

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 <b>(4 marks)</b>
2.	(a) $P(A \cap B) = \frac{10}{100} = \frac{1}{10} = 0.1$ (b) $P(A') = \frac{75}{100} = 0.75$ (c) $P(B' A) = \frac{P(B' \cap A)}{P(A)} = \frac{\frac{15}{100}}{\frac{25}{100}} = \frac{15}{25} = \frac{3}{5} = 0.6$ (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 (2) M1 A1 (2) M1 A1 (2) M1 A1 A1 (3) <b>(9 marks)</b>
3.	Let $X$ represent amount dispersed into cups $\therefore X \sim N(55, \sigma)$ (a) $P(X < 50) = 0.10 \Rightarrow \frac{50 - 55}{\sigma} = -1.2816$ $\sigma = 3.90137$ (b) $P(X > 61) = P(Z > \frac{61 - 55}{3.90137...})$ $= P(Z > 1.54)$ $= 1 - 0.90382 = 0.0618$ ; 6.18% (c) Let $Y$ represent new amount dispensed. $\therefore Y \sim N(\mu, 3)$ $P(Y < 50) = 0.025 \Rightarrow \frac{50 - \mu}{3} = -1.96$ $\mu = 55.88$	M1 B1 M1 A1 (4) M1 A1 A1 (3) M1 B1 M1 A1 (4) <b>(11 marks)</b>

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4.	<p>(a) <math>Q_2 = \frac{16+16}{2} = 16</math>; <math>Q_1 = 15</math>; <math>Q_3 = 16.5</math>; IQR = 1.5</p> <p>(b) <math>1.5 \times \text{IQR} = 1.5 \times 1.5 = 2.25</math>  <math>Q_1 - 1.5 \times \text{IQR} = 12.75 \Rightarrow</math> no outliers below <math>Q_1</math>  <math>Q_3 + 1.5 \times \text{IQR} = 18.75 \Rightarrow 25</math> is an outlier                      Boxplot, label scale                      14, 15, 16, 16.5, 18.75 (18)                      Outlier</p> <p>(c) <math>\bar{x} = \frac{322}{20} = 16.1</math></p> <p>(d) Almost symmetrical/slight negative skew                      Mean (16.1) <math>\approx</math> Median (16) and <math>Q_3 - Q_2</math> (0.5) <math>\approx</math> <math>Q_2 - Q_1</math> (1.0)</p>	<p>M1A1; B1; B1;                      B1 (5)                      M1 A1                      A1                      A1                      M1                      A1                      A1 (7)                      M1 A1 (2)                      B1                      B1 (2)  <b>(16 marks)</b></p>
5.	<p>(a) <math>2k + k + 0 + k = 1</math>  <math>\therefore 4k = 1 \Rightarrow k = 0.25</math> (★)</p> <p style="margin-left: 40px;"><math>x</math>    0    1    2    3</p> <p>(b) <math>P(X=x)</math>    0.5    0.25    0    0.25  <del><math>xP(X=x)</math>    0    0.25    0    0.75</del>  <math>x^2P(X=x)</math>    0    0.25    0    2.75  <math>E(X) = \sum xP(X=x) = 0 + 0.25 + 0 + 0.75 = 1</math>  <math>E(X^2) = 0 + 0.25 + 0 + 2.25 = 2.5</math> (★)</p> <p>(c) <math>\text{Var}(3X - 2) = 3^2 \text{Var}(X)</math>  <math>= 9(2.5 - 1^2) = 13.5</math></p> <p>(d) <math>P(X_1 + X_2) = P(X_1 = 3 \cap X_2 = 2) + P(X_1 = 2 \cap X_2 = 3) = 0 + 0 = 0</math>                      Let <math>Y = X_1 + X_2</math>    <math>y</math>    0    1    2    3    4    5    6</p> <p>(e) <math>P(Y=y)</math>    0.25    0.25    0.0625    0.25    0.125    (0)    0.0625</p> <p>(f) <math>P(1.3 \leq X_1 + X_2 \leq 3.2) = P(X_1 + X_2 = 2) + P(X_1 + X_2 = 3)</math>  <math>= 0.0625 + 0.25 = 0.3125</math></p>	<p>M1                      A1 (2)                        M1 A1                      M1 A1 (4)                      M1                      M1 A1 (3)                      B1 (1)                      B1                      B2 (3)                      M1                      A1ft, A1ft (3)  <b>(16 marks)</b></p>

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