Marking Scheme Module 1 Paper 1

No.		Solution	Marks
1.	(a)	$= \log_2 2^2 + \log_2 m + \log_2 n$ $= 2\log_2 2 + 2x + \dfrac{\log_4 n}{\log_4 2}$ $= 2 + 2x + \dfrac{y-3}{\log_4 4^{\frac{1}{2}}}$ $= 2 + 2x + 2(y-3)$ $= 2x + 2y - 4$	1 1
	(b)	$= \dfrac{\log_2 n}{\log_2 m}$ $= \dfrac{2(y-3)}{2x}$ $= \dfrac{y-3}{x}$	 1
2.		$90\,000\left(\dfrac{26}{25}\right)^{x-1} > 450\,000$ $\left(\dfrac{26}{25}\right)^{x-1} > 5$ $\log_{10}\left(\dfrac{26}{25}\right)^{x-1} > \log_{10} 5$ $(x-1)\log_{10}\dfrac{26}{25} > \log_{10} 5$ $x - 1 > \dfrac{\log_{10} 5}{\log_{10}\frac{26}{25}}$ $x > 42.04$ $x = 43\ years$	1 1 1
3.		$Distance = \sqrt{13.5^2 + 9.3^2} = 16.39\ km$ She has to pay the delivery cost because her house is located outside the 16 km radius.	1 1
4.		$Mean = 2(x+2) - 3 = 2x + 1$ $Standard\ deviation = 2\sqrt{y-3}$ $Variance = 2^2(y-3) = 4y - 12$	1 1 1
5.		$\left(\dfrac{x}{6} - \dfrac{y}{3} = 2\right) \div 2$ $\dfrac{x}{12} - \dfrac{y}{6} = 1$ $m = -\dfrac{(-6)}{12} = \dfrac{1}{2}$ $y - (-8) = \dfrac{1}{2}(x+3)$ $y = \dfrac{1}{2}x - \dfrac{13}{2}$	 1 1 1

6.	(a) (b)	$\overline{x} = \frac{688}{10} = 68.8$ Karen's performance is not good because her score is less than the mean.	1,1 1
7.		$\begin{pmatrix} 6+3 \\ -2-4 \end{pmatrix} + 3\begin{pmatrix} k-6 \\ m+2 \end{pmatrix} = \begin{pmatrix} 3 \\ -6 \end{pmatrix}$ $3k - 9 = 3$ $k = 4$ $3m = -6$ $m = -2$	1 1 1 1
8.	(a) (b)	$\sec x = \frac{1}{\sqrt{1-p^2}}$ $\cos 2x = 1 - 2\sin^2 x$ $= 1 - 2p^2$	1 1 1
9.		$log_{10} y = log_{10}(a3^x)$ $log_{10} y = log_{10} a + log_{10} 3^x$ $log_{10} y = log_{10} a + x log_{10} 3$ $log_{10} a = 4$ $a = 10^4 @ 10000$ $t = 4 + 3log_{10} 3$ $t = 5.431$	 1 1 1 1
10.		$\int_0^h (x^2 - 8)dx = -5h$ $\left[\frac{x^3}{3} - 8x\right]_0^h = -5h$ $\left[\frac{h^3}{3} - 8h\right] - 0 = -5h$ $\frac{h^3}{3} - 8h = -5h$ $\frac{h^3}{3} = 3h$ $h^3 - 9h = 0$ $h(h^2 - 9) = 0$ $h(h-3)(h+3) = 0$ $h = 3, h = -3, h = 0$ $h = 3$	1 1 1 1
11.	(a)	Probability of not getting "3" in a roll $= \frac{5}{6}$ Probability of not getting "3" in a roll of 8 fair dice $= \left(\frac{5}{6}\right)^8$ Probability of getting at least one "3" in a roll of 8 fair dice $=$ $1 - \left(\frac{5}{6}\right)^8$ $= 0.7674$	 1 1

		Probability of not getting "3" in a roll of n fair dice $= \left(\frac{5}{6}\right)^n$ Probability of getting at least one "3" in a roll of n fair dice $= 1 - \left(\frac{5}{6}\right)^n$ $1 - \left(\frac{5}{6}\right)^n > 0.95$ $\left(\frac{5}{6}\right)^n < 0.05$ $(1.2)^n > 20$ $n > \frac{\log_{10} 20}{\log_{10} 1.2}$ $n > 16.43$ The smallest number of dice is 17.	1 1
12.		$\mu = 13.2 \qquad \sigma^2 = 1.584$ $\mu = np$ $13.2 = np$ $\sigma^2 = npq$ $\sigma^2 = np(1-p)$ $1.584 = 13.2(1-p)$ $\frac{1.584}{13.2} = 1 - p$ $0.12 = 1 - p$ $p = 0.88$ $np = 13.2$ $n(0.88) = 13.2$ $n = 15$	 1 1 1
13.		$\mu = 60$ and $z = -2$ $\frac{m-60}{2.5} = -2$ $m = 55$	1, 1 1 1
14.		$2x^2 - 6x + h + 4 = 0$ $(-6)^2 - 4(2)(h+4) > 0$ $36 - 8h - 32 > 0$ $4 > 8h$ $h < ½$	1 1 1
15.		$(-2)^2 - p(-2) + 6 = 0.$ $4 + 2p + 6 = 0$ $p = -5$	1 1
16.		$f(2x+3) = k(2x+3) - 4$ $= 2kx + 3k - 4$ $3k - 4 = h$ $k = \frac{h+4}{3}$	1 1 1

17.	(a)	$\frac{3x+1}{2} = x$	1
		$x = -1$	1
	(b)	$\frac{3(2m+7)+1}{2} = 4 - m$	1
		$m = -\frac{7}{4}$	1
18.	(a)	(2 , -16)	1
	(b)	x = 2 or x-2 = 0	1
	(c)	-2 < x < 6	1
19.		$4m^2 - m < 5$ $4m^2 - m - 5 < 0$ $(4m - 5)(m + 1) < 0$	1
		$-1 < m < \frac{5}{4}$	1
20.		$\cos 30^o = \frac{MB}{\sqrt{3}k}$ or $\cos 60^o = \frac{AM}{k}$ or $\sin 60^o = \frac{h}{k}$	1
		$MB = \frac{3}{2}k$ or $AM = \frac{1}{2}k$ or $h = \frac{\sqrt{3}}{2}k$	1
		Area = $\frac{1}{2}k^2\left(\frac{\pi}{3}\right) - \frac{1}{2}(\frac{1}{2}k)(\frac{\sqrt{3}}{2}k) + \frac{1}{2}(\sqrt{3k})^2(\frac{\pi}{6}) - \frac{1}{2}(\frac{\sqrt{3}}{2}k)(\frac{3}{2}k)$	1
		$= \frac{5}{12}\pi k^2 - \frac{\sqrt{3}}{2}k^2$	1
21.		$\frac{ds}{dx} = \frac{1}{2}(4x^4 - 6x^2 + \frac{49}{16})^{-\frac{1}{2}}(16x^3 - 12x)$	1
		$(16x^3 - 12x) = 0$	1
		$x = 0 \quad or\ x = \pm\sqrt{\frac{3}{4}}$	1
		$P\left(\frac{\sqrt{3}}{2}, \frac{3}{2}\right) \quad or \quad P\left(-\frac{\sqrt{3}}{2}, \frac{3}{2}\right)$	1
22.	(a)	d = - 3x	1
	(b)	a +7d = *y*	
		a = y + 21 *x*	1
		$S_{10} = \frac{10}{2}(y + 21x + y - 6x)$	
		$= 10y + 75x$	1
23.		$r = ¼$	1
		$S_\infty - S_4 = \frac{p^2}{1-\left(\frac{1}{4}\right)} - \frac{p^2(1-(\frac{1}{4})^4)}{1-\frac{1}{4}}$	1
		$= \frac{4}{3}(p^2 - p^2 + p^2(\frac{1}{256})$	1
		$= \frac{1}{192}p^2$	1
24.		$m = \frac{6-(-4)}{4-0}$ $m = \frac{10}{4}$	

		$m = \frac{5}{2}$ $(y - x) = \frac{5}{2}x^2 - 4$ $y = \frac{5}{2}x^2 + x - 4$	 1 1
25.	(a)	$\overrightarrow{PQ} = \begin{pmatrix} 3 \\ -6 \end{pmatrix} - \begin{pmatrix} -2 \\ 6 \end{pmatrix}$ $= \begin{pmatrix} 5 \\ -12 \end{pmatrix}$ $= 5\underline{i} - 12\underline{j}$	1 1
	(b)	$\widehat{\overrightarrow{PQ}} = \frac{5\underline{i} - 12\underline{j}}{13}$ $= \frac{5}{13}\underline{i} - \frac{12}{13}\underline{j}$	 1