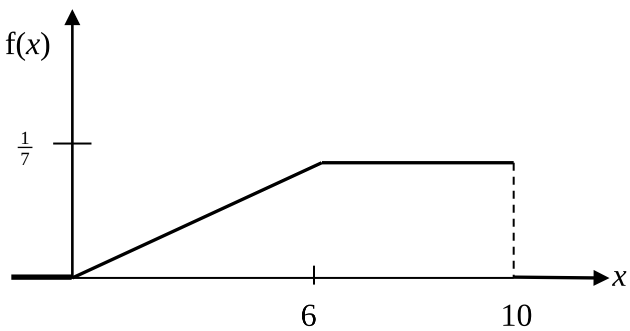
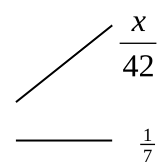
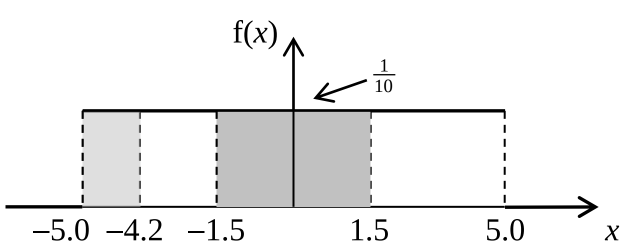
**Mock Paper Mark Scheme**

**Advanced Subsidiary/Advanced GCE**
General Certificate of Education

Subject **STATISTICS** Paper No. **Mock S2**

| Question number | Scheme | Marks |
|---|---|---|
| **1.** (*a*) |   | B1<br>B1 |
| | Labelled axes and < 0, > 10 | B1 |
| | $\frac{1}{7}$, 6, 10 | B1 (4) |
| (*b*) | $P(X \geq 5) = 1 - P(X < 5)$ — 5 and ∫ or area Δ | M1 |
| | $= 1 - \frac{5}{42} \times \frac{1}{2} \times 5$ (area of Δ) — full method | M1 |
| | $= 1 - \frac{25}{84} = \frac{59}{84}$ | A1 (3) |
| (*c*) | Probability it does *not* break down is $\left(\frac{59}{84}\right)^2$ | M1 |
| | $\therefore$ probability it does break down is $1 - \left(\frac{59}{84}\right)^2 =$ (awrt) 0.507 | A1 (2) **(9)** |
| **2.** |  | |
| (*a*) | $P(X < -4.2) = \frac{0.8}{10} = 0.08$ | B1 (1) |
| (*b*) | $P(\lvert X \rvert < 1.5) = \frac{3}{10} = 0.3$ | M1 A1 (2) |
| Question number | Scheme | Marks |

| | | |
|---|---|---|
| (*c*) | $Y$ = no. of lengths with $\lvert X \rvert < 1.5$ $\therefore Y \sim B(10, 0.3)$ | M1 |
| | $P(Y > 5) = 1 - P(Y \leq 5)$ | M1 |
| | $= 1 - 0.9527 = 0.0473$ | A1 (3) |
| (*d*) | $R$ = no. of lengths of piping rejected | |
| | $R \sim B(60, 0.08) \Rightarrow R \approx \sim Po(4.8)$ 4.8 or 60 × (*a*) | B1 √ |
| | $P(R \leq 2) = e^{-4.8}\left[1 + 4.8 + \frac{(4.8)^2}{2!}\right]$ Po and ≤ 2, formula | M1, M1 A1√ (ft for their $\lambda$ if full expression seen) |
| | $= 17.32 \times e^{-4.8} = 0.1425\ldots$ (accept awrt 0.143) | A1 cao (5) **(11)** |
| **3.** (*a*) | $D$ is continuous | B1 (1) |
| (*b*) | Sampling Frame is the list of competitors or their results,<br>e.g. label the results 1—200 and randomly select 36 of them | B1<br>B1 (2) |
| (*c*) | $X$ = no. of competitors with $A = 2$ $X \sim B(36, \frac{1}{3})$ | |
| | $X \approx \sim N(12, 8)$ | M1 A1 |
| | $P(X \geq 20) \approx P\left(Z \geq \frac{19.5 - 12}{\sqrt{8}}\right)$ $\pm\frac{1}{2}$, 'z' | M1, M1 |
| | $= P(Z \geq 2.65\ldots)$ | A1 |
| | $= 1 - 0.9960 = 0.004$ | A1 (6) |
| (*d*) | Probability is very low, so assumption of $P(A = 2) = \frac{1}{3}$ is unlikely.<br>(Suggests $P(A = 2)$ might be higher.) | B1, B1 (2)<br>**(11)** |

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| **4.** (*a*) | $X$ = no. of vases with defects $\quad X \sim B(20, 0.15)$ | B1 |
| | $P(X \leq 0) = 0.0388$ Use of tables to | M1 |
| | $P(X \leq 6) = 0.9781 \quad \therefore P(X \geq 7) = 0.0219$ find each tail | M1 |
| | $\therefore$ critical region is $X \leq 0$, or $X \geq 7$ | A1, A1 (5) |
| (*b*) | Significance level = $P(X \leq 0) + P(X \geq 7) = 0.0388 + 0.0219 = 0.0607$ | B1 (1) |
| (*c*) | $H_0: \lambda = 2.5, \quad H_1: \lambda > 2.5 \quad$ [or $H_0: \lambda = 10, \quad H_1: \lambda > 10$] | B1, B1 |
| | $Y$ = no. sold in 4 weeks. Under $H_0$ $Y \sim Po(10)$ | M1 |
| | $P(Y \geq 15) = 1 - P(Y \leq 14)$ = , $1 - 0.9165 = 0.0835$ | M1, A1 |
| | More than 5% so not significant. Insufficient evidence of an increase in the rate of sales. | A1 (6) **(12)** |

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| **5.** (*a*) | $F(1.5) = 1 \Rightarrow k(2 \times (1.5)^3 - (1.5)^4) = 1$ | M1 |
| | i.e. $k\left[2 \times \frac{27}{8} - \frac{81}{16}\right] = 1$ | |
| | i.e. $k\left(\frac{108-81}{16}\right) = 1$ $\therefore k = \frac{16}{27}$ (*) | A1 cso (2) |
| (*b*) | $P(T > 1) = 1 - F(1)$, $= 1 - \frac{16}{27}(2-1) = \frac{11}{27}$ | M1, A1 (2) |
| (*c*) | $f(t) = F'(t) =$, $\frac{16}{27}(6t^2 - 4t^3)$ | M1, A1 |
| | i.e. $f(t) = \begin{cases} \frac{32}{27}(3t^2 - 2t^3) & 0 \le t \le 1.5 \\ 0 & \text{otherwise} \end{cases}$ Full definition | B1 (3) |
| (*d*) | $E(T) = \int_0^{1.5} t\,f(t)\,dt = \frac{32}{27}\int_0^{1.5}(3t^3 - 2t^4)\,dt$ $\int t\,f(t)$ | M1 |
| | $= \frac{32}{27}\left[\frac{3t^4}{4} - \frac{2t^5}{5}\right]_0^{\frac{3}{2}}$ | A1 |
| | $= \frac{32}{27}\left[\left(\frac{243}{64} - \frac{2}{5} \times \frac{243}{32}\right) - (0)\right]$ | |
| | $= \frac{9}{2} - \frac{18}{5} = 0.9$ (*) | A1 cso (3) |
| (*e*) | $F(E(T)) = \frac{16}{27}(2 \times 0.9^3 - 0.9^4) = 0.4752$ evidence seen | B1 |
| (*f*) | $P(T > 1 \mid T > 0.9) = \frac{P(T>1)}{P(T>0.9)}$, $= \frac{\text{part }(b)}{1 - \text{part }(e)}$, $= 0.7763\ldots$ | M1, M1, |
| | accept awrt 0.776 | A1 (3) |
| | | **(14)** |

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| **6.** (*a*) | $X$ = no. of customers arriving in 10 minute period | |
| | $X \sim \text{Po}(3)$ $\quad$ $P(X \geq 4) = 1 - P(X \leq 3) =$ , $\quad 1 - 0.6472 = 0.3528$ | M1 A1 (2) |
| (*b*) | $Y$ = no. of customers in 30 minute period $\quad Y \sim \text{Po}(9)$ | B1 |
| | $P(Y \leq 7) = 0.3239$ | M1 A1 (3) |
| (*c*) | $p$ = probability of no customers in 5 minute period = $e^{-1.5}$ | B1 |
| | $C$ = number of 5 minute periods with no customers | |
| | $C \sim B(6, p)$ | M1 |
| | $P(C \leq 1)$, $= (1-p)^6 + 6(1-p)^5 p$ | M1, M1 A1 |
| | $= 0.59866\ldots$ $\quad$ (accept awrt 0.599) | A1 (6) |
| (*d*) | $W$ = no. of customers on Wednesday morning | |
| | $3\frac{1}{2}$ hours = 210 minutes $\quad \therefore W \sim \text{Po}(63)$ $\quad$ '63' | B1 |
| | Normal approximation $\quad W \approx \sim N(63, (\sqrt{63})^2)$ | M1 A1 |
| | $P(W > 49) \approx P(W \geq 49.5)$ $\quad \pm\frac{1}{2}$ | M1 |
| | $= P\left(Z \geq \frac{49.5 - 63}{\sqrt{63}}\right)$ $\quad$ standardising | M1 |
| | $= P(Z \geq -1.7008)$ | A1 |
| | $= 0.9554$ (tables) $\quad$ (accept awrt 0.955 or 0.956) | A1 (7) |