

### Exercise 4.1

- (a)  $x - 24 = 8$   
 $x = 32$   $IQR = Q_3 - Q_1$  (M1)  
(A1)
- (b) The number of people  
 $= (30 + 10) \left( \frac{3}{4} \right)$   
 $= 30$   $\frac{3n}{4}$  (M1)  
(A1)
- (c) The mean number of hours  
 $= \frac{900}{30}$   
 $= 30$   $\frac{x_1 + x_2 + \dots + x_n}{n}$  (M1)  
(A1)
- (d) (i) The total number of hours  
 $= (40)(28)$   
 $= 1120$   $n\bar{x}$  (M1)  
(A1)
- (ii) The mean number of hours  
 $= \frac{1120 - 900}{10}$   
 $= 22$   $\frac{x_1 + x_2 + \dots + x_n}{n}$  (M1)  
(A1)
- (e) (i) The required mean  
 $= 22 - 3$   
 $= 19$   $\bar{x} - k$  (M1)  
(A1)
- (ii) The required variance  
 $= 2.5^2$   
 $= 6.25$   $\sigma^2$  (A1)  
(A1)



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**Exercise 4.2**

- (a) 20 minutes (A1)
- (b) 10 minutes (A1)
- (c) The number of students  
 $= 270 - 90$  270 - 90 (M1)  
 $= 180$  (A1)
- (d) The number of students spent not more than  $k$   
minutes to travel to school  
 $= 360 - 360 \times \frac{1}{6}$  360 - 360  $\times \frac{1}{6}$  (M1)  
 $= 300$  300 (A1)  
 $\therefore k = 30$  (A1)
- (e)  $r$   
 $= 25 + (1.5)(10)$   $Q_3 + 1.5IQR$  (M1)  
 $= 40$  (A1)
- (f) Systematic sampling (A1)

### Exercise 4.3

- (a) (i)  $r = 0.3346566771$   
 $r = 0.335$  (A1)
- (ii) Weak, positive (A1)(A1)
- (b) (i)  $a = 0.4228571429$   
 $a = 0.423$  (A1)  
 $b = 6.22$  (A1)
- (ii)  $b$  represents the expected sales in 2023. (A1)
- (c) The estimated sales  
 $= 0.4228571429(2.5) + 6.22$   $x = 2.5$  (M1)  
 $= 7.277142857$  millions of dollars  
 $= 7.28$  millions of dollars (A1)

### Exercise 4.4

- (a) The values of the first variable are not quantifiable data. (A1)
- (b) Assign correct ranks for selling price: (A1)

Brand	A	B	C	D	E
Ranking	5	2	4	1	3
Selling price	4	3	5	1	2

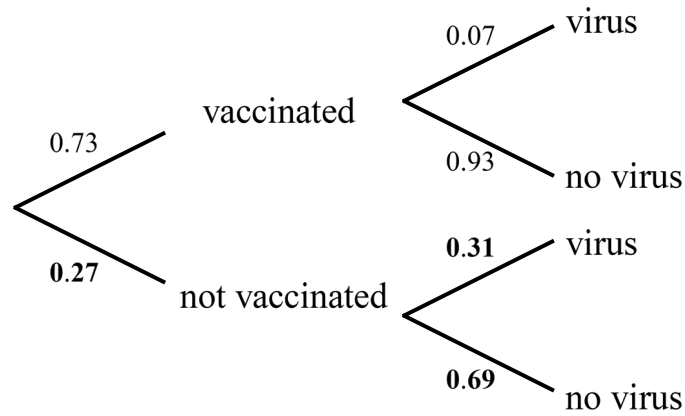
- $r_s = 0.8$  (A1)
- (c) It is more likely for a type of ice cream to have a higher ranking if its selling price is higher. (A1)



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Exercise 4.5

- (a) For any one correct (A1)  
For all correct (A1)



- (b) (i) The required probability  
 $= (0.73)(0.07) + (0.27)(0.31)$  Sum of two paths (M1)  
 $= 0.1348$  (A1)
- (ii) The required probability  
 $= \frac{(0.27)(0.31)}{0.1348}$   $\frac{P(A \cap B)}{P(B)}$  (M1)  
 $= 0.620919881$   
 $= 0.621$  (A1)

### Exercise 4.6

- (a)  $P(X = 0) + P(X = 10) + P(X = 20) + P(X = 30) = 1$  **Sum of probabilities (M1)**  
 $5k + 5k + 2k + 8k = 1$   
 $20k = 1$   
 $k = 0.05$  **(A1)**
- (b)  $E(X)$   
 $= (0)(0.25) + (10)(0.25) + (20)(0.1) + (30)(0.4)$  **(0)(0.25) + ... + (30)(0.4) (A1)**  
 $= 16.5$  **(A1)**

### Exercise 4.7

- (a) Let  $X \sim B(75, 0.11)$  be the number of left-handed students.  
 $E(X)$   
 $= (75)(0.11)$   **$np$  (M1)**  
 $= 8.25$  **(A1)**
- (b) The required probability  
 $= P(X = 10)$   **$P(X = 10)$  (M1)**  
 $= 0.1103559416$   
 $= 0.110$  **(A1)**
- (c) The required probability  
 $= P(X > 6)$   **$P(X > 6)$  (M1)**  
 $= 1 - P(X \leq 6)$   **$1 - P(X \leq 6)$  (M1)**  
 $= 0.7312259865$   
 $= 0.731$  **(A1)**
- (d) The required probability  
 $= P(X = 10 | X > 6)$   **$P(X = 10 | X > 6)$  (M1)**  
 $= \frac{P(X = 10 \cap X > 6)}{P(X > 6)}$   
 $= \frac{P(X = 10)}{P(X > 6)}$   **$\frac{P(X = 10)}{P(X > 6)}$  (M1)**  
 $= \frac{0.1103559416}{0.7312259865}$   
 $= 0.1509190642$   
 $= 0.151$  **(A1)**



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**Exercise 4.8**

- (a) (i) Let  $H$  be the height of a tree.  
 The required probability  
 $= P(H < 3.2)$  (M1)  
 $= 0.0111354575$   
 $= 0.0111$  (A1)
- (ii) The required probability  
 $= P(H < 3 | H < 3.2)$  (M1)  
 $= \frac{P(H < 3 \cap H < 3.2)}{P(H < 3.2)}$   
 $= \frac{P(H < 3)}{P(H < 3.2)}$  (M1)  
 $= \frac{0.0021374316}{0.0111354575}$   
 $= 0.1919482518$   
 $= 0.192$  (A1)
- (b)  $P(H > \alpha) = 0.31$  (M1)  
 $\alpha = 4.173547621$   
 $\alpha = 4.17$  (A1)
- (c) The required probability  
 $= (P(H < 3.2))^2$  (M1)  
 $= 0.0111354575^2$   
 $= 0.0001239984137$   
 $= 0.000124$  (A1)
- (d) (i) Let  $X$  be the number of short trees.  
 $E(X)$   
 $= (400)(0.0111354575)$  (M1)  
 $= 4.454182999$   
 $= 4.45$  (A1)
- (ii) The required probability  
 $= P(X > 8)$  (M1)  
 $= 1 - P(X \leq 8)$  (M1)  
 $= 0.0372881747$   
 $= 0.0373$  (A1)

### Exercise 4.9

- (a) (i)  $H_0$ : The number of heads follows the assigned distribution. (A1)
- (ii) 30 (A1)
- (iii) 3 (A1)
- (iv) 10.4 (A1)
- (b) The null hypothesis is rejected. (A1)  
As  $\chi^2_{calc} > 7.815$ .  $\chi^2_{calc} > 7.815$  (R1)

### Exercise 4.10

- (a) (i)  $H_0$ : The city where the children come from and the choices of their most favourite fruits are independent. (A1)
- (ii)  $H_1$ : The city where the children come from and the choices of their most favourite fruits are not independent. (A1)
- (iii) 6 (A1)
- (b)  $p$ -value  
= 0.0396398341 0.0396398341 (A1)  
= 0.0396 (A1)
- (c) The null hypothesis is not rejected. (A1)  
As the  $p$ -value is greater than 0.01.  $p$ -value > 0.01 (R1)



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**Exercise 4.11**

- (a) The lengths of fishes are normally distributed. (A1)
- (b) (i)  $H_0: \mu_1 = \mu_2$  (A1)
- (ii)  $H_1: \mu_1 \neq \mu_2$  (A1)
- (c)  $p$ -value  
= 0.0282515306 0.0282515306 (A1)  
= 0.0283 (A1)
- (d) The null hypothesis is rejected. (A1)  
As the  $p$ -value is less than 0.05.  $p$ -value < 0.05 (R1)