5(a)	$\frac{1}{16}\left[\frac{2}{3}x^{\frac{3}{2}}\right]_0^4+\frac{1}{k}\left[2\sqrt{x}\right]_4^9=1$ $\frac{1}{24}(8-0)+\frac{2}{k}(3-2)=1$ OR $\frac{1}{3}+\frac{2}{k}=1$
	$\frac{2}{k}=\frac{2}{3},\ k=3$
5(b)	$\frac{1}{16}\int_0^4\sqrt{x}\,\mathrm{d}x+\frac{1}{3}\int_4^m x^{-\frac{1}{2}}\,\mathrm{d}x=\frac{1}{2}$ OR $\frac{1}{3}\int_m^9 x^{-\frac{1}{2}}\,\mathrm{d}x=0.5$
	$\frac{1}{3}+\frac{2}{3}\left(\sqrt{m}-2\right)=\frac{1}{2}$ OR $\frac{2}{3}\left(3-\sqrt{m}\right)=\frac{1}{2}$
	$m=\frac{81}{16}\quad[=5.0625]$

5(c)	$\mathrm{F}(x)=\begin{cases}\frac{1}{24}x^{\frac{3}{2}} & 0\leqslant x<4\\ \frac{2}{3}x^{\frac{1}{2}}-1 & 4\leqslant x\leqslant 9\end{cases}$
	$\mathrm{G}(y)=\begin{cases}\frac{1}{24}y^3 & 0\leqslant y<2\\ \frac{2}{3}y-1 & 2\leqslant y\leqslant 3\end{cases}$
	$\mathrm{g}(y)=\begin{cases}\frac{1}{8}y^2 & 0\leqslant y<2\\ \frac{2}{3} & 2\leqslant y\leqslant 3\\ 0 & \text{otherwise}\end{cases}$
	Alternative method for question 5(c)
	Using chain rule (or inverse function): $\mathrm{G}(y)=\mathrm{F}\left(y^2\right)$ so $\mathrm{g}(y)=\frac{\mathrm{d}}{\mathrm{d}y}\mathrm{F}\left(y^2\right)=2y\mathrm{f}\left(y^2\right)$.
	$\mathrm{g}(y)=\begin{cases}2y\left(\frac{1}{16}\sqrt{y^2}\right) & 0\leqslant y<2\\ 2y\left(\frac{1}{3\sqrt{y^2}}\right) & 2\leqslant y\leqslant 3\end{cases}$
	$\mathrm{g}(y)=\begin{cases}\frac{1}{8}y^2 & 0\leqslant y<2\\ \frac{2}{3} & 2\leqslant y\leqslant 3\\ 0 & \text{otherwise}\end{cases}$

4(a)	$a = -\frac{1}{5}$
	$b = \frac{7}{25}$
4(b)	$\mathrm{f}(x) = \begin{cases} \frac{1}{5} & 1 \leqslant x < 4, \\ \frac{1}{25}x & 4 \leqslant x \leqslant 6, \\ 0 & \text{otherwise.} \end{cases}$
4(c)	$\mathrm{E}(X^2) = \frac{1}{5}\int_1^4 x^2 \mathrm{d}x + \frac{1}{25}\int_4^6 x^3 \mathrm{d}x = \left[\frac{1}{15}x^3\right]_1^4 + \left[\frac{1}{100}x^4\right]_4^6$
	$\mathrm{Var}(X) = \frac{73}{5} - \left(\frac{529}{150}\right)^2$
	2.16
4(d)	10th percentile: $\frac{1}{5}x - \frac{1}{5} = \frac{1}{10}$ 90th percentile: $\frac{1}{50}x^2 + \frac{7}{25} = \frac{9}{10}$
	10th percentile = 1.5
	90th percentile = $\sqrt{31}$

2(a)	$(\mathrm{F}(x) =) \begin{cases} 0 & x < 0 \\ \frac{2}{9}x^2 + \frac{4}{9}x & 0 \leqslant x < 1 \\ \frac{1}{3}(x-2)^3 + 1 & 1 \leqslant x \leqslant 2 \\ 1 & x > 2 \end{cases}$
2(b)	$\frac{2}{9}m^2 + \frac{4}{9}m = \frac{1}{2}$
	$m = \frac{1}{2}\left(-2 + \sqrt{13}\right)$
2(c)	$(\mathrm{G}(y) =) \begin{cases} 0 & y < 0 \\ \frac{2}{9}y^4 + \frac{4}{9}y^2 & 0 \leqslant y < 1 \\ \frac{1}{3}(y^2-2)^3 + 1 & 1 \leqslant y \leqslant \sqrt{2} \\ 1 & y > \sqrt{2} \end{cases}$

2(d)	$\mathrm{G}\left(\frac{1}{2}\left(-2+\sqrt{13}\right)\right)=0.379$
	$0.379<0.5$ so the median of Y is greater than the median of X.
	Alternative method for question 2(d)
	$m_y^2=\dfrac{-2+\sqrt{13}}{2}$
	$m_y^2=m_x<1$ and hence $m_y>m_x$.
	Alternative method for question 2(d)
	Solves $\frac{2}{9}y^4+\frac{4}{9}y^2=\frac{1}{2}$.
	$m_y=0.896>0.803=m_x$

2(a)	$5a+\frac{3}{2}a=1$, leading to $a=\frac{2}{13}$.
	Attempt to solve 2 independent equations in b and c or 3 independent equations in a, b and c.
	$b=\frac{16}{39}$, $c=\frac{2}{39}$
2(b)	$\left[\mathrm{E}(X)=\right]\int_0^5 \frac{2}{13}x\,\mathrm{d}x+\int_5^8 x\left(\frac{16}{39}-\frac{2}{39}x\right)\mathrm{d}x$
	$\left[\frac{1}{13}x^2\right]_0^5+\left[\frac{8}{39}x^2-\frac{2}{117}x^3\right]_5^8$
	$\frac{43}{13}=3.31$
2(c)	$\frac{2}{13}m=0.5$ OR $\int_0^m \frac{2}{13}\mathrm{d}x=0.5$
	$m=\frac{13}{4}=3.25$
2(d)	$\frac{2}{13}x,\ \frac{16}{39}x-\frac{1}{39}x^2\ (+k)$
	$k=-\frac{25}{39}$
	$\mathrm{G}(y)=\begin{cases}0 & y<0\\ \frac{2}{13}\sqrt{y} & 0\leqslant y\leqslant 25\\ \frac{16}{39}\sqrt{y}-\frac{1}{39}y-\frac{25}{39} & 25<y\leqslant 64\\ 1 & y>64\end{cases}$

3(a)	$\int_0^1 kx\,\mathrm{d}x + \int_1^8 k(8-x)\,\mathrm{d}x = 1 \quad \left[\left[\tfrac{1}{2}kx^2\right]_0^1 + \left[8kx - \tfrac{1}{2}kx^2\right]_1^8 = 1\right]$ $\tfrac{1}{2}k + (64k - 32k) - (8k - \tfrac{1}{2}k) = 1$
	$25k = 1$, leading to $k = \frac{1}{25}$.
	Alternative method for question 3(a)
	$\tfrac{1}{2}\times 1\times k + \tfrac{1}{2}\times 7\times 7k = 1$
	$25k = 1$, leading to $k = \frac{1}{25}$.
3(b)	$\int_0^1 kx\,\mathrm{d}x + \int_1^m k(8-x)\,\mathrm{d}x = \tfrac{1}{2}$
	$m^2 - 16m + 39 = 0$ or
	$m = 3$
	Alternative method for question 3(b)
	$\tfrac{1}{2}\times(8-m)\times k(8-m) = \tfrac{1}{2}$
	$(8-m)^2 = 25$
	$m = 3$

3(c)	$\mathrm{F}(x) = \begin{cases} \frac{1}{50}x^2 & [0 \leqslant x < 1] \\ \frac{8}{25}x - \frac{1}{50}x^2 - \frac{7}{25} & [1 \leqslant x \leqslant 8] \end{cases}$ [$\mathrm{F}(x) = 0$ for $x < 0$ and $\mathrm{F}(x) = 1$ for $x > 8$]
	$\mathrm{G}(y) = \begin{cases} \frac{1}{50}y^6 & [0 \leqslant y < 1] \\ \frac{8}{25}y^3 - \frac{1}{50}y^6 - \frac{7}{25} & [1 \leqslant y \leqslant 2] \end{cases}$ [$\mathrm{G}(y) = 0$ for $x < 0$ and $\mathrm{G}(y) = 1$ for $y > 2$]
	$\mathrm{g}(y) = \begin{cases} \frac{3}{25}y^5 & 0 \leqslant y < 1 \\ \frac{24}{25}y^2 - \frac{3}{25}y^5 & 1 \leqslant y \leqslant 2 \\ 0 & \text{otherwise.} \end{cases}$
	Alternative method for question 3(c)
	Let $\mathrm{p}(y) = \sqrt[3]{y}$, then $\mathrm{q}(y) = \mathrm{p}^{-1}(y) = y^3$.
	$\mathrm{q}'(y) = 3y^2$.
	$\mathrm{g}(y) = \begin{cases} \frac{1}{25}y^3(3y^2) & [0 \leqslant y < 1] \\ \frac{1}{25}(8-y^3)(3y^2) & [1 \leqslant y \leqslant 2] \end{cases}$ or $\mathrm{g}(x) = \begin{cases} \frac{1}{25}x(3x^{\frac{2}{3}}) & [0 \leqslant x < 1] \\ \frac{1}{25}(8-x)(3x^{\frac{2}{3}}) & [1 \leqslant x \leqslant 8] \end{cases}$ ($\mathrm{g}(y) = 0$ otherwise) ($\mathrm{g}(x) = 0$ otherwise)
	$\mathrm{g}(y) = \begin{cases} \frac{3}{25}y^5 & 0 \leqslant y < 1 \\ \frac{24}{25}y^2 - \frac{3}{25}y^5 & 1 \leqslant y \leqslant 2 \\ 0 & \text{otherwise.} \end{cases}$