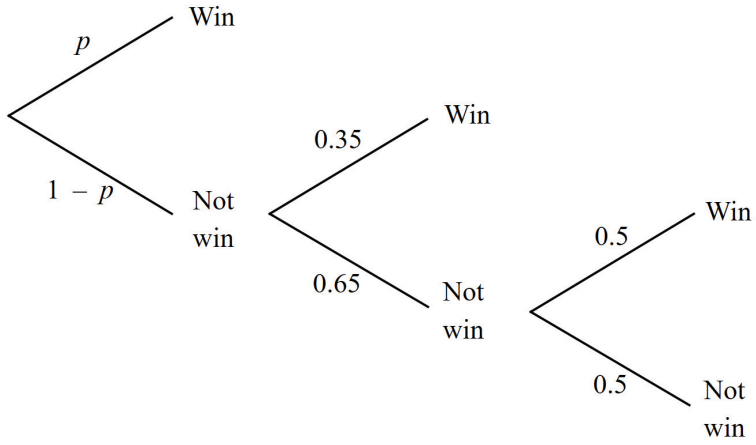
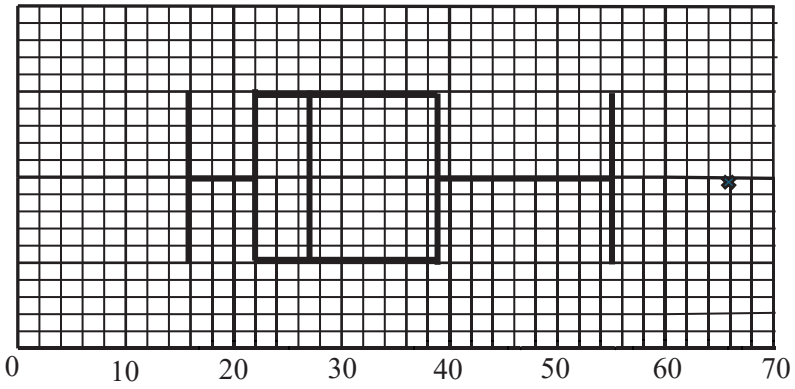
Question Number	Scheme	Marks
1(a)		M1 A1
		(2)
(b)	$p+(1-p)\times 0.35+(1-p)\times 0.65\times 0.5\left[=0.74\right]$ or $(1-p)\times 0.65\times 0.5\left[=1-0.74\right]$	M1
	$0.325p=0.065$ or $1-p=0.8$	M1
	$p=0.2$	A1
		(3)
(c)	0.26 oe	B1
		(1)
(d)	$\frac{"0.8"\times 0.35}{0.74}$	M1
	$=\frac{14}{37}$	A1
		(2)

	Notes		Total 8
(a)	**M1**	for the correct structure of the branches, with no extra branches unless the probabilities = 0	
	A1	all probabilities correct on the branches with appropriate labels. e.g. gets it in and not get it in **or** win and lose **or** in and out	
(b)	**M1**	for a correct probability expression. May be implied by $p = 0.2$ oe	
	M1	For forming an equation with p and $1-p$ and 0.74 with an attempt to solve **or** $1-p$ and $1-0.74$ with an attempt to solve. May be implied by $p = 0.2$ oe	
	A1	Oe e.g. $\frac{1}{5}$	
(c)	**B1**	Oe e.g. $\frac{13}{50}$	
(d)	**M1**	for a correct ratio of probabilities ft their 0.8 ($1-p=0.8$)	
	A1	allow awrt 0.378	

Question Number	Scheme	Marks
2(a)(i)	Median = 27	B1
(ii)	IQR = 39 – 22 = 17	M1 A1
		(3)
(b)	[22 – 1.5 × "17" = – 3.5 and] 39 + 1.5 × "17" = 64.5	M1
	So 66 is the only outlier	A1
		M1 M1 A1ft
		(5)
(c)(i)	$\frac{115}{23}[=5]$ and 115 + 200 × 23 [=4715]	M1
	200 + "5" = 205 and $\frac{"4715"}{23} = 205$	M1A1
(ii)	$\sqrt{\frac{4623}{23} - "5"^2}$ and $\sqrt{\frac{4623 + 400 \times "4715" - 23 \times 40000}{23} - "205"^2}$	M1
	= awrt 13.3	A1
		(5)

	Notes	Total 13
(a)	**B1**	Cao
	M1	for 39 – a where $a < 27$ or b – 22 where $b > 27$ May be implied by IQR = 17
	A1	Cao
(b)	**M1**	for a correct method to find the upper outlier boundary
	A1	for 66 identified as the one outlier **NB** If no working shown then 66 (only) marked on the box plot implies M1A1
	M1	box with 2 whiskers
	M1	lower whisker plotted at 16 or upper whisker at 55/64.5 (ft their upper outlier boundary) Allow ½ square tolerance
	A1ft	fully correct with 1 outlier ft Q1, Q2 and Q3 Allow ½ square tolerance
(c)(i)	**M1**	for $\frac{115}{23}$ May be implied by 5 or 115 + 200 × 23 May be implied by 4715 or $\bar{x} = 205$
	M1	for adding their 5 to 200 or dividing their 4715 by 23 May be implied by 205
	A1	Cao
(ii)	**M1**	for a correct method to find the standard deviation
	A1	awrt 13.3 Allow $\sqrt{176}$ oe e.g. $4\sqrt{11}$

Question Number	Scheme	Marks
3(a)	$[\mathrm{E}(X)=](-4)\times r+(-2)\times s[+0\times t]+2\times s+6\times r[=0.36]$ or $2r[=0.36]$	M1
	$r=0.18$ *	A1*
		(2)
(b)	$[\mathrm{E}(X^2)=](-4)^2\times r+(-2)^2\times s[+0^2\times t]+2^2\times s+6^2\times r$ or $52r+8s$ or $9.36+8s$	M1
	$[\mathrm{Var}(X)=]52r+8s-0.36^2[=10.8304]$ or $[\mathrm{Var}(X)=]9.36+8s-0.36^2[=10.8304]$ or $8s=1.6$	M1
	$s=0.2$	A1
	$2\times 0.18+2\times "s"+t=1$ or $"0.76"+t=1$	M1
	$t=0.24$	A1
		(5)
(c)	$[\mathrm{E}(7-5X)=7-5\times 0.36=]5.2$	B1
	$[\mathrm{Var}(7-5X)=](-5)^2\times 10.8304$ or $297.8-5.2^2$	M1
	$=270.76$ awrt 271	A1
		(3)
(d)	$2X^2+5X-7>0$ or $2X^2$: 32. 8, 0, 8, 72	M1
	$[(X-1)(2X+7)>0]$ so $X>1$ or $X<-3.5$ or $7-5X$: 27, 17, 7, –3, –23	M1
	Need –4, 2 and 6 or $2r+s$ or $2\times 0.18+"0.2"$	M1
	0.56	A1
		(4)

	Notes		Total 14
(a)	**M1**	for a correct method to find E(X) e.g. $-4r-2s$ [$+0t$] $+2s+6r$ or $2r=\ldots$	
	A1*	Answer is given so no incorrect working must be seen	
(b)	**M1**	for a correct method to find E(X^2) e.g. $16r+4s$ [$+0t$] $+4s+36r$ May be seen embedded in a calculation of Var(X)	
	M1	for a correct method to find Var(X) in terms of s and r	
	A1	$s=0.2$	
	M1	for use of the sum of the probabilities = 1 You may need to check if no working shown $(t=0.64-2\times "s")$	
	A1	$t=0.24$	
(c)	**B1**	Cao	
	M1	For $(-5)^2\times 10.8304$ or $297.8-5.2^2$	
	A1	awrt 271	
(d)	**M1**	for a correct inequality > 0 Can be implied by $x=-3.5$ and $x=1$or all values of $2X^2$ stated. May be implied by all values of $2X^2+5X-7$: 5, –9, –7, 11, 95	
	M1	for $X>1$ or $X<-3.5$ Can be implied by identifying –4, 2 and 6 or all values of $7-5X$ stated. May be implied by all values of $2X^2+5X-7$: 5, –9, –7, 11, 95	
	M1	for identifying –4, 2 and 6 If seen as a calculation then ft their s May be seen in parts e.g. 0.18 + "0.2" and 0.18	
	A1	Oe	

Question Number	Scheme	Marks
4(a)	Width = 3 [cm]	B1
	Area of 6.72 for a frequency of 16 so $\frac{6.72}{16}\times 40 = 16.8$ for a frequency of 40	M1
	$[h =]\frac{16.8}{3} = 5.6$ [cm]	A1
		(3)
(b)	$Q_2[= 45+]\frac{17}{50}\times 2$ or $Q_2[= 47-]\frac{33}{50}\times 2$ or $[45+]\frac{125-108}{158-108}\times(47-45)$ or $[47-]\frac{158-125}{158-108}\times(47-45)$	M1
	= awrt 45.7	A1
		(2)
(c)(i)	Mean = $\left[\frac{11225}{250} =\right] 44.9$	B1
(ii)	$\sqrt{\frac{507388}{250} - "44.9"^2}$ = awrt 3.68	M1 A1
		(3)
(d)	$\frac{16}{4} + 49 + \frac{40}{2}[= 73]$ or $\left(\frac{1}{2}\times 40 + 68\right) - \left(\frac{3}{4}\times 16 + 3\right)[= 73]$	M1
	$\frac{"73"}{250}\times\frac{"72"}{249}$	M1
	$\frac{876}{10375} = 0.0844...$	A1
		(3)
(e)(i)	No change	B1
(ii)	No change	B1
		(2)

	Notes	Total 13
(a)	**B1**	Cao
	M1	for sight of 16.8 or fd = 4 or $w \times h = 16.8$ oe
	A1	Cao
(b)	**M1**	for $\frac{17}{50}\times 2$ or $\frac{33}{50}\times 2$ Allow use of 17.5 or 32.5
	A1	awrt 45.7
(c)(i)	**B1**	Cao
(ii)	**M1**	a correct method to find the standard deviation (must include the square root)
	A1	awrt 3.68
(d)	**M1**	for a correct method to find the number of people. May be implied by 73
	M1	Ft their 73
	A1	oe Allow awrt 0.084
(e)(i)	**B1**	Cao
(ii)	**B1**	Cao

Question Number	Scheme	Marks
5(a)	$\frac{9}{25}=x+x-x^2$ oe or $1-2x+x^2=\frac{16}{25}$ oe	M1
	$\left[(5x-1)(5x-9)=0\Rightarrow\right]x=\frac{1}{5}$ or $\left[(1-x)^2=\frac{16}{25}\Rightarrow\right]x=\frac{1}{5}$	A1
		(2)
(b)(i)	$3\mathrm{P}(C\cap D)=\frac{11}{20}+\mathrm{P}(D)-\mathrm{P}(C\cap D)$	M1
	$\frac{6}{13}\mathrm{P}(D)=\mathrm{P}(C\cap D)$	M1
	$4\left(\frac{6}{13}\mathrm{P}(D)\right)=\frac{11}{20}+\mathrm{P}(D)$ oe	M1
	$\mathrm{P}(D)=\frac{13}{20}$	A1
		(4)
(b)(ii)	$\mathrm{P}(C\cap D)=\frac{3}{10}$	B1ft
	$\left[\mathrm{P}(D\mid C')=\right]\frac{\mathrm{P}(D\cap C')}{\mathrm{P}(C')}=\frac{7/20}{9/20}=\frac{7}{9}$	M1A1
		(3)

	Notes	Total 9
(a)	**M1**	for a correct 3TQ May be implied by $x=\frac{1}{5}$ or $x=\frac{9}{5}$
	A1	Oe If $x=\frac{9}{5}$ is stated then it must be rejected
(b)(i)	**M1**	for writing or using $\mathrm{P}(C\cup D)=\mathrm{P}(C)+\mathrm{P}(D)-\mathrm{P}(C\cap D)$
	M1	for use of $\mathrm{P}(C\mid D)=\frac{6}{13}$ e.g. $\frac{6}{13}=\frac{\mathrm{P}(C\cap D)}{\mathrm{P}(D)}$ May be embedded in an equation to find the P(D)
	M1	for setting up a correct equation in terms of P(D) only Allow equivalent equations e.g. $\mathrm{P}(D)\left(4\left(\frac{6}{13}\right)-1\right)=\frac{11}{20}$ or $\frac{\frac{1}{4}\left(\frac{11}{20}+\mathrm{P}(D)\right)}{\mathrm{P}(D)}=\frac{6}{13}$ May be implied by $\mathrm{P}(D)=\frac{13}{20}$ oe
	A1	Oe
(b)(ii)	**B1ft**	for $\mathrm{P}(C\cap D)=\frac{3}{10}$ ft their P(D) e.g. $\frac{6}{13}\times"\frac{13}{20}"$ May be seen in (b)(i) May be implied by $\mathrm{P}(D\cap C')=\frac{7}{20}$ or $\mathrm{P}(C\mid D)=\frac{7}{9}$
	M1	for a correct conditional probability expression e.g. $\frac{\mathrm{P}(D\cap C')}{\mathrm{P}(C')}$ or $\frac{\mathrm{P}(D)-\mathrm{P}(C\cap D)}{1-\mathrm{P}(C)}$ oe or a correct ratio of probabilities.
	A1	Allow awrt 0.778

Question Number	Scheme	Marks
6(a)	$P(W > 3500) = P\left(Z > \frac{3500-3200}{200}\right)\left[= P(Z > 1.5)\right]$	M1
	0.0668 (Calc 0.066807…) awrt 0.0668	A1
		(2)
(b)	$P(W > 3600) = P\left(Z > \frac{3600-3200}{200}\right)\left[= P(Z > 2)\right]$	M1
	0.0228 (Calc 0.02275…)	A1
	$\frac{"0.0228"}{"0.0668"}$	M1
	0.3413… awrt 0.341	A1
		(4)
(c)	$0.756 \times "0.0668" \left[= 0.0505\right]$	M1
	$\frac{w-3200}{200} = 1.64$	M1B1
	3528	A1
		(4)

	Notes	Total 10
(a)	**M1**	for standardising using 3500, 3200 and 200 May be implied by ± 1.5
	A1	awrt 0.0668
(b)	**M1**	for standardising using 3600, 3200 and 200 May be implied by ± 2
	A1	awrt 0.0228 May be implied by 1 – 0.9772 if used in a ratio of probabilities
	M1	for a correct ratio of probabilities ft their 0.0228 and their 0.0668 provided it results in a probability
	A1	awrt 0.341 Allow $\frac{57}{167}$
(c)	**M1**	ft their 0.0668 May be implied by 0.0505
	M1	for standardising (allow any letter) and set = to z value $1.6 < \lvert z \rvert < 1.68$
	B1	for awrt 1.64 seen
	A1	For 3528 or 3530 **only**

Question Number	Scheme	Marks
7(a)	$\left[S_{yy} =\right] 9^2 \times 10 [= 810]$	M1
	$\left[S_{xy} =\right] 0.8 \times "810" [= 648]$	M1
	$\sum xy = "648" + \dfrac{104.5 \times 113.6}{10}$	M1
	$= 1835.12$	A1
		(4)
(b)	$\left[S_{xx} =\right] 9.3^2 \times 10 [= 864.9]$	M1
	$b = \dfrac{"648"}{"864.9"} [= 0.7492...]$ or $b = \dfrac{\left(\dfrac{"648"}{\sqrt{"810" \times "864.9"}}\right)^2}{0.8} [= .7492...]$	M1
	$a = 11.36 - "0.7492"... \times 10.45 [= 3.530...]$	M1
	$y = 3.53 + 0.749x$	A1
		(4)

NB Any solutions using Cov(x, y) Please send to review

	Notes		Total 8
	Mark parts (a) and (b) together		
(a)	**M1**	for a correct method to find S_{yy} May be implied by 810	
	M1	for a correct method to find S_{xy} ft S_{yy} May be implied by 648	
	M1	for a correct method to find $\sum xy$ ft S_{xy} (may need to check this if no working shown)	
	A1	Allow $\frac{45878}{25}$	
(b)	**M1**	for a correct method to find S_{xx} May be implied by 864.9 May be seen in part (a)	
	M1	for a correct method to find b ft S_{xy} and S_{xx} or ft their S_{xy}, S_{yy} and S_{xx}	
	M1	for a correct method to find a ft their b Do not allow $b = 0.8$	
	A1	for y = awrt 3.53 + awrt 0.749x	