ \&F4s\ or\ F4s\&F1s)$ $= 2(0.3x0.1\ x0.2x0.175)$ $= 0.13$	