Topic Y5 Probability and proof (Pre-TT) [42] MARKSCHEME

1.

(i)		$\frac{3}{4}+\frac{1}{4}\times\frac{3}{8}$ $+\frac{1}{4}\times\frac{5}{8}\times\frac{3}{16}$ $=\frac{447}{512}$ or 0.873 (3 sf)	M1 M1 A1 [3]	$\frac{1}{4}\times\frac{5}{8}\times\frac{13}{16}$ (= $\frac{65}{512}$ or 0.127) $1-\frac{1}{4}\times\frac{5}{8}\times\frac{13}{16}$	
(ii)		0.6*p* or equiv seen $0.4+0.6p=0.58$ $p=0.3$	B1 M1 A1 [3]	Tree diag alone insufficient for mark. Or $0.6p=0.18$. "0.18" alone insufficient	NB $0.6\times0.3=0.18$ seen at the end is probably a check, not an answer. But if 0.3 seen and 0.18 is very clearly indicated as the ans then B1M1A0

2.

5(i)	$^{12}/_{22}$ x $^{11}/_{21}$ $=\,^{2}/_{7}$ oe or 0.286 (3 sfs)	M1 A1 2	or $^{12}C_2$ / $^{22}C_2$
(ii)	$^{7}/_{15}$ x $^{6}/_{14}$ x $^{8}/_{13}$ or $^{8}/_{65}$ oe × 3 oe $=\,^{24}/_{65}$ or 0.369 (3 sfs)	M1 M1 A1 3	Numerators any order $^{7}C_2$ x $^{8}C_1$:M1 3 x prod any 3 probs (any C or P)/$^{15}C_3$:M1 (dep <1) $1-(^{8}/_{15}x^{7}/_{14}x^{6}/_{13}+3\times^{8}/_{15}x^{7}/_{14}x^{7}/_{13}+^{7}/_{15}x^{6}/_{14}x^{5}/_{13})$: M2 one prod omitted or wrong: M1
(iii)	$\frac{x}{45}\times\frac{x-1}{44}=\frac{1}{15}$ oe $x^2-x-132=0$ or $x(x-1)=132$ $(x-12)(x+11)=0$ or $x=\frac{1\pm\sqrt{(1^2-4\times(-132))}}{2}$ No. of Ys = 12	M1 A1 M1 A1 4	not $\frac{x}{45}\times\frac{x}{44}=\frac{1}{15}$ or $\frac{x}{45}\times\frac{x}{45}=\frac{1}{15}$ or $\frac{x}{45}\times\frac{x-1}{45}=\frac{1}{15}$ oe ft 3-term QE for M1 condone signs interchanged allow one sign error Not $x=12$ or -11 ans 12 from less wking, eg $12\times11=132$ or T & I: full mks Some incorrect methods: $\frac{x}{45}\times\frac{x-1}{44}=\frac{1}{15}$ oe M1 $x^2+x=132$ A0 $x=11$ M1A0 $12\times11=132$ M1A1M1 $x=12$ and (or "or") 11 A0 NB 12 from eg 12.3 rounded, check method
Total		**9**	

3.

14 (i)	For an explanation or statement to show when the claim $3^x \geq 2^x$ fails This could be e.g. • when $x=-1$, $\frac{1}{3}<\frac{1}{2}$ or $\frac{1}{3}$ is not greater than or equal to $\frac{1}{2}$ • when $x<0$, $3^x<2^x$ or 3^x is not greater than or equal to 2^x	M1	2.3
	followed by an explanation or statement to show when the claim $3^x \geq 2^x$ is true. This could be e.g. • $x=2$, $9 \geq 4$ or 9 is greater than or equal to 4 • when $x \geq 0$, $3^x \geq 2^x$ and a correct conclusion. E.g. • so the claim $3^x \geq 2^x$ is sometimes true	A1	2.4

		(2)	
(ii)	Assume that $\sqrt{3}$ is a rational number So $\sqrt{3} = \frac{p}{q}$, where *p* and *q* integers, $q \neq 0$, and the HCF of *p* and *q* is 1	M1	2.1
	$\Rightarrow p = \sqrt{3}q \Rightarrow p^2 = 3q^2$	M1	1.1b
	$\Rightarrow$ p^2 is divisible by 3 and so *p* is divisible by 3	A1	2.2a
	So $p = 3c$, where *c* is an integer From earlier, $p^2 = 3q^2 \Rightarrow (3c)^2 = 3q^2$	M1	2.1
	$\Rightarrow q^2 = 3c^2 \Rightarrow$ q^2 is divisible by 3 and so *q* is divisible by 3	A1	1.1b
	As both *p* and *q* are both divisible by 3 then the HCF of *p* and *q* is not 1 This contradiction implies that $\sqrt{3}$ is an irrational number	A1	2.4
		(6)	

4.

(i)		Attempt to represent information e.g. by Venn diagram with *x* in centre and 3 other correct values in terms of *x* Attempt total (in terms of *x*) $= 30$ $x = 4$ so $n(S \cap H \cap T) = 4$	**B1** **M1** **E1** **[3]**	**3.3** **3.4** **1.1**	Any equivalent method Or the number doing all three is 4. **E0** for just $x = 4$	**OR** **B1** $\frac{18}{30}+\frac{19}{30}+\frac{17}{30}-\left(\frac{8}{30}+\frac{9}{30}+\frac{11}{30}\right)\left(=\frac{26}{30}\right)$ **M1** $1-"\frac{26}{30}"\left(=\frac{4}{30}\right)$
(ii)		$\frac{5}{9}$ oe	**B1FT** **[1]**	**2.2a**	FT their (i)	
(iii)		$\frac{5}{9}\times\frac{19}{29}$ $\frac{4}{9}\times\frac{18}{29}$ $\frac{5}{9}\times\frac{19}{29}+\frac{4}{9}\times\frac{18}{29}$ $=\frac{167}{261}$ oe or 0.640 (3 s.f.)	**B1** **B1** **M1** **A1** **[4]**	**2.2a** **2.2a** **2.2a** **1.1**	All correct	

5.

7i	$^2/_9$ or $^7/_9$ oe seen $^3/_9$ or $^6/_9$ oe seen $^1/_8$ or $^7/_8$ oe seen Correct structure All correct	B1 B1 B1 B1 B1	5	ie 8 correct branches only, ignore probs & values including probs and values, but headings not req'd
ii	$^3/_{10}$ x $^7/_9$ + $^7/_{10}$ x $^3/_9$ + $^7/_{10}$ x $^6/_9$ $^{14}/_{15}$ or 0.933 oe	M2 A1	3	or $^3/_{10}$x$^7/_9$ + $^7/_{10}$ or $1-{}^3/_{10}$ x $^2/_9$ M1: one correct prod or any prod + $^7/_{10}$ or $^3/_{10}$ x $^2/_9$
iii	$^3/_{10}$ x $^2/_9$ x $^7/_8$ + $^7/_{10}$ x $^6/_9$ $^{21}/_{40}$ or 0.525 oe	M2 A1	3	M1: one correct prod cao
	No ft from diag except: with replacement:	(i) structure: B1	(ii) $^{91}/_{100}$: B2	(iii) 0.553: B2
Total		**11**		