EDEXCEL PURE MATHEMATICS S1 (6683) – JANUARY 2003 PROVISIONAL MARK SCHEME

Question Number	Scheme	Marks
1.	Frequency densities: 0.16, 1.0, 1.0, 0.4, 0.4, 0.08 Histogram: Scale and labels Correct histogram	M1, A1 B1 B1 **(4 marks)**
2. (*a*)	$P(A \cap B) = \frac{10}{100} = \frac{1}{10} = 0.1$	M1 A1 **(2)**
(*b*)	$P(A') = \frac{75}{100} = 0.75$	M1 A1 **(2)**
(*c*)	$P(B' \mid A) = \frac{P(B' \cap A)}{P(A)} = \frac{\frac{15}{100}}{\frac{25}{100}} = \frac{15}{25} = \frac{3}{5} = 0.6$	M1 A1 **(2)**
(*d*)	$P(A' \cap B) = 0.4$; $P(A')P(B) = 0.75 \times 0.5 = 0.375$ Since $P(A' \cap B) \neq P(A')P(B) \Rightarrow$ not independent One of models is less reliable	M1 A1 A1 **(3)** **(9 marks)**
3.	Let X represent amount dispersed into cups $\therefore X \sim N(55, \sigma)$	
(*a*)	$P(X < 50) = 0.10 \Rightarrow \frac{50 - 55}{\sigma} = -1.2816$	M1 B1
	$\sigma = 3.90137$	M1 A1 **(4)**
(*b*)	$P(X > 61) = P(Z > \frac{61 - 55}{3.90137...})$	M1
	$= P(Z > 1.54)$	A1
	$= 1 - 0.90382 = 0.0618$; 6.18%	A1 **(3)**
(*c*)	Let Y represent new amount dispensed. $\therefore Y \sim N(\mu, 3)$	
	$P(Y < 50) = 0.025 \Rightarrow \frac{50 - \mu}{3} = -1.96$	M1 B1
	$\mu = 55.88$	M1 A1 **(4)** **(11 marks)**

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4.	(*a*)	$Q_2 = \frac{16+16}{2} = 16$; $Q_1 = 15$; $Q_3 = 16.5$; IQR = 1.5	M1A1; B1; B1; B1 **(5)**
	(*b*)	$1.5 \times \text{IQR} = 1.5 \times 1.5 = 2.25$	M1 A1
		$Q_1 - 1.5 \times \text{IQR} = 12.75 \Rightarrow$ no outliers below Q_1	A1
		$Q_3 + 1.5 \times \text{IQR} = 18.75 \Rightarrow 25$ is an outlier	A1
		Boxplot, label scale	M1
		14, 15, 16, 16.5, 18.75 (18)	A1
		Outlier	A1 **(7)**
	(*c*)	$\bar{x} = \frac{322}{20} = 16.1$	M1 A1 **(2)**
	(*d*)	Almost symmetrical/slight negative skew	B1
		Mean (16.1) ≈ Median (16) and $Q_3 - Q_2$ (0.5) ≈ $Q_2 - Q_1$ (1.0)	B1 **(2)**
			(16 marks)
5.	(*a*)	$2k + k + 0 + k = 1$	M1
		$\therefore 4k = 1 \Rightarrow k = 0.25$ **(✱)**	A1 **(2)**
	(*b*)	x: 0, 1, 2, 3	
		$\text{P}(X = x)$: 0.5, 0.25, 0, 0.25	
		~~$x\text{P}(X = x)$: 0, 0.25, 0, 0.75~~	
		$x^2\text{P}(X = x)$: 0, 0.25, 0, 2.75	
		$\text{E}(X) = \Sigma x\text{P}(X = x) = 0 + 0.25 + 0 + 0.75 = 1$	M1 A1
		$\text{E}(X^2) = 0 + 0.25 + 0 + 2.25 = 2.5$ **(✱)**	M1 A1 **(4)**
	(*c*)	$\text{Var}(3X - 2) = 3^2\,\text{Var}(X)$	M1
		$= 9(2.5 - 1^2) = 13.5$	M1 A1 **(3)**
	(*d*)	$\text{P}(X_1 + X_2) = \text{P}(X_1 = 3 \cap X_2 = 2) + \text{P}(X_1 = 2 \cap X_2 = 3) = 0 + 0 = 0$	B1 **(1)**
	(*e*)	Let $Y = X_1 + X_2$: y = 0, 1, 2, 3, 4, 5, 6	B1
		$\text{P}(Y = y)$: 0.25, 0.25, 0.0625, 0.25, 0.125, (0), 0.0625	B2 **(3)**
	(*f*)	$\text{P}(1.3 \le X_1 + X_2 \le 3.2) = \text{P}(X_1 + X_2 = 2) + \text{P}(X_1 + X_2 = 3)$	M1
		$= 0.0625 + 0.25 = 0.3125$	A1ft, A1ft **(3)**
			(16 marks)

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Question Number	Scheme	Marks
6. (*a*)	x 20 26 32 34 37 44 48 50 53 58	
	y 24 38 42 44 43 52 59 66 70 79	B1
	Change in cost of advertising influences number of new car sales	B1
	Graph: Scale and labels	B1
	Points all correct	B2 **(5)**
(*b*)	$S_{xy} = 22611 - \frac{402 \times 517}{10} = 1827.6$	M1 A1
	$S_{xx} = 17538 - \frac{402^2}{10} = 1377.6$	A1
	$b = \frac{S_{xy}}{S_{xx}} = \frac{1827.6}{1377.6} = 1.326655\ldots$	M1 A1
	$a = \frac{517}{10} - (1.326655\ldots) \times \frac{402}{10} = -1.63153\ldots$	B1
	$\therefore y = -1.63 + 1.33x$	B1ft **(7)**
(*c*)	$\frac{c - 4000}{10} = -1.63 + 1.33(p - 100)$	M1 A1ft
	$c = 2653.7 + 13.3p$	A1 **(3)**
(*d*)	No. sold if no money spent on advertising	B1
	$p = 0$ is well outside valid range – meaningless	B1 **(2)**
(*e*)	$2 \times 13.3 = 27$ extra cars sold	B1
	Only valid in range of data for 1990s	B1 **(2)**
		(19 marks)