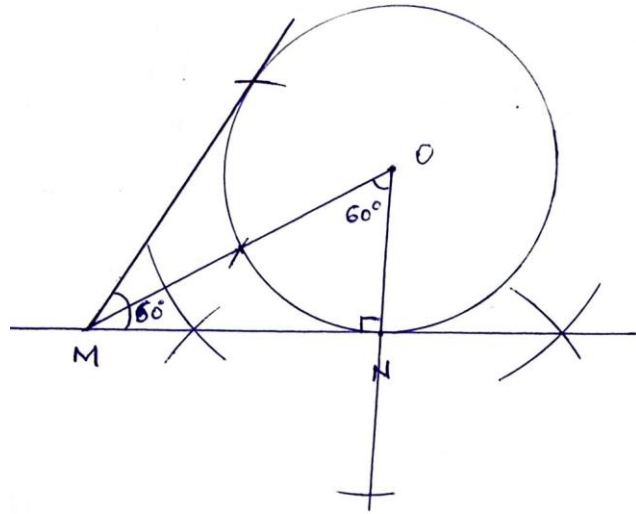


Marking scheme math paper 2 2020

	Content	Marks
1	<p>Maize : Millet 60 : 90 85 $maize : millet = \Delta millet : \Delta maize$ $(90 - 85) : (85 - 60)$ $= 1 : 5$ $maize = \frac{1}{6} \times 100\%$ $= 16\frac{2}{3} \%$</p>	
2	<p>a, ar, ar^2 $a + ar = 20 \dots i$ $ar + ar^2 = 30 \dots ii$ $\frac{ar(1+r)}{a(1+r)} = \frac{30}{20}$ $r = 1.5$</p>	
3	<p>$\frac{1}{\sin 75} = \frac{4}{(\sqrt{6} + \sqrt{2})} \cdot \frac{(\sqrt{6} + \sqrt{2})}{\sqrt{6} - \sqrt{2}}$ $\frac{4\sqrt{6} - 4\sqrt{2}}{4}$ $= \sqrt{6} - \sqrt{2}$</p>	
4	<p>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 $x = 0.1$ $1 - 1.5(0.1) + 0.9(0.1)^2$ $= 0.859$</p>	
5	<p>$\sphericalangle EOF =$ $EO = OF = \sqrt{5^2 + 8.5^2}$ $= 9.8615$ $a^2 = b^2 + c^2 - 2bc \cos A$ $15^2 = 9.8615^2 + 9.8615^2 - 2 \times 9.8615^2 \cos A$ $\cos A = -0.156822$ $A = 99.02$</p>	
6	<p>$y = cx^n$ $c = \frac{320}{16^n} = \frac{256}{64^n}$ $\frac{2^{4n}}{2^{6n}} = \frac{32}{256}$ $2^{-2n} = 2^{-3}$ $n = 1.5$</p>	

7

Construction

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8

$$0.5 \log_2 9 + \log_2(5x - 4) = 7$$

$$\log_2 3 + \log_2(5x - 4) = 7 \log_2 2$$

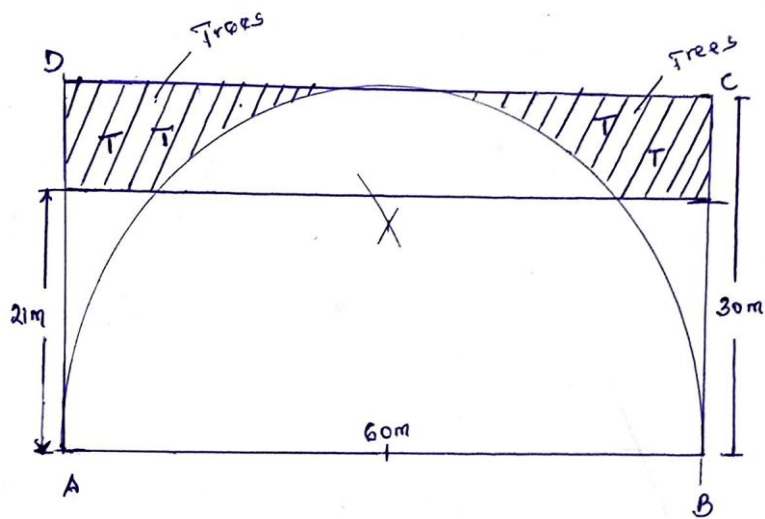
$$\log_2 3(5x - 4) = \log_2 2^7$$

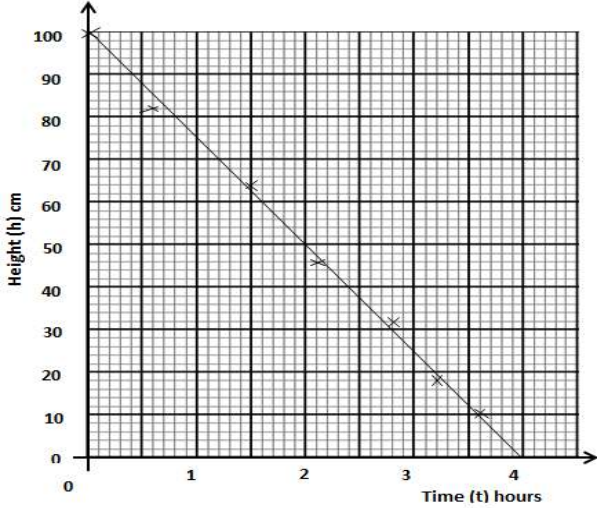
$$15x = 140$$

$$x = 9 \frac{1}{3}$$

9

Construction



10	<p style="text-align: center;">PDF Compressor Free Version</p> $\begin{pmatrix} 1 & 1 \\ -1 & 2 \end{pmatrix} \begin{pmatrix} 1 & -1 \\ 2 & 3 \end{pmatrix} \begin{pmatrix} 3 & 2 \\ 3 & 7 \end{pmatrix}$ $\text{inverse} = \frac{1}{15} \begin{pmatrix} 7 & -2 \\ -3 & 3 \end{pmatrix}$ $= \begin{pmatrix} \frac{7}{15} & \frac{2}{15} \\ \frac{1}{5} & \frac{1}{5} \end{pmatrix}$	
11	<p>a)</p>  <p>b) Slope = $\frac{(50-0)\text{cm}}{(2-4)\text{hr}}$ $= -25\text{cm/hr}$</p>	
12	$0 = \frac{\sum fd}{f}$ $\frac{-3 + d}{6} = 0$ $d = 3$ $\text{Var} = \frac{\sum fd^2}{\sum f}$ $= \frac{16+25+9+4+1+d^2}{6}$ $= \frac{55+d^2}{6}$ $= \frac{(55+3^2)}{6}$ $= 10\frac{2}{3}$	
13	<p>$P = \text{cash price} - \text{deposit}$ $27500 - 17250 = 10250$ $A = PR^n = \text{instalments}$ $10250R^6 = 6 \times 2100$ $R^6 = \frac{12600}{10250}$ $R = 1.035006$ but $R = 1 + r$ $r = 3.500\% \text{ pm}$</p>	

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

17

a. PDF Compressor Free Version

$$Q = \frac{3}{10}$$

$$\therefore P \& Q \text{ in } 1 \text{ hr} \rightarrow \frac{1}{2}$$

$$? \rightarrow 1$$

$$= 2 \text{ hours}$$

$$\text{b. if } 1 \text{ hr} \rightarrow \frac{1}{2}$$

$$40 \text{ min} \rightarrow ?$$

$$\frac{40}{60} \times \frac{1}{2} = \frac{1}{3} \text{ of land}$$

$$\text{remaining} \rightarrow \frac{2}{3} \text{ of land}$$

$$1 \text{ hr } Q \rightarrow \frac{3}{10}$$

$$? \leftarrow \frac{2}{3}$$

$$\frac{2 \times 10}{3 \times 3} \times 1 \text{ hr}$$

$$= 2 \frac{2}{9} \text{ hrs}$$

$$\text{total time} = 2 \frac{2}{9} \text{ hrs} + 40 \text{ min}$$

$$= 2 \text{ hrs } 53 \text{ min } 20 \text{ sec}$$

$$\approx 2 \text{ hrs } 53 \text{ min or } 2.889 \text{ hrs}$$

$$\text{c. } 1 \text{ hr } PQR = \frac{5}{6} \text{ of land}$$

$$1 \text{ hr } PQ = \frac{1}{2} \text{ of land}$$

$$\therefore 1 \text{ hr } R = \frac{5}{6} - \frac{1}{2} = \frac{1}{3} \text{ of land}$$

$$1 \text{ hr } R = \frac{1}{3} \text{ of land}$$

$$1 \text{ hr } 12 \text{ min} = ?$$

$$= \frac{1 \text{ hr } 12 \text{ min}}{1 \text{ hr}} \times \frac{1}{3}$$

$$= \frac{2}{5} \text{ of land}$$

$$\text{amount paid} = \frac{2}{5} \times 20000$$

$$= \text{sh } 8000$$

18	<p>a. $\text{Yti} = \text{Bs} + \text{allowances}$ $= 40000 + 11090 + 7000$</p> <p>$= \text{sh } 58090 \text{ pm}$</p> <p>1st slab $11189 \times 10\% = \text{sh } 1118$ ii) 2nd slab $10534 \times 15\% = \text{sh } 1580.1$ 3rd slab $10534 \times 20\% = \text{sh } 2106.8$</p> <p>4th slab $10534 \times 25\% = \text{sh } 2633.5$ Bal $= 58090 - 42782 = 15308$ 5th slab $15308 \times 30\% = \text{sh } 4592.4 +$ gross tax $= \text{sh } 12\,030.80$</p> <p>b. relief $= \text{gross tax} - \text{net tax}$ $= 12030.80 - 10750.80$ $= 1280$</p> <p>c) i) $11180 \times 150\% \times 10\% = 16770 \times 10\% = 1677$</p> <p>1 - 16770 10% ii) 16771 - 27304 15% 27305 - 37838 20% 37839 - 48372 25% over 48372 30% $(58090 - 48372) \times 30\% = \text{sh } 2915.40$</p>	
19	<p>a) i) $1 \text{ pen} = \frac{180}{2x-1}$ ii) $1 \text{ pencil} = \frac{200}{3x+1}$</p> <p>b) $\frac{180}{2x-1} - \frac{200}{3x+1} = 4$ $6x^2 - 36x - 96 = 0$ $x^2 - 6x - 16 = 0$ $(x+2)(x-8) = 0$ $x = -2 \text{ or } x = 8$</p> <p>c) Pen $= \frac{180}{2x-1}$ but $x = 8$</p> <p>$\frac{180}{2 \times 8 - 1} = \text{sh } 12$ new pen price $= 1.25 \times 12 = \text{sh } 15$ pencil $= \text{sh } 8$</p> <p>Let no of pens be m and pencils be n $n + m = 46$ $15n - 8m = 0$ $\begin{pmatrix} 1 & 1 \\ 15 & -8 \end{pmatrix} \begin{pmatrix} n \\ m \end{pmatrix} = \begin{pmatrix} 46 \\ 0 \end{pmatrix}$ solving using Cramer's rule $\Delta = -23$ $n = \frac{\begin{vmatrix} 46 & 1 \\ 0 & -8 \end{vmatrix}}{-23}$</p>	

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$$n = \frac{46x - 8}{-23} = 10 \text{ pens}$$

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

$$m = -\frac{46 \times 15}{-23}$$

$$m = 30 \text{ pencils}$$

20

a) (i) $\theta = 75 + 15 = 90$
 $\frac{90}{360} \times 2 \times \frac{22}{7} \times 6370 \cos \alpha = 5005$
 $\cos \alpha = 0.500$
 $\alpha = 60$
B(60 N, 75W)

ii) $\text{speed} \times \text{time} = \frac{\theta}{360} \times 2\pi R$
 $910 \times 3\text{hr}40\text{min} = \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 6370$
 $\theta = 30$
new latitude = 60N – 30 = 30 N
C(30 N, 75 W)

b) local time C when departing from A(07 20hr)
 $1^\circ = 4 \text{ min}$
 $90^\circ = ?$
 $\frac{90}{1} \times 4 \text{ min} = 6 \text{ hrs}$
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. $Y < 2X \dots i$
 $X \leq 6 \dots ii$
 $8X + 15Y \geq 240 \dots iii$
But $Y=2y$ and $X=3x$

$y < 3x \dots i$
 $x \leq 2 \dots ii$
 $4x + 5y \geq 40 \dots iii$
 $x > 0 \ \& \ y > 0$

b.

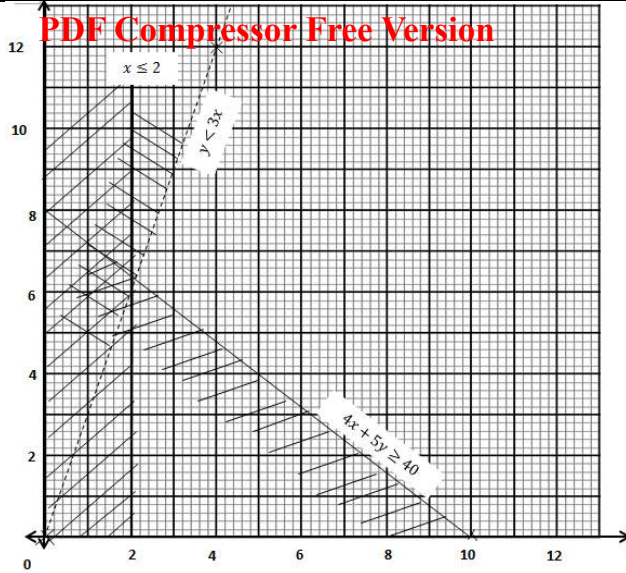
$y \leq 3x \dots i$

x	0	4
y	0	12

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

x	0	10
y	8	0

Graph



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

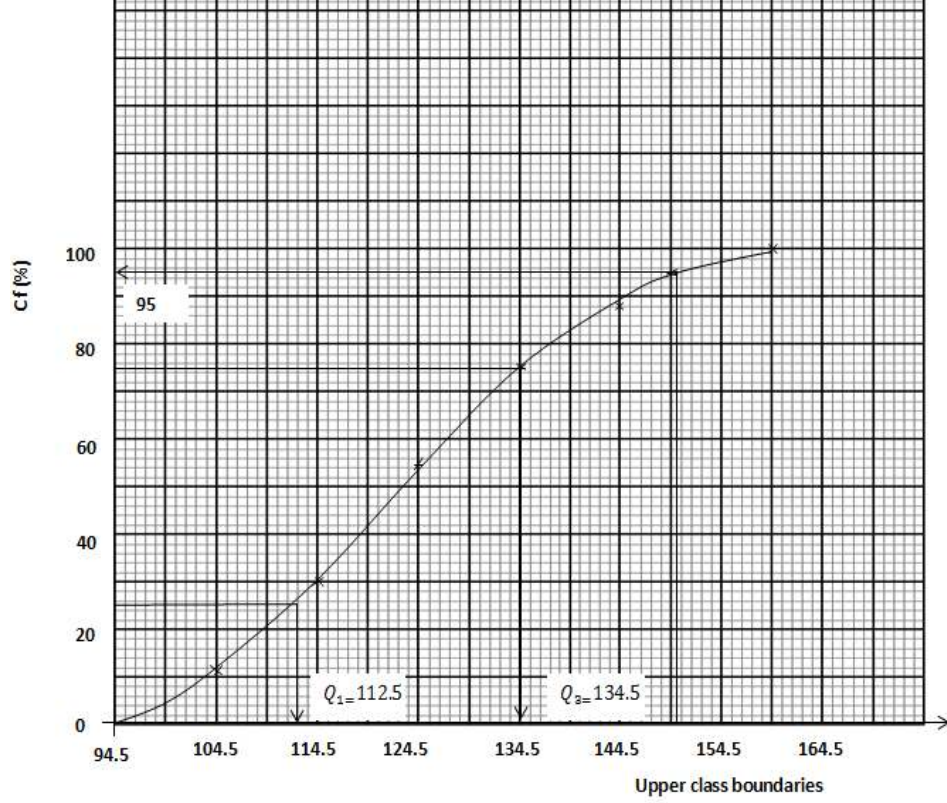
$(9, 2), (6, 4), (3, 6)$
 $5000x + 12500y = 70000$
 $c = 5000x + 12500y = 80000$
 $5000x + 12500y = 90000$
 \therefore no of type A lorries = 9 & type B = 2

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

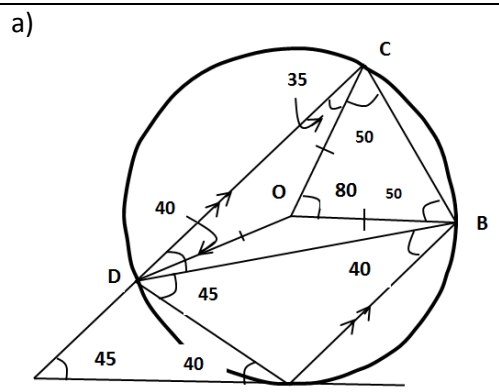
Graph



b. $Q_1 = 112.5$ & $Q_3 = 134.5$
 Interquartile range $= Q_3 - Q_1$
 $= 134.5 - 112.5$
 $= 22$

c) more than 150 $\rightarrow 100\% - 95\% = 5\%$
 $\therefore no. = 5\% \times 60$
 $= 3$

23



i. $\angle ADB = 45$
 ii. $\angle OCD = 35$

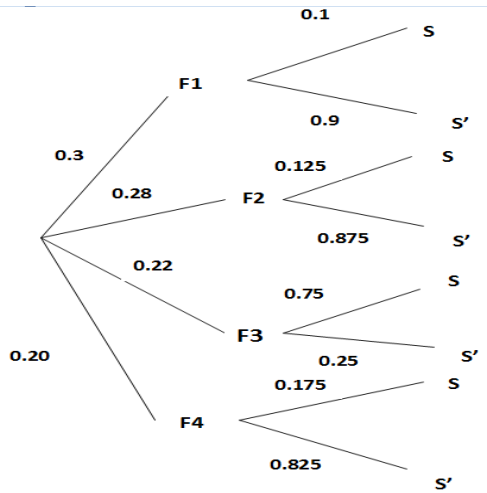
b) $8.4 \times 3.5 = AE^2$

AE = 5.422
PDF Compressor Free Version

$\therefore AE = 5.422 \approx 5.4$

$r = \frac{2.45}{\cos 35}$
 $= 2.991$
 $\approx 3.0 \text{ cm}$

24



a) $P(F4) = \frac{40}{200} = 0.2$

b) $P(s) = p(F1 \text{ s or } F2 \text{ s or } F3 \text{ s or } F4 \text{ S})$
 $= 0.3 \times 0.1 + 0.28 \times 0.125 + 0.22 \times 0.75 + 0.4 \times 0.175$
 $= 0.265$

b) i) $P(F1 \& F4) = 2(0.3 \times 0.2)$
 $= \frac{3}{25} \text{ or } 0.12$

ii) $P(F1s \& F4s \text{ or } F4s \& F1s)$
 $= 2(0.3 \times 0.1 \times 0.2 \times 0.175)$
 $= 0.13$