PAVEMENT FORM 4 TRIAL 2 EXAMINATION 2021/2022

Kenya Certificate of Secondary Education (K.C.S.E)

121/2

MATHEMATICS PAPER 2

MARKING SCHEME

No.	Marking scheme	Marks	Comments
1.	$\left(x-\frac{4}{3}\right)\left(x-\frac{1}{2}\right)\quad 0$ $x^2-\frac{5}{6}x-\frac{2}{3}-0$ $6x^2\quad 5x\quad 4=0$	M1 M1 A1 **3**	
2.	$\text{Actual volume}=\{8\times4.20\times5.6\}=188.16\ \text{cm}^3$ $\text{Maximum volume}=\{8.5\times4.205\times5.65\}=201.945125\ \text{cm}^3$ $\text{Minimum volume}=\{7\cdot5\times4\cdot195\times5\cdot55\}=174\cdot616875\ \text{cm}^3$ $\text{Absolute error}=\frac{201\cdot945125-174\cdot616875}{2}$ 13.664125 $\text{Percentage error}=\left(\frac{13\cdot664125}{188\cdot16}\right)\times100\%$ $=7\cdot262\%$	M1 A1 **2**	Alternative method $\left(\frac{0.5}{8}-\frac{0.005}{4.20}+\frac{0.005}{5.6}\right)\times100\%$ 7.261906%
3.	(a) Sh.(25 000 – 3730) = Sh. 21 250 $\text{Carrying charge}=\left(21250\times\frac{40}{100}\times2\right)$ = Sh. 17 000 (b) $\left(\frac{21250+17000}{24}\right)=$ Sh. 1 593.75	M1 A1 B1 **3**	

4.	$3\log_4\left(\sqrt{3}\right) \quad \frac{1}{2}\log_4 3 + 3\log_4 2 \quad \log_4 6$ $-\log_4\left(\frac{3^{\frac{3}{2}}}{3^{\frac{1}{2}}}\times\frac{2^3}{6}\right)$ $-\log_4 2^3$ Let $m = \log_4 2^3 \Rightarrow 2^{2m} = 2^3$ $2m \quad 3$ $m \quad 1\frac{1}{2}$ $\therefore \log_4 2^3 = 1\frac{1}{2}$	M1 M1 A1 **03**	
5.	$2^{\log_2}(a+x)^{-\frac{1}{3}} = 20^{\log_2}$ $(a+x)^{-\frac{1}{3}} = (10^{\log_2})^{\frac{1}{3}}$ $a-x = 10^{3\log_2}$ $\log(a+x) \quad 3n\log 10$ $n = \frac{1}{3}\log(a+x)$	M1 M1 A1 **3**	
6.	The required angle is BDE Now $\angle EBC = 90°$ angles in a semicircle in triangle EBC $\angle BEC = 27°$, hence; $\angle ECB = 90 \quad 27 = 63°$ (angles in a triangle) But $\angle BDE = \angle BCE$, angles in the same segment. Hence $\angle BDE = 63°$	B1 B1 B1	For 90°

		3	
7.	$\frac{1}{x} - \frac{1}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}} - \frac{2-\sqrt{3}}{1} - 2-\sqrt{3}$ $x - \frac{1}{x} - (2-\sqrt{3}) - (2+\sqrt{3}) - -2\sqrt{3}$ $\left(x - \frac{1}{x}\right)^3 = (-2\sqrt{3})^3$ $-(-2)^3(\sqrt{3})^2$ $= 24\sqrt{3}$	M1 M1 A1	
		3	
8.	$(x-y)^4 - x^4 + 4x^3(-y) - 6x^2 - y^2 + 4x(-y)^3 + (-y)^4$ $(1\cdot58)^4 - (2 - 0.42)^2$ $2^4 - 4(2)^3(0.42) + 6(2)^2 - 4(2)(0.42)^3 - (0.42)^4$ $-16 - 13.44 - 4.2336 - 0.592704 + 0.013069123$ -6.213965123 $\simeq 6.214$	M1 M1 A1	
		3	
9.	$BE - \sqrt{4^2 + 2^2}$ $-2\sqrt{5}$ $DE - \sqrt{5^2 + 2^2}$ $= \sqrt{29}$ $\cos\beta - \frac{41 + 20 - 29}{2 \times \sqrt{41} \times \sqrt{20}}$ $= 56.0^\circ$	M1 M1 M1 A1	

		4	
10.	$y \quad 2\cos(2x+90^{\circ})$ Amplitude -2 Phase shift $= \frac{180^{\circ}}{4} = 45^{\circ}(\text{left of } 45^{\circ})$	B1 B1	
		2	
11.	$Q_1 - \frac{48}{4} - 12^{th} \text{ item} - 11,000$ $Q_3 - \frac{3}{4} \times 48 - 36^{th} \text{ item}$ $= 13,000$ $Q.D = \frac{13,000 - 11,000}{2}$ $-1,000$	M1 M1 A1	
		3	
12.	Latitude difference $= 51^{\circ} + 37^{\circ} = 88^{\circ}$ Distance in kilometres; $\frac{88}{360} \times \frac{22}{7} \times 2 \times 6370$ $= 9787.6$ km	B1 M1 A1	
		3	

13.	(a) Side of QRST $= \sqrt{(1-1)^2 + (3-1)^2}$ $= 2$ $\therefore$ Area $= 2 \times 2 = 4$ (b) the area of image $Q'R'S'T'$ $-\det\begin{pmatrix} 3 & 1 \\ 0 & 2 \end{pmatrix} \times 4$ $= 6 \times 4$ $= 24sq$	M1 A1 M1 A1 **4**	Or equivalent
14.	$AB = 6.5\tan 70^\circ$ $= 17.86$ cm Area of quadrilateral OABC$=2\left(\frac{1}{2} \times 6.5^2 \tan 70^\circ\right)$ -116.08 cm^2 Area of sector OAC $= \frac{140}{360} \times 3.142 \times 6.5^2$ $= 51.62$ cm^2 Shaded area $= 116.08 - 51.62$ $= 64.47$ cm^2	M1 M1 M1 A1 **4**	$OB \quad \frac{6.5}{\cos 70^\circ} \quad 19.00$ cm $2\left(\frac{1}{2} \times 17.86 \times 6.5\right) - 116.09$ cm^2
15.	C fraction in 1 minute $-\frac{1}{30} - \frac{1}{40} - \frac{1}{120}$ C takes 120 minutes B fraction in 1 minute $\frac{1}{30} - \frac{1}{45} \quad \frac{1}{90}$ B takes 90 minutes A fraction in 1 minute $-\frac{1}{30} - \frac{1}{90} - \frac{5}{360}$ A takes $-\frac{360}{5} - 72$ minutes	B1 B1 B1 **3**	
16.			

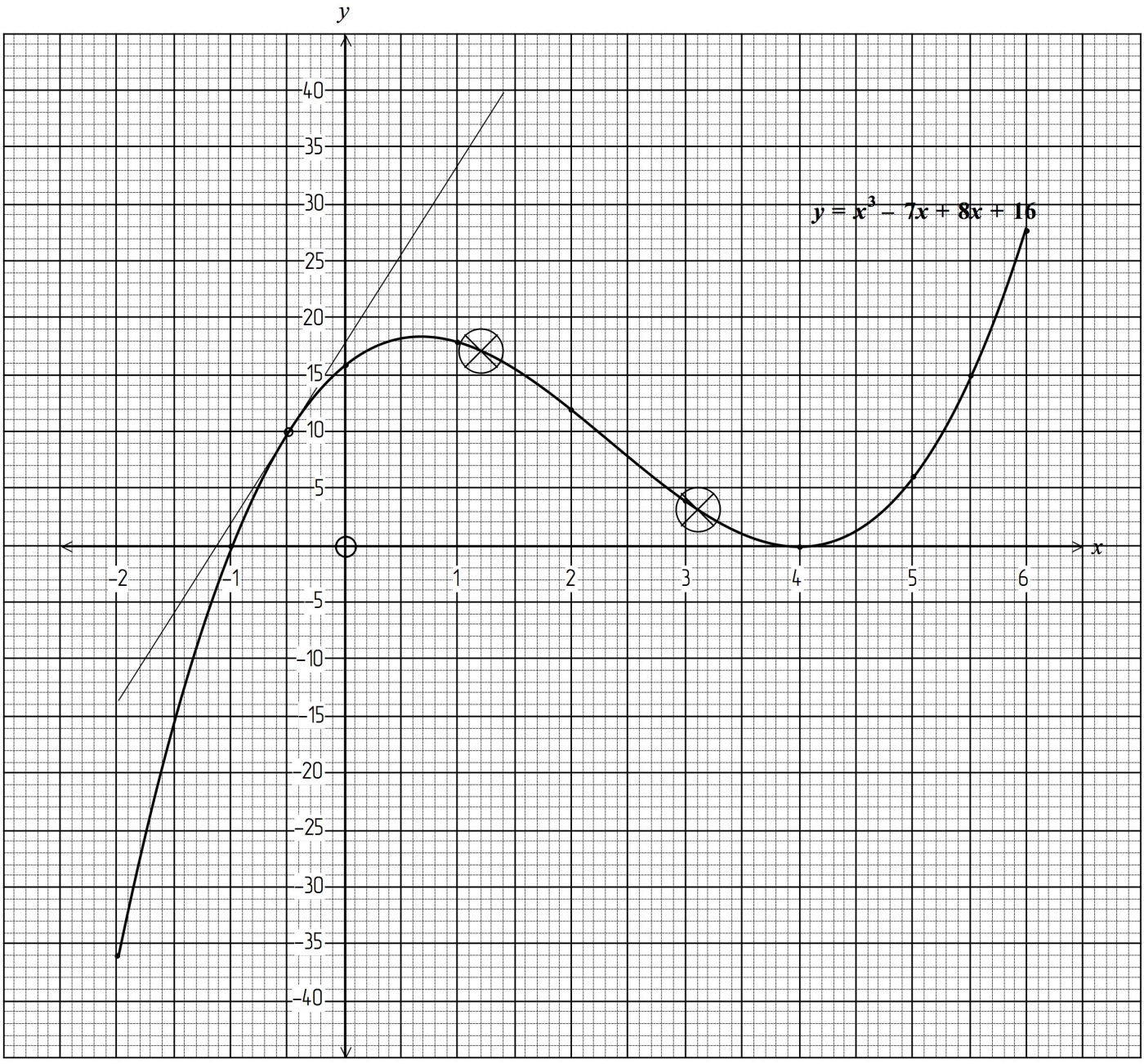
	$x^2-2x+\left(\frac{-2}{2}\right)^2+y^2-8y-\left(\frac{8}{2}\right)^2-8+1+16$	M1	
	$(x-1)^2+(y+4)^2-5^2$	A1	
	Centre $(1,\ 4)$	B1	
	Radius 5 units		
		B1	
		4	

17. (a)

x	-2	-1	0	1	2	3	4	5	6
y	-36	0	16	18	12	4	0	6	28

B2 Allow B1 for 4√

(b)



S1

P1

C1

(c) Average rate of change;

$$-\frac{3 \quad 17}{3.1-1.2}$$

M1

$$= \quad 7.37$$

A1

(d) Tangent at $x = \quad 0.5$

B1

$$\text{Gradient} - \frac{6 \quad 30}{-1.5-0.8}$$

M1

$$= 15.7$$

A1

		10	
18.	(a) (i) $\left.\begin{aligned}\frac{a-4d}{a+11d}=\frac{6}{13}\Rightarrow a=2d\ldots\ldots\ldots\ldots(i)\\ a(a+2d)=32\ldots\ldots\ldots\ldots\ldots\ldots(ii)\end{aligned}\right\}$	M1	
	$2d(2d+2d)=32$	M1	
	$8d^2=32$		
	$d^2=4$		
	$d=\pm 2$	M1	Solving for d
	$d=2$		
	$a=2d$		
	$=2\times 2$		
	$=4$	A1	Solving for a
	(ii) $S_5=\frac{5}{2}\{2\times 4+(5-1)2\}$	M1	
	$=\frac{5}{2}(8+8)$		
	$=40$	A1	
	(b) $\frac{n}{2}\{2\times 4-(n-1)2\}>700$	M1	Correct substitution
	$\frac{n}{2}\{8-2n\}>700$		
	$2n^2+6n-1400>0$	M1	
	$n^2+3n-700>0$		
	$n^2-28n+25n-700>0$		
	$n(n+28)-25(n+28)>0$	M1	Solving quadratic equation
	$(n+25)(n-28)>0$		
	$\because n+25>0$		
	$n>25$		
	$n=25+1$		
	$=26$	A1	$n+1$

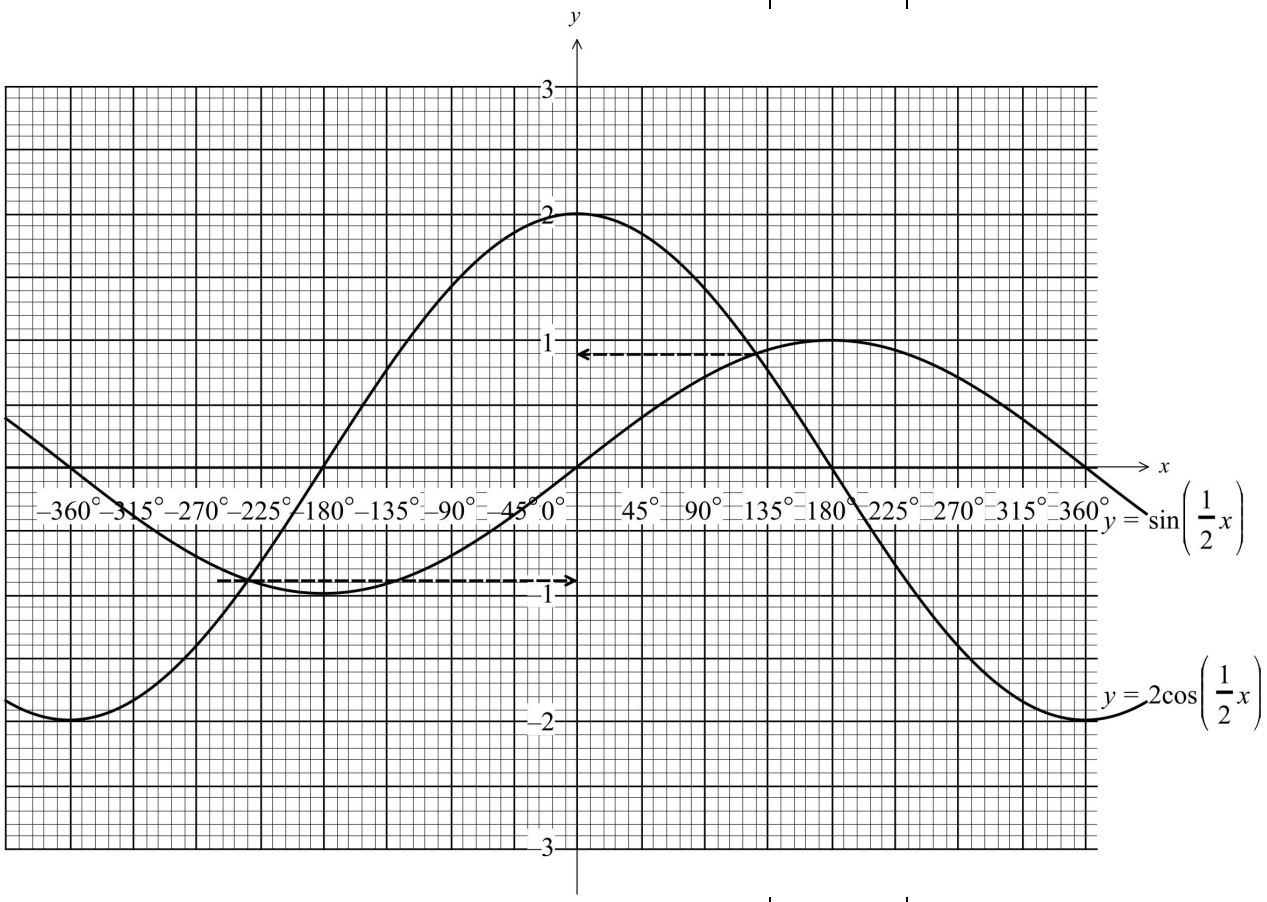
		10	
19.		B2	All values correct

(a)

$x°$	–360	–270	–180	–90	0	90	180	270	360
$y=\sin\left(\frac{1}{2}x\right)$	0	**– 0.7**	**–1.0**	**– 0.7**	0	– 0.7	**1.0**	**0.7**	0
$y=2\cos\left(\frac{1}{2}x\right)$	– 2.0	**–1.4**	0	**1.4**	**2.0**	**1.4**	0	**–1.4**	– 2.0

B1 Atleast 5 values correct

(b) S1 Suitable scale used



B1

P1

C1 $y=\sin\left(\frac{1}{2}x\right)$

C1 $y=2\cos\left(\frac{1}{2}x\right)$

(c) (i) $-234^{\circ} \_ 1^{\circ}$ and $126^{\circ} \perp 1^{\circ}$ (ii) values of y $y_1 = -0 \cdot 9$ $y_2 = 0.9$	B1 B1	

		10	
21.	(a) Distance in 1 minute $\frac{144\times30}{3600}$ 1.2 km $D_{252\ km/h}$ $1.2+x$ $D_{144\ km/h}$ x $S-252$ km/h $S-144$ km/h $T=\frac{1.2+x}{252}$ $T=\frac{x}{144}$ $\frac{1.2\ \ x}{252}=\frac{x}{144}$ $1.75x-x-1.2$ $0.75x-1.2$ $x-1.6$ km $D_{252\ km/h}-1.2-x$ $-1.2-1.6$ -2.8 km (b) Remaining distance = 3.22 – 2.8 = 0.42 km $\text{Distance}-144\times\frac{0.42}{252}-0.24$ km $(0.42-0.24)-0.18$ km (c) $\text{Distance}\quad 2x+x\quad 3x$ $RS=(25+15)=40$ km/h	M1 M1 A1 B1 M1 M1 A1 B1 M1	Alternatively; Relative speed = 252 – 144 = 108 km/h $T-\frac{1.2}{10.8}-\frac{1}{90}$ hrs $D-\frac{1}{90}\times144$ -2.8 km

	$\frac{3x}{40} - \frac{10.83}{3600}$ $x - \frac{40 \times 10.8}{3 \times 3600}$ $= 0.04 \text{ km} = 40 \text{ m}$ Train 1 $= 40$ m Train 2; $2 \times 40 - 80$ m	A1 **10**	

22.

(a) $C \quad k+\frac{m}{N}$ — B2

(b)

$$\left.\begin{array}{l} 8700 \quad k+\frac{m}{100} \\ 10,000 \quad k+\frac{m}{35} \end{array}\right\}$$ — M1

$8700-\frac{m}{100}-10,000-\frac{m}{35}$ — M1

$100m-35m=4550,000$

$m=\frac{4550,000}{65}$

$-70,000$ — A1

$k=85,000 \quad \frac{m}{100}$

$=85,000 \quad \frac{70,000}{100}$

-8000

$C-8000-\frac{70,000}{N}$ — B1

(c) Let the number of people be x ; $P \quad \frac{90}{100}x \quad 0.9x$

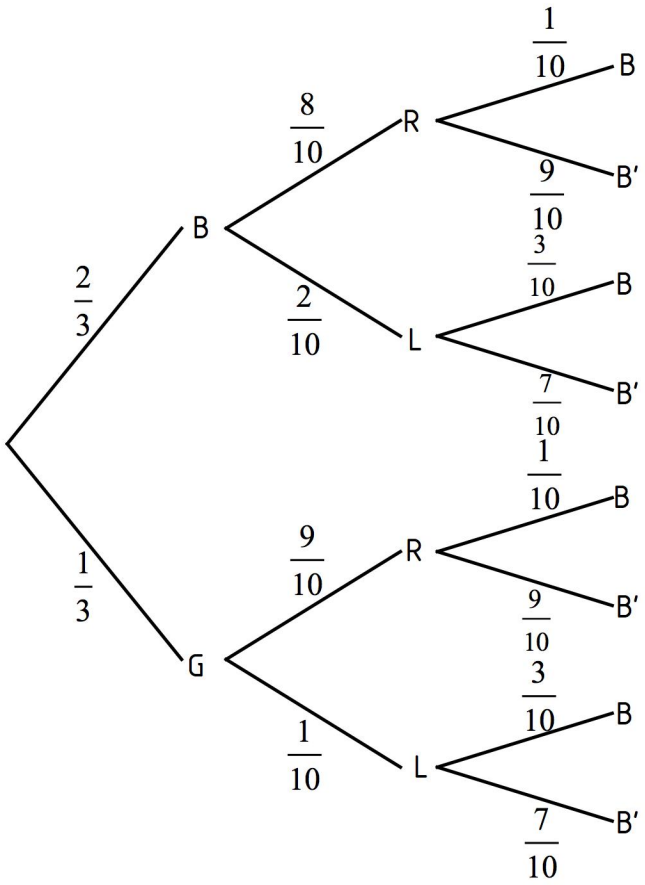
Amount per person $=\frac{57400}{0.9x}$ — M1

$\frac{57400}{0.9x}=800 \mid \frac{70000}{0.9x}$ — M1

$\frac{1}{0.9x}(574000-70000)-8000$

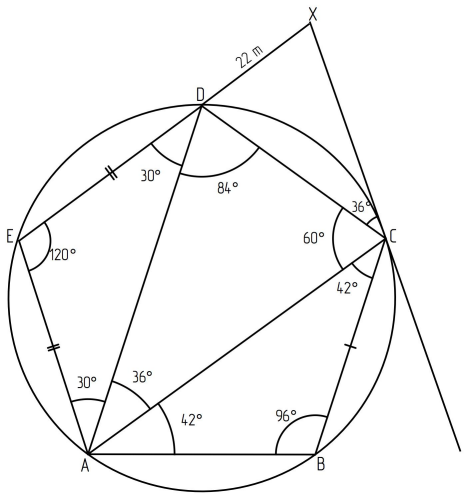
$x-\frac{504000}{0.9\times 8000}$

$=70$ — A1

		10	
23.	(a)  (b) (i) $P(BL)$ or $P(GL)$ $P(BL)$ or $P(GL) - \left(\frac{2}{3} \times \frac{2}{10}\right) + \left(\frac{1}{3} - \frac{1}{10}\right)$ $= \frac{1}{6}$ (ii) $P(BRB)$ or $P(BLB)$ or $P(GRB)$ or $P(GLB)$ $-\left(\frac{2}{3} \times \frac{8}{10} \times \frac{1}{10}\right) + \left(\frac{2}{3} \times \frac{2}{10} \times \frac{3}{10}\right) - \left(\frac{1}{3} \times \frac{9}{10} \times \frac{1}{9}\right) + \left(\frac{1}{3} \times \frac{1}{10} \times \frac{3}{10}\right)$ $\frac{4}{75} + \frac{1}{25} + \frac{1}{30} - \frac{1}{100}$ $-\frac{41}{300}$ (iii) P(GRB) or P(GLB)	B1 B1 M1 A1 M1 A1	Correct tree diagram

	$P(GRB) \text{ or } P(GLB) - \left(\frac{1}{3}\times\frac{9}{10}\times\frac{1}{10}\right) - \left(\frac{1}{3}\times\frac{1}{10}\times\frac{3}{10}\right)$		
	$= \frac{9}{300} + \frac{1}{100}$	M1	
	$= \frac{1}{25}$		
	(iv) $P(BRB') \text{ or } P(GLB')$	A1	
	$P(BRB') \text{ or } P(GLB') - \left(\frac{2}{3}\times\frac{8}{10}\times\frac{9}{10}\right) + \left(\frac{1}{3}\times\frac{1}{10}\times\frac{3}{10}\right)$		
	$= \frac{144}{300}\times\frac{3}{300}$	M1	
	$= \frac{3}{625}$		
		A1	
		10	

24.	(a) (i) $\mathbf{OD} \quad \underset{\sim}{a}+\frac{1}{3}\underset{\sim}{b}$ (ii) $\mathbf{BE} \quad -\underset{\sim}{b}-\frac{1}{3}\underset{\sim}{a} \quad \frac{1}{3}\underset{\sim}{a}-\underset{\sim}{b}$ (iii) $\mathbf{BD}=\mathbf{BO}+\mathbf{OA}+\mathbf{AD}$ $-\underset{\sim}{b}-\underset{\sim}{a}+\frac{1}{3}\underset{\sim}{b}$ $=\underset{\sim}{a}-\frac{2}{3}\underset{\sim}{b}$ (b) $\mathbf{OX}-k\left(\underset{\sim}{a}+\frac{1}{3}\underset{\sim}{b}\right)-k\underset{\sim}{a}+\frac{1}{3}k\underset{\sim}{b}$ $\mathbf{OX}=\mathbf{OB}+h\mathbf{BE}$ $\underset{\sim}{b}+h\left(\frac{1}{3}\underset{\sim}{a}-\underset{\sim}{b}\right) \quad \underset{\sim}{b}(1-h)-\frac{1}{3}h\underset{\sim}{a}$ (c) (i) $k\underset{\sim}{a}+\frac{1}{3}k\underset{\sim}{b} \quad \underset{\sim}{b}(1-h)+\frac{1}{3}h\underset{\sim}{a}$ $k-\frac{1}{3}h$ $\frac{1}{3}k \quad 1-h \ > k \quad 3(1-h)$ $\frac{1}{3}h-3-3h$ $3\frac{1}{3}h \quad 3$ $h-\frac{9}{10}$ $k \quad \frac{1}{3}\times\frac{9}{10}$ $-\frac{3}{10}$ (ii) $\mathbf{OX:XD}=3:7$	B1 B1 B1 B1 B1 B1 M1 M1 A1 B1	Both values of h and k

		10	
25.	(a) 		
	$\angle ABC = 180° - 84° - 96°$	B1	
	$\angle ACD = 180° - (84 + 36)° = 60°$		
	$\angle DEA = 180° - 60° = 120°$		
	$\angle EDA = \angle EAD = \left(\frac{180° - 120°}{2}\right) = 30°$	B1	
	$\left.\begin{aligned}\angle BCD &= \angle ACD + \angle ABC \\ &= 60 + 42 = 102° \\ \angle CDE &= \angle CDA + \angle EDA \\ &= 84 + 30 \\ &= 114°\end{aligned}\right\}$	B1	
	$\left.\begin{aligned}\angle EDA &= 120° \\ \angle EAB &= \angle EAD + \angle DAC - \angle CAB \\ &= 30 + 36 - 42 \\ &= 108°\end{aligned}\right\}$	B1	
	(b) $\angle CAB = \angle BCY = 42°$ Alternate angles are equal	B1	
	$\angle XDC = 180 - (30 + 84) = 66°$, Angles on straight line are supplementary/add up to 180°	B1	
	$\angle DXC = 180 - (66 + 36) = 78°$, sum of angles in a triangle add up to 180°	B1	Reason
	(c) $DC = \sin 78\left(\frac{28}{\sin 36}\right) = 33.28 \text{ m}$	M1	
	$A = \frac{1}{2} \times 33.28 \times 20 \sin 66°$	M1	
	$= 305.05 \text{ m}^2$	A1	

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