Question Number	Scheme	Marks
4 (a)	$X \sim N(170,16^2)$	
	$P(X>190)=P\left(Z>\frac{190-170}{16}\right)\left[=P(Z>1.25)\right]$	M1
	$[=1-0.8944]=0.1056$ awrt 0.106	A1
		(2)
(b)	$P(X>d)=0.9$	
	$\frac{d-170}{16}=-1.2816$ or $\frac{170-d}{16}=1.2816$ (Calc value ±1.28155…)	M1 A1
	$d=149.494...$ awrt 149	dA1
		(3)
	Notes	**Total 5**

Question Number	Scheme	Marks
5. (a)	$[P(A<388)=0.001 \Rightarrow]$ $\frac{388-\mu}{\sigma}=\pm z$ (where $\lvert z\rvert>2.25$)	M1
	So $388-\mu=-3.0902\sigma$ (o.e.)	A1
	$[P(A>410)=0.0197 \Rightarrow]$ $\frac{410-\mu}{\sigma}=\pm z$ (where $1<\lvert z\rvert<2.5$)	M1
	So $410-\mu=2.06\sigma$ (o.e.)	A1
	So $22=5.1502\,\sigma$ (calc gives 5.1502323…)	M1
	$\underline{\boldsymbol{\sigma}}=4.2716…$ (awrt **4.27**) and $\underline{\boldsymbol{\mu}}=401.20…$ (awrt **401**)	A1, A1
		(7)
(b)	[Let X = profit in £]	
	x -100 -0.30 0.25	M1
	$P(X=x)$ 0.001 0.0197 $1-(0.001+0.0197)=0.9793$	M1
	$E(X)=-100\times0.001-0.30\times0.0197+0.25\times0.9793$	M1
	$=0.138915…$ (**£ 0.14**)	A1
	(allow any answer in the range 0.138…~0.141…)	
		(4)
		[Total 11]

Question Number	Scheme	Marks
4. (a)	[W = weight of a package delivered to Susie $W \sim N(510, 45^2)$]	
	$P(W < 450) = P\left(Z < \frac{450-510}{45}\right)$ or $P(Z < -1.3333)$	M1
	$= 1 - 0.9082$	M1
	$= 0.0918$ **[0.0912~0.0918]**	A1
		(3)
(b)	[$P(W > d) = 0.05$ implies] $\frac{d-510}{45} = 1.6449$	M1B1
	$d = 584.0205\ldots$ awrt **584**	A1
		(3)
(c)	$[P(W > 450 \mid W < \text{“584.02…”}) =] \frac{P(450 < W < \text{"584.02..."})}{P(W < \text{"584.02..."})}$	M1
	$= \frac{0.95 - \text{"0.0918"}}{0.95}$ or $\frac{\text{"0.9082"} - 0.05}{0.95}$	M1A1
	$= 0.903368\ldots$ awrt **0.904** or **0.903**	A1
		(4)
(d)	$\left(\frac{19}{20}\right)^4 \times \frac{1}{20} \times 5$	M1dM1
	$= 0.203626\ldots$ awrt **0.204**	A1
		(3)
		[13]

Question Number	Scheme	Marks
3(a)	$P(X < 40) = P\left(Z < \frac{40-42}{5}\right) = P(Z < -0.4)$	M1
	$= 1 - 0.6554$	M1
	$= 0.3446$ awrt **0.345**	A1
		(3)
(b)	P(Qualify) = $1 - (\text{"0.3446"})^3$ or $(1 - \text{"0.3446"}) + (\text{"0.3446"})(1 - \text{"0.3446"}) + (\text{"0.3446"})^2(1 - \text{"0.3446"})$	M1
	[$q = 0.9590\ldots$ full calc: 0.9590867…]	
	$P(X > 45) = P\left(Z > \frac{45-42}{5}\right) = P(Z > 0.6)$	M1
	$= 1 - 0.7257$ or 0.2743 allow 1 – awrt 0.726 or awrt 0.274	A1
	$P(X > 45 \text{ on 3rd throw} \mid \text{in final}) = \frac{\text{"0.3446"}^2 \times \text{"0.2743"}}{\text{"0.959"}}$	dM1
	$= \frac{\text{"0.0326..."}}{\text{"0.9590..."}}$ (calc: 0.033952…)	
	= awrt **0.034**	A1
		(5)
		Total 8

Qu	Scheme	Marks
7(a)(i)	$P(J>510)=P\left(Z>\frac{510-500}{25}\right)$ or $P(Z>0.4)$	M1
	$=1-0.6554 \Rightarrow 0.3446$ *	A1*
		(2)
(ii)	$\frac{d-500}{25}=-1.4$ (calc –1.3997…)	M1B1
	$d=465$ (calc 465.007)	dA1
		(3)
(b)	$(1-0.3446)^5$	M1
	$=0.1209\ldots$ **awrt 0.121**	A1
		(2)
(c)	$\frac{r-520}{k}=-1.0364$	M1A1
	$\frac{3r-800-520}{k}=2.5758$	M1A1
	$-240=(3\times-"1.0364k")-"2.5758"k$ or $\frac{r-520}{"-1.0364"}=\frac{3r-1320}{"2.5758"}$ oe	ddM1
	$k=42.216...$ **awrt 42**	A1
	$r=476.246...$ **awrt 476**	dA1
		(7)
	Notes	**Total 14**

Question Number	Scheme	Marks
5. (a)	$P(X<7)=P\left(Z<\frac{7-10}{6}\right)=P(Z<-0.5)$	M1
	$=1-0.6915$; $=0.308537\ldots$ awrt **0.309**	M1; A1
		(3)
(b)	$\frac{10+k-10}{6}=0.8416$	M1 B1
	$k=5.0496$ awrt **5.05**	A1
		(3)
(c)	Area of rectangle is $X(X-3)$	M1
	Need $X(X-3)>40$	M1
	$X^2-3X-40>0 \Rightarrow (X-8)(X+5)>0$	M1
	So critical values are 8 and -5	A1
	Need $P(X>8)+P(X<-5)$ or $1-P(-5<X<8)$	M1
	So $P(Z>-0.33)+P(Z<-2.5)$	M1
	$=0.6293+0.0062$	dM1
	$=0.6355$ $[0.6355\sim0.637]$	A1
		(8)
		[14]

Question Number	Scheme	Marks
5. (a)	$P(X<37) = P\left(Z<\frac{37-40}{2.4}\right) = P(Z<-1.25)$	M1
	$= 1-0.8944$; $= 0.105649...$ awrt **0.106**	M1; A1 (3)
(b)	P(one value is greater than 32) $= \sqrt{0.16}$ [=0.4]	M1
	$\frac{32-m}{2.4} = 0.2533$	M1 B1
	$m = 31.392...$ awrt **31.4**	A1 (4)
(c)	$P(Y<0) = P\left(Z<\frac{0-4}{8}\right) = P(Z<-0.5)$ [= 0.3085]	M1
	Let X be the number of negative values	
	$P(X \geqslant 1) = 1 - P(X=0)$ oe	M1
	$= 1-(0.6915)^5$	M1
	$= 0.84188...$ awrt **0.842**	A1 (4)
		[11]
	Notes	