2002

XVIII

1583

Time allowed

Score

/

Percentage

%

Maths

Mark Scheme

AQA
AS & A LEVEL

Probability

2(a)	$P(X) = 0.3$ $P(Y) = 0.4$ $P(Z) = 0.2$			
(i)	$P(X \cap Y \cap Z) = 0.3 \times 0.4 \times 0.2 = 0.024$	M1	1	
(ii)	$P(X' \cap Y' \cap Z') = 0.7 \times 0.6 \times 0.8$	M1		At least 2 correct terms
	$= 0.336$	A1	2	CAO
(iii)	$P(X' \cap Y' \cap Z) = 0.7 \times 0.6 \times 0.2$	M1		Correct numerical expression
	$= 0.084$	A1		CAO
(b)	$P(W \mid Z) = 0.9$ $P(W \mid Z') = 0.25$			
(i)	$P(Z \cap W) = 0.2 \times 0.9$	M1		Correct numerical expression
	$= 0.18$	A1	2	CAO
(ii)	$P((Z \cap W') \cup (Z' \cap W))$ **or** $1 - [P((Z \cap W) \cup (Z' \cap W'))]$			
	$= 0.2 \times (1 - 0.9)$	M1		0.2×0.9 or (b)(i)
	$+$			
	$(1 - 0.2) \times 0.25$	M1		$(1 - 0.2) \times (1 - 0.25)$
				Cannot score an M1 in both methods
	$= 0.02 + 0.20$			$1 - (0.18 + 0.60)$
	$= 0.22$	A1	3	CAO
	Total		11	

6		0 (R)	1 (S)	2 (T)	≥3	T
	D (D)	24	32	41	23	120
	SD (D')	40	37	88	35	200
	T	64	69	129	58	320

(a)(i) $P(D) = \dfrac{120}{320}$ or $\dfrac{3}{8}$ or 0.375 — B1 — 1 — CAO; or equivalent

(ii) $P(D \cap R) = \dfrac{24}{320}$ or $\dfrac{3}{40}$ or 0.075 — B1 — 1 — CSO; or equivalent

(iii) $P(D \cup T) = \dfrac{120 + 88}{320} = \dfrac{129 + 24 + 32 + 23}{320}$ — M1

$= \dfrac{208}{320}$ or $\dfrac{13}{20}$ or 0.65 — A1 — 2 — CAO; or equivalent

(iv) $P(D \mid R) = \dfrac{P(D \cap R)}{P(R)} = \dfrac{(ii)}{P(R)} = \dfrac{24/(320)}{64/(320)}$ — M1 — M0 if independence assumed

$= \dfrac{24}{64}$ or $\dfrac{3}{8}$ or 0.375 — A1 — 2 — CAO; or equivalent

(v) $P(R \mid D') = \dfrac{P(R \cap D')}{P(D')} = \dfrac{40/(320)}{200/(320)}$ — M1 — numerator — allow independence assumed

M1 — denominator

$= \dfrac{40}{200}$ or $\dfrac{1}{5}$ or 0.2 — A1 — 3 — CAO; or equivalent

(b)(i) R and S or R and T or S and T — B1 — 1 — not D and D'

(ii) $P(D) = 0.375 = P(D \mid R)$ or (i) = (iv) — M1 — $P(D) \times P(R) = 0.375 \times 0.2$ $= 0.075 = P(D \cap R)$ or (ii) or $P(R \mid D) = P(R) = 0.2$, etc

so YES — A1 — 2

(c)(i) A semi-detached house — B1 — CAO
or two children (or both) — B1 — 2 — or equivalent

(ii) A detached house and/with — B1 — CAO
less than two children — B1 — 2 — (0 or 1 must not include 'both')

Total — 16

5(a)	$P(D' \cap E' \cap F') = 0.4 \times 0.3 \times 0.2$	M1		At least 1 probability correct
	$= 0.024$	A1	2	CAO; OE
(b)	$P(D' \cap E' \cap F) = 0.4 \times 0.3 \times 0.8$	M1		At least 2 probabilities correct
	$= 0.096$	A1	2	CAO; OE
(c)	P(One) = (b) $+ P(D \cap E' \cap F') + P(D' \cap E \cap F')$	M1		Use of 3 possibilities; ignore multipliers
	$=$(b) $+ (0.6 \times 0.3 \times 0.2) + (0.4 \times 0.7 \times 0.2)$	M1		At least 1 new term correct
	$= 0.096 + 0.036 + 0.056 = 0.188$	A1	3	CAO; OE
(d)	P(One or two) = (c) + (3 terms each of 3 probabilities) **or** = 1 − (a) − (1 term of 3 probabilities)	M1		(c) + P(Two) Used; OE; ignore multipliers 1 − (a) − P(Three)
	$= 0.188 + (0.6 \times 0.7 \times 0.2) +$ $(0.6 \times 0.3 \times 0.8) + (0.4 \times 0.7 \times 0.8)$ $= 0.188 + 0.084 + 0.144 + 0.224$ **or** $= 1 - 0.024 - (0.6 \times 0.7 \times 0.8)$ $= 1 - 0.024 - 0.336$	M1		At least 1 new term correct
	$= 0.64$	A1	3	CAO; OE
	Total		10	

2	Ratios: Penalise first occurrence only of a correct answer			
(a)(i)	P(Welsh back) $= \dfrac{7}{50}$ or 0.14	B1	1	CAO; OE
(ii)	P(English) $= \dfrac{14+8}{50} =$	B1		Correct expression; PI
	$\dfrac{22}{50}$ or $\dfrac{11}{25}$ or 0.44	B1	2	CAO; OE
(iii)	P(not English) = 1 − (ii) =			
	$\dfrac{28}{50}$ or $\dfrac{14}{25}$ or 0.56	B1√	1	√ on (ii) if used; $0 < p < 1$
(iv)	P(Irish $\vert$ back) = $\dfrac{P(\text{Irish} \cap \text{back})}{P(\text{back})} = \dfrac{6}{\sum(\text{back})} =$	M1		Used; may be implied by values or answer
	$\dfrac{6}{23}$ or 0.26 to 0.261	A1	2	CAO/AWFW (6/50 ⇒ 0)

(v)	P(forward | not Scottish) = $$\dfrac{P(\text{forward} \cap \text{not Scottish})}{P(\text{not Scottish})} =$$ $$\dfrac{14+5+6}{50-4} = \dfrac{27-2}{50-4} =$$	M1		Used; OE May be implied by values or answer
	$$\dfrac{25}{46} \quad \text{or} \quad 0.54 \text{ to } 0.544$$	A1	2	CAO/AWFW (25/50 $\Rightarrow$ 0)
(b)	P(4 × English) = $$\left(\dfrac{22}{50}\right) \times \left(\dfrac{21}{49}\right) \times \left(\dfrac{20}{48}\right) \times \left(\dfrac{19}{47}\right) =$$	M1 M1		Reducing non-tabulated value 4 times Reducing 50 and multiplying 4 terms (ignore multipliers)
	$$\dfrac{175560}{5527200} \quad \text{or} \quad \dfrac{209}{6580}$$ or 0.0317 to 0.032	A1	3	CAO/AWFW
	Total		11	