1. $\frac{1}{0.325} = \frac{1}{3.25} \times \frac{1}{10^{-1}}$ — M1

$\frac{1}{0.325} = 0.3077 \times 10 = 3.077$

$\sqrt[3]{\frac{0.000125}{0.325}} = \sqrt[3]{0.000125} \times 3.077$

$\sqrt[3]{0.000125} = \sqrt[3]{125 \times 10^{-6}} = \sqrt[3]{10^{-6} \times 5}$ — M1

$5 \times 10^{-2} = 0.05$

Hence 0.05×3.077 — A1

$= 0.15385$

3.

2. Let the amount of money shared be x

Elder boy $\Rightarrow \frac{4}{9}x$

Younger boy $\Rightarrow \frac{2}{5} \times \frac{5}{9}x = \frac{2}{9}x$ — M1

Girl $\Rightarrow x - \left(\frac{4}{9}x + \frac{2}{9}x\right) = \frac{1}{3}x$

$\frac{2}{9}x \div \frac{1}{3} \times 100$ — M2

$= 66\frac{2}{3}\%$ — A1

03.

3. Let Sh 20 coins be x

Then Sh 50 notes will be 3x

$20x + 3x(50) = 3400$ — M1

$170x = 3400$

$x = \frac{3400}{170} = 20.$ — A1

Sh 50 notes $= 3(20) = 60$
Sh 20 coins $= 20$

B1 / 3

4 Area of the rhombus $= 9^2 \sin 60^\circ = 70.1481$ M1

Area of sector $= \frac{60}{360} \times \frac{22}{7} \times 9^2 = 42.4286$ M1

Shaded area $= 70.1481 - 42.4286$ M1

Shaded Area $= 27.7195$

$\simeq 27.72$ (2 d.p) A1 / 4

5. $2x^2 + 3x = 5$

$x^2 + \frac{3}{2}x + \left(\frac{3}{4}\right)^2 = \frac{5}{2} + \left(\frac{3}{4}\right)^2$ M1

$\left(x + \frac{3}{4}\right)^2 = \frac{49}{16}$

$x + \frac{3}{4} = \pm\sqrt{\frac{49}{16}}$ M1

$x = -\frac{3}{4} \pm \frac{7}{4}$

$x = -2.5$ or $x = 1$ A1 / 03

6. $\frac{3x^2 - 4xy^2 + y}{9x^2 - y^2}$

$\frac{3xy}{} = \frac{3x^2 - 3xy - xy + y^2}{(3x - y)(3x + y)}$ M1

$= \frac{(3x - y)(x - y)}{(3x - y)(3x + y)}$ M1

$= \frac{x - y}{3x + y}$ A1 / 03

7. $8x^2 + 2x - 3 = 0$. M1

$8x^2 + 6x - 4x - 3 = 0$. A1

$(2x-1)(4x+3) = 0$.

$x = 1/2$ or $x = -3/4$ B1

$\therefore \cos y = 1/2$ or $\cos y = -3/4$

$y = 60°$ or $y = 138.6°$. B1

8. $PQ = \begin{pmatrix} 4 \\ 3 \end{pmatrix} - \begin{pmatrix} 3 \\ 4 \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$ B1

$PR = \begin{pmatrix} 1 \\ 6 \end{pmatrix} - \begin{pmatrix} 3 \\ 4 \end{pmatrix} = \begin{pmatrix} -2 \\ 2 \end{pmatrix}$ B1

$PR = -2PQ$ shows PR is parallel to PQ and they share a common point P: $\therefore$ P, Q and R are collinear B1

9. $x \leq 2x + 7 \leq -\frac{1}{3}x + 14$

$x \leq 2x + 7$ M1

$-7 \leq x$

$x \geq -7$

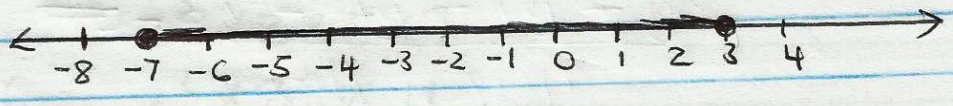
$2x + 7 \leq -\frac{1}{3}x + 14$

$6x + 21 \leq -x + 42$ M1

$7x \leq 21$

$x \leq 3$

$-7 \leq x \leq 3$



A1

10. Let the numbers be a, b, c, d, e

$\frac{a+b+c+d+e}{5} = 20$ M1

$\frac{a+b+c}{3} = 16$

10. $48+d+e=100$

$d+e=52$

$e-d=8$ M1

$2e=60$

5th number $e=30$. A1

11. $V.S.F = \frac{4752}{1408} = 3.375$ M1

$L.S.F = \sqrt[3]{3.375} = 1.5$ M1

$A.S.F = 1.5^2$

Area of Larger container

$= 352 \times 2.25$

$= 792 cm^2$ A1

12. $\frac{1}{2}\log_2 81 + \log_2\left(x^2 - \frac{x}{3}\right) = 1$

$\log_2 9 + \log_2\left(x^2 - \frac{x}{3}\right) = \log_2 2^2$ M1

$9x^2 - 3x - 2 = 0$

$(3x+1)(3x-2) = 0$ M1

$x = -\frac{1}{3}$ or $x = \frac{2}{3}$ A1

13. $840 = 2^3 \times 3 \times 5 \times 7$ M1

$396 = 2^2 \times 3^2 \times 11$

G.C.D $= 2^2 \times 3^2 = 12$ M1

Area $= 12 \times 12 = 144$. A1

14. Inverse of $\begin{bmatrix} 4 & 3 \\ 3 & 5 \end{bmatrix}$

14. Det $= 20 - 9 = 11$

Inverse $= \frac{1}{11}\begin{bmatrix} 5 & -3 \\ -3 & 4 \end{bmatrix} = \begin{bmatrix} 5/11 & -3/11 \\ -3/11 & 4/11 \end{bmatrix}$

(b) $\begin{bmatrix} 4 & 3 \\ 3 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 5 \end{bmatrix}$

$\begin{bmatrix} 5/11 & -3/11 \\ -3/11 & 4/11 \end{bmatrix}\begin{bmatrix} 4 & 3 \\ 3 & 5 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5/11 & -3/11 \\ -3/11 & 4/11 \end{bmatrix}\begin{bmatrix} 6 \\ 5 \end{bmatrix}$ M1

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 15/11 \\ 2/11 \end{bmatrix}$

$x = 15/11 \quad y = 2/11$ A1

15 a) $\angle AOB = 180^\circ - (20 + 20) = 140^\circ$ B1

(b) $\angle ACB = \frac{1}{2}$ reflex $\angle AOB$

$= \frac{1}{2}(360 - 140)$ M1

$= \frac{1}{2} \times 220$

$= 110^\circ$ A1

16. Exterior x, interior $= 120 + x$

$120 + x + x = 180$ M1

$120 + 2x = 180$

$2x = 60$ M1

$x = 30^\circ$ A1

$\frac{360}{30} = 12$ sides

17-9 $\frac{40}{100} \times 1,350,000 = 540\,000$

(b) Shared equally $= \frac{30}{100} \times 1350\,000 \times \frac{1}{3} = 135,000$

Ratio 112 : 128 : 210

Trinity Shared in the ratio

$\frac{210}{450} \times \frac{30}{100} \times 1,350,000 = 189,000$

Total Trinity's amount

$135,000 + 189,000 = 324,000$

Bela's ratio share

$\frac{112}{450} \times \frac{30}{100} \times 1,350,000 = 100800$

Total Bela's Amount

$135000 + 100800 = 235,800$

Difference $= 324000 - 235800 = 88,200$

(c) Joan's

$135000 + \frac{128}{450} \times \frac{30}{100} \times 1,350,000 = 250,200$

$\frac{250,200}{(\frac{60}{100} \times 1,350\,000)} \times 100$

$= \frac{250,200}{810\,000} \times 100$

$= 30\ 8/9\ \%$

18

x	-5	-4	-3	-2	-1	0	1
x^3	-125	-64	-27	-8	-1	0	1
$6x^2$	150	96	54	24	6	0	6
$8x$	-40	-32	-24	-16	-8	0	8
y	-15	0	3	0	-3	0	15

(b) Curve

(c) Roots of Equation

$x^3+5x^2+4x+x^2+3x+1=0$.

$x^3+6x^2+7x+1=0$

$y = x^3+6x^2+8x$

$0 = x^3+6x^2+7x+1$

$y = x-1$

$x = -4.2$

$x = -1.8$

$x = 0.2$

19. a) Scale drawing

b(i) Bearing of Island R from Island P
$= 82° \pm 1°$

(b) Bearing of port S from Island R
$= 263° \pm 1°$.

(c) Distance PR $= 6.5 \times 100 = 650\text{km} \pm 10\text{km}$

(d) Bisecting any two sides of $\triangle PSR$
Locating T in the scale drawing

20. Expressing in terms of a and b, the vectors

(i) $AD = AO + OD = -a + \frac{2}{5}b$ or $\frac{2}{5}b - a$

(ii) $OE = a + \frac{1}{2}(-a + b)$

$OE = \frac{1}{2}a + \frac{1}{2}b$

Alternatively

$OE = b + \frac{1}{2}(-b + a)$

$OE = \frac{1}{2}b + \frac{1}{2}a$

(b) value of s and t

$AF = sAD = s(\frac{2}{5}b - a) = \frac{2}{5}sb - sa$

$OF = tOE = t(\frac{1}{2}a + \frac{1}{2}b) = \frac{1}{2}ta + \frac{1}{2}tb$

Also

$OF = OA + AF = a - sa + \frac{2}{5}sb = (1-s)a + \frac{2}{5}sb$

Comparing the coefficients of a and b

$\frac{1}{2}t = 1 - s \Rightarrow \frac{1}{2}t = 2$

$s = 1 - \frac{1}{2}t$

$2 \times \frac{1}{2}t = \frac{2}{5}s \times 2 \quad t = \frac{4}{5}s$

$s = 1 - \frac{1}{2}(\frac{4}{5}s) \Rightarrow s = 1 - \frac{2}{5}s$

$s + \frac{2}{5}s = 1 \Rightarrow \frac{7}{5}s = 1 \quad s = \frac{5}{7}$

$t = \frac{4}{5}(\frac{5}{7}) \Rightarrow t = \frac{4}{7}$

(c) O, F and E Collinear:

Consider OF and OE

$OE = \frac{1}{2}(a+b)$ and $OF = (1-s)\underset{\sim}{a} + \frac{2}{5}\underset{\sim}{b} = (1-\frac{5}{7})\underset{\sim}{a} + \frac{2}{5}\underset{\sim}{b}$

$= \frac{2}{7}(a+b)$

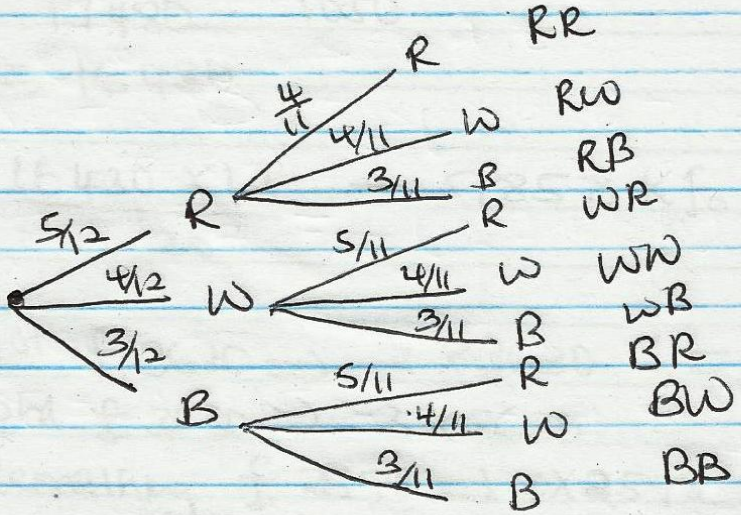
Let $OE = kOF$

$\frac{1}{2}(a+b) = \frac{2}{7}(a+b)$

$k = \frac{2}{7} \div \frac{1}{2} = \frac{4}{7}$ hence $OE = \frac{4}{7}OF$ Thus OE // OF

and O is common hence O, F and E are Collinear

21.



B1

B1

bi) P(RR) or P(WR) or P(BR)

$\left(\frac{5}{12} \times \frac{4}{11}\right) + \left(\frac{4}{12} \times \frac{5}{11}\right) + \left(\frac{3}{12} \times \frac{5}{11}\right)$ M1

$\frac{5}{33} + \frac{5}{33} + \frac{5}{44} = \frac{20+20+15}{132}$ M1

$= \frac{55}{132} = \frac{5}{12}$ A1

(ii) P(RR) or P(WW) or P(BB)

$\left(\frac{5}{12} \times \frac{4}{11}\right) + \left(\frac{4}{12} \times \frac{3}{11}\right) + \left(\frac{3}{12} \cdot \times \frac{2}{11}\right)$ M1

$= \frac{20}{132} + \frac{12}{132} + \frac{6}{132} = \frac{38}{132} = \frac{19}{66}$. A1

21 (iii) P(RB) or P(WB) or P(BB) or P(BW) or P(BR)

$\left(\frac{5}{12} \times \frac{3}{11}\right) + \left(\frac{4}{12} \times \frac{3}{11}\right) + \left(\frac{3}{12} \times \frac{2}{11}\right) + \left(\frac{3}{12} \times \frac{4}{11}\right) + \left(\frac{3}{12} \times \frac{5}{11}\right)$ M1

$\frac{15}{132} + \frac{12}{132} + \frac{6}{132} + \frac{12}{132} + \frac{15}{132}$ M1

$\frac{60}{132} = \frac{5}{11}$ A1

22 Taxable income

$\left[\frac{115}{100} \times 15{,}200\right] - 1050$ M1

$17480 - 1050$

$= 16430$ A1

$\frac{16430 \times 12}{20} = 9858$ Kf M1

(ii) 1st £3630 ⇒ $2 \times 3630 = 7260$

2nd £3630 ⇒ $3 \times 3630 = 10890$ M1

Remaining £2598 ⇒ $4 \times 2598 = 10392$ A1

Total tax = Sh 28542 B1

Gross tax per month = $\frac{28542}{12} = 2378.50$

(i) Net tax = Sh(2378.50 − 450) M1

= 1928.50. A1

(iv) Net salary ⇒ Sh(15200 − (1928.50 + 1050)) M1

= 12221.50. A1

23

marks	M.P (X)	f	CF	$d = x - 65$	t	t^2	ft	ft^2
10–20	15	4	4	−50	−5	25	−20	100
20–30	25	7	11	−40	−4	16	−28	112
30–40	35	12	23	−30	−3	9	−36	108
40–50	45	9	32	−20	−2	4	−18	36
50–60	55	15	47	−10	−1	1	−15	15
60–70	65	23	70	0	0	0	0	0
70–80	75	21	91	10	1	1	21	21
80–90	85	5	96	20	2	4	10	20
90–100	95	4	100	30	3	9	12	36

$\Sigma ft = -74 \quad \Sigma ft^2 = 448$

$$\text{Mean} = A + \left(\frac{\Sigma ft}{\Sigma f} \times C\right) \qquad A = 65$$

$$= 65 + \left(\frac{-74}{100} \times 10\right)$$

$$= 65 - 7.4 = \underline{57.6}$$

$$\text{Median}, M = L + \frac{(N/2 - Cp)i}{f} \qquad \frac{100}{2} = 50$$

$$= 59.5 + \frac{(50 - 47)10}{23}$$

$$= 60 + \frac{3}{23} \times 10$$

$$= 60 + 6.522 = \underline{66.522}$$

$$\text{Std deviation}, s = C\sqrt{\frac{\Sigma ft^2}{\Sigma f} - \left(\frac{\Sigma ft}{\Sigma f}\right)^2}$$

$$s^2 = \left[\frac{448}{100} - \left(\frac{-74}{100}\right)^2\right] \times 10^2$$

$$s^2 = [4.48 - 0.5476] \times 100$$

$$s^2 = 3.9324 \times 100$$

$$s^2 = 393.24$$

$$s = \sqrt{393.24} \qquad s = \underline{19.8303} \qquad s \simeq 19.83$$

24(c) Time taken $= \frac{400}{120} = 3\frac{1}{3}$ hrs M1

Arrival time $= 8{:}30 + 3$hr 20min

$= 11{:}50$ am

(ii) Relative speed $= 120 + 80 = 200$ km/hr A1

Distance between them at 8:30 am.

$= 400 - (80 \times 1\frac{1}{2})$

$= 400 - 40$ M1

$= 360$ km

Time taken $= \frac{360}{200} = 1{\cdot}8$ hr $=$ 1hr 48min M1

Time of meeting $= 8{:}30$ am $+$ 1hr 48min

$= 10{:}18$ am

(iii) Distance travelled $= 1{\cdot}8 \times 80 = 144 + 40$ A1

$= 184$ km.

(iv) Lamu bus taken 3hr 20min

Arrival time $= 11{:}50$ a.m M1

Coast bus $\Rightarrow$ Distance covered in 3hrs 20min A1

$= 80 \times \frac{10}{3} = \frac{800}{3}$ M1

$= 266{\cdot}67$ km

Distance required $= 400 - (266{\cdot}67 + 40)$ M1

$= 93{\cdot}33$ km A1