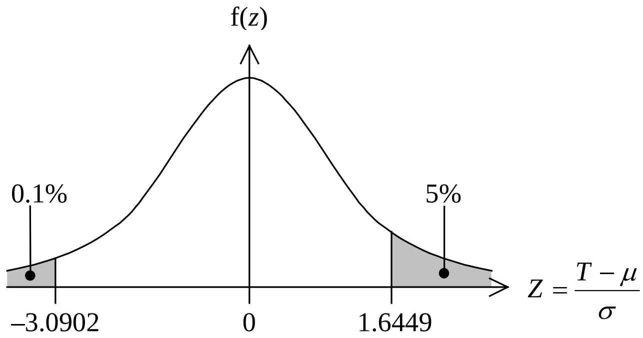
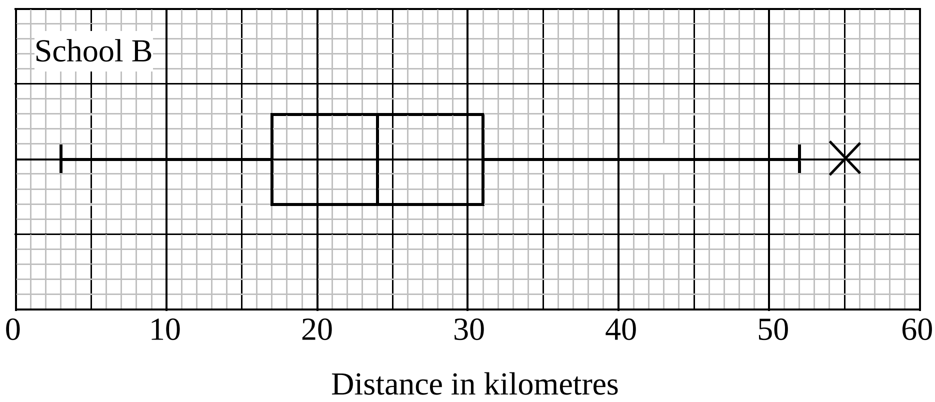
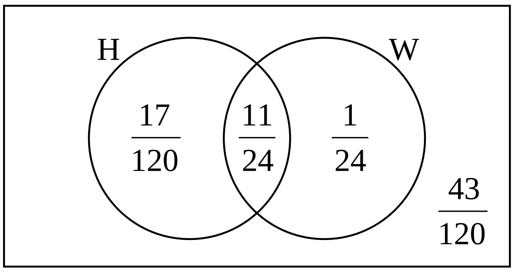
| Question Number | Scheme | Marks |
|---|---|---|
| **1.** (*a*) | A statistical process devised to describe or make predictions about the expected behaviour of a real-world problem. | B1 B1 (2) |
| (*b*) (i) | The number showing on the uppermost side of a die after it has been rolled. | B1 |
| (ii) | The height of adult males. | B1 (2) |
| | | **(4 marks)** |
| **2.** |  | |
| | $P(T > 55) = 0.05$ | |
| | $\therefore P\left(Z > \frac{55 - \mu}{\sigma}\right) = 0.05$    1.6449 <br> Standardising | B1 <br> M1 |
| | $\Rightarrow \frac{55-\mu}{\sigma} = 1.6449$    Completely correct | A1 |
| | $P(T < 10) = 0.001$ | |
| | $\therefore P\left(Z < \frac{10 - \mu}{\sigma}\right) = 0.001$    –3.0902 | B1 |
| | Standardising | M1 |
| | $\Rightarrow \frac{10-\mu}{\sigma} = -3.0902$    Completely correct | A1 |
| | $\therefore 55 - \mu = 1.6449\sigma$ | |
| | $10 - \mu = -3.0902\sigma$    Attempt to solve | M1 |
| | $\therefore \mu = 39.368$    $\mu = 39.4$ | A1 |
| | $\sigma = 9.5035$    $\sigma = 9.50$ | A1 (9) |
| | | **(9 marks)** |

| Question Number | Scheme | | Marks |
|---|---|---|---|
| **3.** (*a*) | $k(1+2+3+4+5)=1$ | Use of $\sum \mathrm{P}(X=x)=1$ | M1 A1 |
| | $\Rightarrow k=\dfrac{1}{\underline{15}}$ * | | A1 (3) |
| (*b*) | $\mathrm{E}(X)=\dfrac{1}{15}\{1+2\times 2+\ldots+5\times 5\}$ | Use of $\mathrm{E}(X)=\sum x\mathrm{P}(X=x)$ | M1 A1 |
| | $=15$ | | A1 |
| | $\therefore \mathrm{E}(2X+3)=2\mathrm{E}(X)+3$ | | M1 |
| | $=\dfrac{31}{3}$ | | A1 ft (5) |
| (*c*) | $\mathrm{E}(X^2)=\dfrac{1}{15}\{1+2^2\times 2+\ldots+5^2\times 5\}$ | Use of $\mathrm{E}(X^2)=\sum x^2\mathrm{P}(X=x)$ | M1 |
| | $=15$ | | A1 |
| | $\mathrm{Var}(X)=15-\left(\dfrac{11}{3}\right)^2$ | Use of $\mathrm{Var}(X)=\mathrm{E}(X^2)-[\mathrm{E}(X)]^2$ | M1 |
| | $=\dfrac{14}{\underline{9}}$ | | A1 |
| | $\mathrm{Var}(2X-4)=4\,\mathrm{Var}(X)$ | Use of $\mathrm{Var}(aX)=a^2\mathrm{Var}(X)$ | M1 |
| | $=\dfrac{56}{\underline{9}}$ | | A1 ft (6) |
| | | | **(14 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **4.** (*a*) | $b = \dfrac{15 \times 484 - 143 \times 391}{15 \times 2413 - (143)^2}$ | M1 A1 |
| | $= -3.0899$ AWRT –3.09 | A1 |
| | $a = \dfrac{391}{15} - (-3.0899)\left(\dfrac{143}{15}\right)$ | M1 A1 |
| | $= 55.5237$ AWRT 55.5 | A1 |
| | $\therefore\ y = 55.52 - 3.09x$ | B1 ft |
| | $\therefore\ h - 100 = 55.52 - 3.09(s - 20)$ | M1 A1 ft |
| | $\therefore\ h = 217.32 - 3.09s$ AWRT 217; 3.09 | A1 (10) |
| (*b*) | For every extra revolution/minute the life of the drill is reduced by 3 hours. | B1 B1 (2) |
| (*c*) | $s = 30 \Rightarrow h = 124.6$ AWRT 125 | M1 A1 ft (2) |
| | | **(14 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **5.** (*a*) | Advantages: Uses central 50% of the data | |
| | Not affected by extreme values (outliers) | |
| | Provide an alternative measure of spread to the variance/standard deviation, i.e. IQR/STQR | |
| | Disadvantages: Not always a simple calculation, e.g. interpolation for a grouped frequency distribution | |
| | Different measures of calculation – no single argued method | |
| | Does not use all the data directly | |
| | Any 4 sensible comments – at least one advantage and one disadvantage | B1 B1 B1 B1 (4) |
| (*b*) | Indicates maximum/minimum observations and possible outliers | |
| | Indicates relative positions of the quartiles | |
| | Indicates skewness | |
| | When plotted on the same scale enables comparisons of distributions | |
| | Any 4 sensible comments | B1 B1 B1 (3) |
| (*c*) | $Q_1 - 1.5(Q_3 - Q_1) = -4 \Rightarrow$ no outlier below lower quartile | B1 |
| | $Q_2 + 1.5(Q_3 - Q_1) = 52 \Rightarrow$ an outlier (55) above upper quartile | B1 |
| |   | |
| | Same scale and label | B1 |
| | $Q_1$, $Q_2$, $Q_3$, 3, 52 | B1 |
| | 55 | B1 (3) |
| | *continued over…* | |

| Question Number | Scheme | Marks |
|---|---|---|
| **5.** (*d*) | A: $Q_3 - Q_2 = 10$; $Q_2 - Q_1 = 10 \Rightarrow$ symmetrical } both distributions<br>B: $Q_3 - Q_2 = 7$; $Q_2 - Q_1 = 7 \Rightarrow$ symmetrical } are symmetrical<br>Median B (24) > Median A (22) $\Rightarrow$ on average teachers in B travel slightly further to school than those in A<br>Range of B is greater than that of A<br>25% of teachers in A travel 12 km or less compared with 25% of teachers in B who travel 17 km or less | |
| | 50% of teachers in A travel between 12 km and 32 km as compared with 17 km and 31 km for B<br>Any 4 sensible comments | B1 B1 B1 B1<br>(4)<br>**(16 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **6.** (a) | $\text{P}(\text{H} \cap \text{W}) = \text{P}(\text{H} \mid \text{W})\text{P}(\text{W})$ | M1 |
| | $= \dfrac{11}{12} \times \dfrac{1}{2} = \underline{\dfrac{11}{24}}$ * | A1 (2) |
| (*b*) |  Diagram | M1 |
| | $\text{H} \cap \text{W}'$ | M1 A1 |
| | $\text{H}' \cap \text{W}$ | A1 |
| | $\text{H} \cap \text{W}$ | B1 (5) |
| (*c*) | P (only one has a degree) $= \dfrac{17}{120} + \dfrac{1}{24} = \dfrac{11}{60}$ | M1 A1 (2) |
| (d) | P (neither has a degree) $= 1 - \left\{\dfrac{17}{120} + \dfrac{11}{24} + \dfrac{1}{24}\right\}$ | M1 A1 |
| | $= \underline{\dfrac{43}{120}}$ | A1 (3) |
| (e) | Possibilities — Any one | B1 |
| | $-(\text{HW}')(\text{H}'\text{W});\ (\text{H}'\text{W})(\text{HW}');\ (\text{HW})(\text{H}'\text{W}');\ (\text{H}'\text{W}')(\text{HW})$ | |
| | All correct | B1 |
| | $\therefore \text{P (only 1 H or 1 W)} = \left(2 \times \dfrac{17}{120} \times \dfrac{1}{24}\right) + \left(2 \times \dfrac{11}{24} \times \dfrac{43}{120}\right)$ — $2 \times \dfrac{17}{120} \times \dfrac{1}{24}$ | B1 ft |
| | $= \underline{\dfrac{49}{144}}$ — $2 \times \dfrac{11}{24} \times \dfrac{43}{120}$ | B1 ft |
| | Adding their probabilities | M1 |
| | $\dfrac{49}{144}$ | A1 (6) |
| | | **(18 marks)** |