## **Mark Scheme**

Q1.

Question	Scheme	Marks	5
Number (a)	(R and S are mutually) exclusive.	B1	
(4)	(N and 5 are indically) exclusive.	D1	(1)
(b)	$\frac{2}{3} = \frac{1}{4} + P(B) - P(A \cap B)$ use of Addition Rule	M1	
	$\frac{2}{2} = \frac{1}{4} + P(B) - \frac{1}{4} \times P(B)$ use of independence	p. (1915)	
	$\frac{1}{3} - \frac{1}{4} + \frac{1}{4} \times \frac{1}$	M1 A1	
	$\frac{5}{12} = \frac{3}{4} P(B)$		
	12 7		
	$P(B) = \frac{5}{9}$	A1	
(c)	3 5 15 5	M1A1ft	(4)
(-)	$P(A' \cap B) = \frac{3}{4} \times \frac{5}{9} = \frac{15}{36} = \frac{5}{12}$		
(d)	1		(2)
(=)	$P(B' A) = \frac{(1-(b))\times 0.25}{0.25}$ or $P(B')$ or $\frac{2}{9}$	M1	
	$0.25 \qquad \frac{1}{4}$		
	$=\frac{4}{9}$	A1	
	9	AI	(2)
		Tot	al 9
NOTES	D1 for '/mutually' analysiss' or 'connect account the same time' connect and		
(a)	B1 for '(mutually) exclusive' or 'cannot occur at the same time' seen or equivalent.  'Intersection is zero' or 'no overlaps' without further explanation is B0.		
(b)	M1 for use of Addition Formula, including an intersection, with at least one probability substituted. Intersection must be explicitly considered for this mark.		
	Accept $\frac{2}{3} = \frac{1}{4} + P(B) - 0$ for M1.		
	M1 for $P(A \cap B) = \frac{1}{4}P(B)$		
	A1 for completely correct equation or equivalent.		
	A1 for $\frac{5}{9}$ or exact equivalent		
	Venn Diagram with 2 overlapping closed curves and correct values possibly without		
	$\frac{1}{3}$ , award M1M1A1.		
(c)	M1 for $\frac{3}{4}$ x 'their P(B)' or 'their P(B)' - P(A \cap B) or P(AUB) - P(B) = $\frac{2}{3} - \frac{1}{4}$		
	Or $P(A' \cap B) = P(A') + \text{ 'their } P(B)' - P(A' \cup B) = \frac{3}{4} + \frac{5}{9} - \frac{8}{9}$		
	A1 for $\frac{5}{12}$ or follow through from their method. Accept exact equivalent.		
	Correct answer only with no working M1A1 but must be clearly labelled (c).		
(d)	M1 for using 1-'their $P(B)$ ' or $(P(A \cup B) - P(A))/P(A)$ or $(P(A) - P(A \cap B))/P(A)$ with a correct attempt at the numerator and denominator. If mutually exclusive is 1		
	assumed then the last option gives $\frac{4}{1}$ for M1.		
	$\frac{1}{4}$		
	A1 for $\frac{4}{9}$ or exact equivalent.		
	For part (c) follow through their stated values; do not follow through incorrectly		
	labelled regions on a Venn Diagram.		
	Throughout the question we require probabilities between 0 and 1 for method marks.		
	Venn Diagram:		
	B B		
	$ \begin{array}{c c} \frac{1}{9} & \frac{5}{36} & \frac{5}{12} \\ & & \frac{1}{3} \end{array} $		
	<u> </u>		

(a) $P(J \cup K) = 1 - 0.7$ or $0.1 + 0.15 + 0.05 = 0.3$ (b) $P(K) = 0.05 + 0.15$ or "0.3" $- 0.25 + 0.15$ or "0.3" $= 0.25 + P(K) - 0.15$ May be seen on Venn diagram $= 0.2$ (c) $[P(K \mid J)] = \frac{P(K \cap J)}{P(J)}$ $= \frac{0.15}{0.25}$ A1  (d) $P(J) \times P(K) = 0.25 \times 0.2 (= 0.05), P(J \cap K) = 0.15 \text{ or}$ $P(K \mid J) = 0.6, P(K) = 0.2 \text{ or may see } P(JK) = 0.75 \text{ and } P(J) = 0.25$ not equal therefore not independent  (e) Not independent so confirms the teacher's suspicion or they are linked (This requires a statement about independence in (d) or in (e))  Notes  (b) $P(K)$ M1 for a complete method, follow through their 0.3, leading to a linear equation for NB You may see this Venn diagram.  A correct diagram (Venn or table) implies M1 in (b)  Need not include box or 0.7  Correct answer only is 2/2  In parts (c) and (d) they must have defined A and B  (c) M1 for a correct ratio of probabilities (if this is seen the M1 is awarded by implication)  Must be in (c). Condone no LHS but wrong LHS (e.g. $P(K)$ or $P(J K)$ ) is M0A0 $2^{nd}$ A1 for correct answer as printed only. Correct answer only 3/3  Mark (d) and (e) together  (d) M1 for a correct comparison of known probabilities for an independence test - ft their values. E.g. $P(J) \times P(X)$ with $P(J \cap K)$ or $P(X J)$ with $P(K)$ [Must have expressions]  The values of these probabilities should be given unless they are in the question or stated elsewhere.  A1ft for correct calculations and correct comment for their probabilities  (e) B1ft ft their conclusion on independence so not independent confirms teacherindependent contradicts teacher.  Methods leading to negative probabilities should score M0	Question Number	Scheme	Marks
(b) $P(K) = 0.05 + 0.15 \text{ or } ``0.3" - 0.25 + 0.15 \text{ or } ``0.3" = 0.25 + P(K) - 0.15 \text{ M1}$ $= 0.2$ (c) $P(K   J) = \frac{P(K \cap J)}{P(J)}$ $= \frac{0.15}{0.25}$ $= \frac{3}{5} \text{ or } 0.6$ $P(K   J) = 0.6, P(K) = 0.25 \times 0.2(= 0.05), P(J \cap K) = 0.15 \text{ or } P(K   J) = 0.6, P(K) = 0.2 \text{ or may see } P(J   K) = 0.75 \text{ and } P(J) = 0.25 \text{ not equal therefore not independent}}$ (d) $P(J) \times P(K) = 0.25 \times 0.2(= 0.05), P(J \cap K) = 0.15 \text{ or } P(K   J) = 0.6, P(K) = 0.2 \text{ or may see } P(J   K) = 0.75 \text{ and } P(J) = 0.25 \text{ not equal therefore not independent}}$ (e) $P(K   J) = 0.6, P(K) = 0.2 \text{ or may see } P(J   K) = 0.75 \text{ and } P(J) = 0.25 \text{ not equal therefore not independence in (d) or in (e)}}$ $P(K   J) = 0.6, P(K) = 0.2 \text{ or may see } P(J   K) = 0.75 \text{ and } P(J) = 0.25 \text{ not equal therefore not independence in (d) or in (e)}}$ $P(K) = 0.5 \text{ Notes}$ (b) $P(K) = 0.5 \text{ Notes}$ $P(K) = 0.5 \text{ Notes}$ Notes  (c) $P(K) = 0.25 \times 0.2(= 0.05), P(J \cap K) = 0.15 \text{ or } P(K) = 0.25 \text{ or } P(K) = $	(a)	$P(J \cup K) = 1 - 0.7 \text{ or } 0.1 + 0.15 + 0.05 = \underline{0.3}$	L. Control
(c) $ [P(K J)] = \frac{P(K \cap J)}{P(J)} $ $= \frac{0.15}{0.25}$ $= \frac{3}{5} \text{ or } 0.6 $ (d) $P(J) \times P(K) = 0.25 \times 0.2 (= 0.05), P(J \cap K) = 0.15 \text{ or} $ $P(K J) = 0.6, P(K) = 0.2 \text{ or may see } P(J K) = 0.75 \text{ and } P(J) = 0.25 $ not equal therefore not independent (This requires a statement about independence in (d) or in (e))  Not independent so confirms the teacher's suspicion or they are linked (This requires a statement about independence in (d) or in (e))  Notes  (b) M1 for a complete method, follow through their 0.3, leading to a linear equation for P(K)  NB You may see this Venn diagram. A correct diagram (Venn or table) implies M1 in (b) Need not include box or 0.7 Correct answer only is 2/2  In parts (e) and (d) they must have defined A and B  or a correct expression (including ratio) in symbols.  1 <sup>st</sup> A1 for a correct ratio of probabilities (if this is seen the M1 is awarded by implication) Must be in (e). Condone no LHS but wrong LHS (e.g. P(K) or P(J K)) is M0A0  2 <sup>nd</sup> A1 for correct answer as printed only. Correct answer only 3/3  Mark (d) and (e) together  (d) M1 for a correct comparison of known probabilities for an independence test - ft their values. E.g. P(J) × P(K) with P(J ∩ K) or P(K J) with P(K) [Must have expressions]  The values of these probabilities should be given unless they are in the question or stated elsewhere.  A1ft for correct calculations and correct comment for their probabilities  (e) B1ft ft their conclusion on independence so not independent confirms teacherindependent contradicts teacher.	(b)	P(K) = 0.05 + 0.15 or "0.3" $-0.25 + 0.15$ or "0.3" $= 0.25 + P(K) - 0.15$	100
(c) $ [P(K   J)] = \frac{P(K \cap J)}{P(J)} $ $= \frac{0.15}{0.25}$ $= \frac{3}{5} \underbrace{\text{or } 0.6} $ $P(J) \times P(K) = 0.25 \times 0.2 (= 0.05),  P(J \cap K) = 0.15 \underbrace{\text{or } 0.6} $ $P(K   J) = 0.6,  P(K) = 0.2 \underbrace{\text{or } \text{may see } P(J   K)} = 0.75 \underbrace{\text{and } P(J) = 0.25} $ $\text{not equal therefore not independent} $ $\text{(e)}  \text{Not independent so confirms the teacher's suspicion } \underbrace{\text{or } \text{they are linked}} $ $\text{(This requires a statement about independence in (d) or in (e))} $ $\text{(1)}  \text{(9 marks)} $ $\text{(b)}  \text{M1}  \text{for a complete method, follow through their } 0.3, \text{ leading to a linear equation for } $ $\text{NB You may see this Venn diagram.} $ $\text{A correct diagram (Venn or table) implies M1 in (b)} $ $\text{Need not include box or } 0.7 $ $\text{Correct answer only is } 2/2 $ $\text{In parts (e) and (d) they must have defined } A \text{ and } B $ $\text{(c)}  \text{M1}  \text{for a correct expression (including ratio) in symbols.} $ $\text{1}^{\text{st}} \text{A1 for a correct aniof of probabilities (if this is seen the M1 is awarded by implication)} $ $\text{Must be in (e). Condone no LHS but wrong LHS (e.g. P(K) or P(J   K)) is M0A0} $ $\text{2}^{\text{nd}} \text{A1 for a correct comparison of known probabilities for an independence test - ft their values. E.g. P(J) \times P(K) with P(J \cap K) or P(K \cup J) with P(K) [Must have expressions]  \text{The values of these probabilities should be given unless they are in the question or stated elsewhere.}  \text{A1ft}  \text{for correct calculations and correct comment for their probabilities}  \text{(e)}  \text{B1ft}  \text{ft their conclusion on independence so not independent confirms} $		·	3535.00
a   3   or 0.6   A1     (d) P(J)×P(K) = 0.25×0.2(= 0.05), P(J ∩ K) = 0.15 or P(K   J) = 0.6, P(K) = 0.2 or may see P(J   K) = 0.75 and P(J) = 0.25     not equal therefore not independent   A1ft     (e) Not independent so confirms the teacher's suspicion or they are linked (This requires a statement about independence in (d) or in (e))   B1ft     (9 marks)     Notes     Notes   Notes     NB You may see this Venn diagram. A correct diagram (Venn or table) implies M1 in (b) Need not include box or 0.7     Correct answer only is 2/2     In parts (c) and (d) they must have defined A and B     (c) M1 for a correct expression (including ratio) in symbols. 1st A1 for a correct of probabilities (if this is seen the M1 is awarded by implication) Must be in (c). Condone no LHS but wrong LHS (e.g. P(K) or P(J/K)) is M0A0 2st A1 for correct answer as printed only. Correct answer only 3/3     Mark (d) and (e) together     (d) M1 for a correct comparison of known probabilities for an independence test - fit their values. E.g. P(J)×P(K) with P(J ∩ K) or P(K J) with P(K) [Must have expressions]     The values of these probabilities should be given unless they are in the question or stated elsewhere.     A1ft for correct calculations and correct comment for their probabilities	(c)	$[P(K \mid J)] = \frac{P(K \cap J)}{P(J)}$	
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<ul> <li>(d) M1 for a correct comparison of known probabilities for an independence test - ft their values. E.g. P(J)×P(K) with P(J ∩ K) or P(K J) with P(K) [Must have expressions]         The values of these probabilities should be given unless they are in the question or stated elsewhere.         A1ft for correct calculations and correct comment for their probabilities     </li> <li>(e) B1ft ft their conclusion on independence so not independent confirms teacherindependent contradicts teacher.</li> </ul>		Mark (d) and (e) together	
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stated elsewhere.  A1ft for correct calculations and correct comment for their probabilities  (e) B1ft ft their conclusion on independence so not independent confirms teacherindependent contradicts teacher.		expressions]	
(e) B1ft ft their conclusion on independence so not independent confirms teacherindependent contradicts teacher.		stated elsewhere.	the question or
teacherindependent contradicts teacher.		A1ft for correct calculations and correct comment for their probabilities	
teacherindependent contradicts teacher.	(e)	B1ft - ft their conclusion on independence so not independent confirms	
•	(c)	· · · · · · · · · · · · · · · · · · ·	
	26	•	0

Question Number	Scheme	Marks
(a) (i)	$P(A \cup B) = a + b$ cao	B1
(ii)	$P(A \cup B) = a + b - ab$ or equivalent	B1 (2)
(b)	$P(R \cup Q) = 0.15 + 0.35$ = 0.5	B1 (1)
(c)	$P(R \cap Q) = P(R Q) \times P(Q)$ = 0.1 \times 0.35	M1
	= 0.035 0.035	A1 (2)
(d)	$P(R \cup Q) = P(R) + P(Q) - P(R \cap Q)$ OR $P(R) = P(R \cap Q') + P(R \cap Q)$ = 0.15+their (c) = 0.15 + 0.035	M1
	P(R) = 0.185 = 0.185 0.185	A1 (2)
Notes	7(a) (i) Accept a + b - 0 for B1  Special Case  If answers to (i) and (ii) are  (i) P(A)+P(B) and (ii) P(A)+P(B)-P(A)P(B)  award B0B1  7(a)(i) and (ii) answers must be clearly labelled or in correct order for marks to be awarded.	

Question Number	Scheme	Marks
(a)	$P(A \cup B) = 0.35 + 0.45 - 0.13 = \underbrace{\text{or}}_{0.67} = 0.22 + 0.13 + 0.32$	M1 A1
(b)	$P(A'   B') = \frac{P(A' \cap B')}{P(B')}$ or $\frac{0.33}{0.55}$	M1
	$=\frac{3}{5}$ or 0.6	A1
(c)	$P(B \cap C) = 0.45 \times 0.2$ $= \underline{0.09}$	M1 A1
(d)	Allow 1st B1 for 3 intersecting circles in a box with zeros in the regions for $A \cap C$ Do not accept "blank" for zero	B1 B1ft B1 B1
(e)	$P(B \cup C)' = 0.22 + \underline{0.22}$ or $1 - [0.56]$ or $1 - [0.13 + 0.23 + 0.09 + 0.11]$ o.e. $= \underline{0.44}$	M1 A1 (2)
	Notes	
(a)	NB May see Venn diagram for A and B only used for (a) and (b) but M marks are a correct expressions only. No ft from an incorrect diagram for M marks.  M1 for attempt to use the addition rule. Correct substitution i.e. correct expressions A1 for 0.67 only. Correct answer only scores 2/2	
(b)	<ul> <li>M1 for a correct ratio of probabilities or a correct formula and at least one correct For a correct formula allow "1 – their (a)" instead of 0.33 but not for correct to Do not award for assuming independence i.e.          \[             \frac{P(A'\cap B')}{P(B')} = \frac{0.65 \times 0.55}{0.55}\] is M0. M0 if the for 3/5 or any exact equivalent.</li> </ul>	ratio case.
(c)	M1 for correct expression. Need correct values for P(B) and P(C) seen. A1 for 0.09 or any exact equivalent. Correct answer only is 2/2	
(d)	No labels $A$ , $B$ , $C$ in (d) loses $1^{st}$ B1 but can score the other 3 by imple B1 for box with $B$ intersecting $A$ and $C$ but $C$ not intersecting $A$ . No box is B0 B1ft for 0.13 and their 0.09 in correct places. [ft $P(B \cap C)$ from (c)] B1 for any 2 of 0.22, 0.22, 0.11 and 0.23 correct B1 for all 4 values correct	
(e)	M1 for a correct expression or follow through from their Venn diagram NB $P(B') \times P(C') = 0.55 \times 0.8$ is OK. Do not ft "blank" for zero and M0 for neg A1 for 0.44 only. Correct answer only is $2/2$	gative probs.

Question	Scheme	Marks
(a)	$[P(B) = 0.4, P(A) = p + 0.1 \text{ so}]$ $0.4 \times (p + 0.1) = 0.1 \text{ or } 0.4 \times P(A) = 0.1$	M1
	$p = \frac{1}{4} - 0.1$	M1A1 (3)
(b)	$\frac{5}{11} = \left[ \frac{P(B \cap C)}{P(C)} = \right] \frac{0.2}{0.2 + q}  \text{or}  \frac{5}{11} = \frac{0.2}{P(C)}$	M1
	$11\times0.2=5\times(0.2+q)$	dM1
	q = 0.24	A1
	r = 0.6 - (p + q) i.e. $r = 0.21$	A1ft (4)
(c)	$r = 0.6 - (p+q) $ i.e. $\underline{r} = 0.21$ $\left[\frac{P((A \cup C) \cap B)}{P(B)}\right] = \frac{0.3}{0.4}$	M1
	= <u>0.75</u>	A1 (2) [9]
	Notes	
(a)	$1^{\text{st}}$ M1 for using independence in an attempt to form an equation in $p$ or $P(A)$ $2^{\text{nd}}$ M1 for a correct attempt to solve their linear equation leading to $p =$ A1 for 0.15 or exact equivalent	
(b)	$1^{\text{st}} \text{ M1}$ for a clear attempt to use $P(B C)$ to form an equation for $q$ or $P(C)$ . Assuming $2^{\text{nd}} \text{ dM1}$ Dep. on $1^{\text{st}} \text{ M1}$ for correctly simplifying to a linear equation in $q$ or $P(C)$ e.g. accept $11 \times 0.2 = 5 \times 0.2 + q$ or $5P(C) = 2.2$	ing indep M0
	$1^{st}$ A1 for $q = 0.24$ or exact equivalent $2^{nd}$ A1ft for $0.6$ – their $(p + q)$ Dependent on $1^{st}$ M1 in (b) only.	
(c)	M1 for a correct ratio expression and one correct value (num < denom) or a fully of Allow $\frac{P(A \cup C \cap B)}{P(B)}$ with one probability correct but only if num < denom.	correct ratio.
	A numerator of $P(A \cup C) \times P(B)$ scores M0	
	A1 for 0.75 or an exact equivalent	

Question Number	Scheme			Marks	
(a)	[P(A) = 1 - 0.18 - 0.22] = 0.6 (or exact equivalent)			B1	
(b)	$P(A \cup B) = "0.6"$	$P(A \cup B) = "0.6" + 0.22 = 0.82$ (or exact equivalent)			(1) B1ft
	,		` '	,	(1)
(c)	$x = P(A \cap B)$	Use $P(B)P(A' B)$	$)=\mathrm{P}(A'\cap B)$	Establish independence before or after 1 <sup>st</sup> M1and score marks for (d) (RH ver)	M1
	$\frac{x}{x+0.22} = 0.6$	$P(B) \times [1 - 0.6] = 0$	0.22	Find P(B)	
	x = 0.6x + 0.132	Use $P(A \cap B) = P(A \cap B)$	$(A \mid B)P(B)$	Use $P(B)P(A) = P(A \cap B)$	dM1
	0.4x = 0.132	$P(A \cap B) = 0.6 \times 0$	.55	$P(A \cap B) = 0.6 \times 0.55$	divii
		x = 0.33 (c)	or exact equivalent)		A1cso
(1)	D(B) 0.55				(3)
(d)	P(B) = 0.55 $P(B) \times P(A) = 0.55$	5 0. 6	ov stating D(4)	= P(A B) [= 0.6]	N1
	$P(B) \times P(A) = 0.33$ $= 0.33$		or stating P(A)	=P(A B)[=0.0]	M1
	$P(B) \times P(A) = P(A)$		or $P(A) = P(A A)$	B)	A1cso
	,	ally) independent		istically) independent	(2)
			Notes		
(b)	B1ft for their	(a) + 0.22 or 1 - 1	$P(A' \cap B')$ Do not ft	their (a) if it is > 0.78	
	NB 3	versions for (c). (	Check carefully that	t Ms are genuinely scored.	
	Look out for ass	uming independen	ice and if you see P	(B) = 0.55 check it is <u>derived</u>	l properly
(c)	1 <sup>st</sup> M1 for a corr	rect equation for $x$ e	e.g. $\frac{x}{x + 0.22} = 0.6$	or a correctly derived equation	on for P(B)
		ing to get in form $k$ : $(A \cap B) = P(B) - 0.22$	x = L or correct use	of P(B) to find P(A $\cap$ B) [2 <sup>no</sup>	or 3 <sup>rd</sup> ver]
	A1cso for 0.33	Dep. on <u>both</u> Ms a	nd no incorrect work	ting seen.	
(d)	`			stating $P(A) = P(A B) (= 0.6 \text{ m})$	
	Alcso for a corre	ect statement: P(B)	$\times P(A) = P(A \cap B) o$	or $P(A) = P(A B)$ and stating in	dependent
	NB The M1 in (d There is no ft of a	) using $P(A \cap B)$ represent $P(B)$	equires $P(B) = 0.55$	1	
		is OK even if 0/3 in	(c)	A (0.27 (0.33) 0.00	B
	{This Venn diagram may be helpful.}			.18	
					11621

Question Number	Scheme	Marl	ks
(a)	$P(A \cap B) = P(A B) \times P(B)$ $P(A \cap B) = \frac{2}{5} \times \frac{1}{2} = \frac{1}{5}$	M1 A1	(2)
(b)	2 intersecting circles and 'P( $A \cap B$ )' $\frac{3}{20} \text{ and } \frac{3}{10}$ Box and $\frac{7}{20}$	B1ft B1 B1	(2)
			(3)
(c)	$\left[P(A) = \frac{3}{20} + \frac{1}{5}\right] = \frac{7}{20} \text{ or } 0.35$	B1ft	
(d)	$P(B \mid A) = \frac{P(A \cap B)}{P(A)} = \frac{\frac{1}{5}}{\frac{7}{20}}$	M1	(1)
	$=\frac{4}{7}$	A1 cao	(2)
(e)	0.3	B1ft	(1)
	Notes		
(a)	M1 for $\frac{2}{5} \times \frac{1}{2}$ or a correct probability product expression and one correct prob. Ans	only 2/2	
(b)	1 <sup>st</sup> B1 for 2 intersecting circles labelled <i>A</i> and <i>B</i> and ft their prob. for intersect Condone missing labels for 2 <sup>nd</sup> and 3 <sup>rd</sup> B marks	tion	
(c)	B1ft for 0.35 (o.e.) if no Venn diagram or correct follow through from their or allow 0.35 (or correct ft) from correct working e.g. $0.65 - 0.5 + (a)$ B0 for 0.35 if their diagram does not give 0.35 unless it comes from correct bon't insist on $P(A) =$ but do not award for $P(A' \cap B') = \frac{7}{20}$		
(d)	their (c) NB incorrect use of $P(A' \cap B') = \frac{7}{20}$ scores M0 and num $\geq$ denom scores	s M0	
(e)	A1 for $\frac{4}{7}$ only  B1ft for 0.3 or correct ft from their Venn diagram or ft from $\frac{13}{20}$ – their (c)		

Question Number	Scheme	Marks
(a)	$[P(B \cap R') =]  \underline{0}$	B1
(b)	$P(B) = 0.27 + 0.33 = 0.6$ , $P(D) = 0.27 + 0.15 + t$ , $P(B \cap D) = 0.27$ $[P(B) \times P(D) = P(B \cap D)$ gives] $0.6 \times (0.42 + t) = 0.27$	(1) M1 M1
	$0.42 + t = \frac{0.27}{0.6}$ or $0.6t = 0.018$	A1
	$t = \underline{0.03}$	A1 (4)
(c)	$[u=] 1-(0.6+0.15+t)$ $u=\underline{0.22}$	M1 A1ft
(d)(i)	$\begin{bmatrix} P(R \cap B) \end{bmatrix} = 0.27 + 0.33$	M1
	$= \underline{0.45}$	A1
(ii)	$\left[\frac{P(D \cap [R \cap B'])}{P(R \cap B')} = \right] = \frac{0.15}{0.15 + u}$	M1
	$=\frac{15}{37}$	A1
(e)	37	(4) M1
	= <u>33</u>	A1 (2) [13 marks]

	Notes
(b)	1 <sup>st</sup> M1 for attempting 3 suitable probabilities, one involving t (at least 2 correct)
(0)	e.g. sight of 0.6, 0.27, 0.42 + $t$ correctly labelled in terms of $B$ , $D$ , $R$ or in a correct equation.
	May see e.g. $P(B D) = \frac{0.27}{0.42 + t}$
	2 <sup>nd</sup> M1 for using the independence to form a linear equation in t. ft their probs if stated.
	1 <sup>st</sup> A1 for solving leading to a correct equation as far as $p + t = q$ or $pt = q$
	2 <sup>nd</sup> A1 for 0.03 or exact equivalent
(c)	M1 for a correct expression for $u$ . Allow their $t$ or just letter $t$ in a correct expression
	A1ft for 0.22 (or exact equivalent) or ft their t. i.e. $u = 0.25 - t$ provided $u \& t$ are probs
	Can score M1A1ft provided their $u$ + their $t$ = 0.25 where $u$ and $t$ are both in [0, 1]
(d)(i)	M1 for a correct numerical ratio of probabilities
	A1 for 0.45 or exact equivalent (Answer only 2/2)
(ii)	M1 for a correct numerical ratio of probabilities, ft their u, provided u is a probability
	A1 for $\frac{15}{37}$ or $0.405$ or allow awrt 0.41 following a correct expression (Ans only 2/2)
	M1 for a correct method for <u>both</u> 18 and 15 ft their 0.45 and their $\frac{15}{37}$ provided both in [0,1]
(e)	NB $P(D) \times 77$ is M0
	A1 for 33 only
	NB $\frac{27}{33} \times 40 = 32.7$ which rounds to 33 but scores M0A0. (Ans only send to review)