

Chapter 21 Solution

Exercise 86

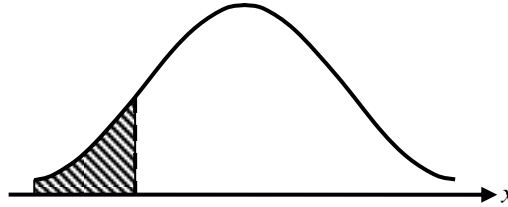
1. (a) $P(X > 86) = 0.28$ A1 N1 [1]
- (b) $P(80 < X < 86) = P(X > 80) - P(X > 86)$ (M1) for valid approach
 $P(80 < X < 86) = 0.5 - 0.28$ (A1) for substitution
 $P(80 < X < 86) = 0.22$ A1 N3 [3]
- (c) $P(74 < X < 80) = P(80 < X < 86)$ (M1) for symmetric property
 $P(74 < X < 80) = 0.22$ A1 N2 [2]
2. (a) $P(X < 270) = 0.15$ A1 N1 [1]
- (b) $P(270 < X < 300) = P(X < 300) - P(X < 270)$ (M1) for valid approach
 $P(270 < X < 300) = 0.5 - 0.15$ (A1) for substitution
 $P(270 < X < 300) = 0.35$ A1 N3 [3]
- (c) $P(270 < X < 330) = 2 \times P(270 < X < 300)$ (M1) for symmetric property
 $P(270 < X < 330) = 0.7$ A1 N2 [2]
3. (a) $P(X > 2.7) = 0.07$ A1 N1 [1]
- (b) $P(1.5 < X < 2.7) = P(X > 1.5) - P(X > 2.7)$ (M1) for valid approach
 $P(1.5 < X < 2.7) = 0.5 - 0.07$ (A1) for substitution
 $P(1.5 < X < 2.7) = 0.43$ A1 N3 [3]
- (c) $P(X > 0.3) = 2 \times P(1.5 < X < 2.7) + P(X > 2.7)$ (M1) for symmetric property
 $P(X > 0.3) = 0.93$ A1 N2 [2]

4. (a) $P\left(X > \frac{3}{11}\right) = 1 - \frac{1}{6}$ (M1) for valid approach
 $P\left(X > \frac{3}{11}\right) = \frac{5}{6}$ A1 N2
[2]
- (b) $d - \frac{6}{11} = \frac{6}{11} - \frac{3}{11}$ (M1) for valid approach
 $d = \frac{9}{11}$ A1 N2
[2]
- (c) $P\left(\frac{3}{11} < X < d\right) = 1 - 2 \times P\left(X < \frac{3}{11}\right)$ (M1) for symmetric property
 $P\left(\frac{3}{11} < X < d\right) = \frac{2}{3}$ A1 N2
[2]

Exercise 87

1. (a) For vertical line clearly to the left of the mean A1
 For shading to the left of the vertical line A1 N2

[2]



- (b) $P(X \leq 60) = 0.022750062$ (A1) for correct value
 $P(X \leq 60) = 0.0228$ A1 N2

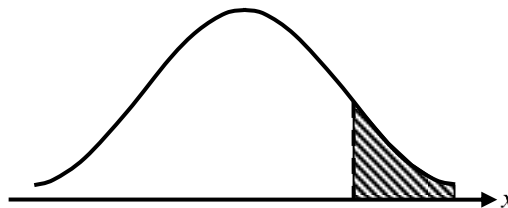
[2]

- (c) $c = 61.7961209$
 $c = 61.8$ A2 N2

[2]

2. (a) For vertical line clearly to the right of the mean A1
 For shading to the right of the vertical line A1 N2

[2]



- (b) $P(X \geq 4.83) = 0.2653735838$ (A1) for correct value
 $P(X \geq 4.83) = 0.2654$ A1 N2

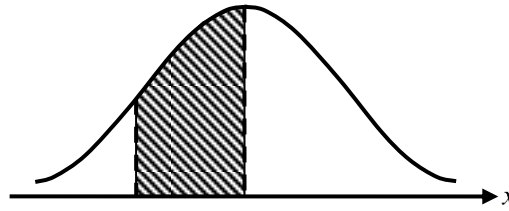
[2]

- (c) $c = 4.7613483$
 $c = 4.76$ A2 N2

[2]

3. (a) For vertical lines clearly to the left of the mean and at the mean A1
 For shading area bounded by the vertical lines A1 N2

[2]



- (b) $P(23.5 \leq X \leq 30) = 0.4479187309$ (A1) for correct value
 $P(23.5 \leq X \leq 30) = 0.4479$ A1 N2

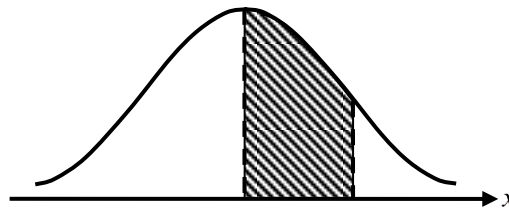
[2]

- (c) $c = 32.0976017$
 $c = 32.1$ A2 N2

[2]

4. (a) For vertical lines clearly at the mean and to the right of the mean A1
 For shading area bounded by the vertical lines A1 N2

[2]



- (b) $P(162 \leq X \leq 171) = 0.3697054352$ (A1) for correct value
 $P(162 \leq X \leq 171) = 0.3697$ A1 N2

[2]

- (c) $c = 158.0331972$
 $c = 158$ A2 N2

[2]

Exercise 88

1. (a) $P(X < Q_1) = 0.25$ (M1) for valid approach
 $Q_1 = 229.882656$
 Thus, the lower quartile is 230. A1 N2 [2]
- (b) $P(X < Q_3) = 0.75$ (M1) for valid approach
 $Q_3 = 250.117344$
 Thus, the upper quartile is 250. A1 N2 [2]
- (c) The interquartile range of X
 $= Q_3 - Q_1$ (A1) for correct formula
 $= 250.117344 - 229.882656$
 $= 20.234688$
 $= 20.2$ A1 N2 [2]
2. (a) $P(X < q_{30}) = 0.3$ (M1) for valid approach
 $q_{30} = 155.804797$
 Thus, the 30th percentile is 156. A1 N2 [2]
- (b) $P(X < q_{70}) = 0.7$ (M1) for valid approach
 $q_{70} = 164.195204$
 Thus, the 70th percentile is 164. A1 N2 [2]
- (c) $q_{70} - q_{30}$
 $= 164.195204 - 155.804797$ (A1) for substitution
 $= 8.390407$
 $= 8.39$ A1 N2 [2]

3.	$P(X < q_{90}) = 0.9$ $q_{90} = 93.126207$ $P(X < q_{10}) = 0.1$ $q_{10} = 82.87379373$ $q_{90} - q_{10}$ $= 93.126207 - 82.87379373$ $= 10.25241327$ $= 10.3$	<p>(M1) for valid approach</p> <p>(A1) for correct value</p> <p>(M1) for valid approach</p> <p>(A1) for correct value</p> <p>(A1) for correct formula</p> <p>A1 N6</p>
		[6]

4.	$P(X < s) = \frac{1}{3}$ $s = 48.707818$ $P(X < t) = \frac{2}{3}$ $t = 51.292182$ $t - s$ $= 51.292182 - 48.707818$ $= 2.584364$ $= 2.58$	<p>(M1) for valid approach</p> <p>(A1) for correct value</p> <p>(M1) for valid approach</p> <p>(A1) for correct value</p> <p>(A1) for substitution</p> <p>A1 N6</p>
		[6]

Exercise 89

1. (a) (i) Let W be the weight of a randomly selected fish.
 The required probability
 $= P(W > 850)$ (M1) for valid approach
 $= 0.0083943057$
 $= 0.00839$ A1 N2
- (ii) $P(W > 900 | W > 850)$ (R1) for correct probability
 $= \frac{P(W > 850 \cap W > 900)}{P(W > 850)}$ (A1) for correct formula
 $= \frac{P(W > 900)}{P(W > 850)}$
 $= \frac{0.000252385136}{0.0083943057}$ (A1) for correct values
 $= 0.0300662312$
 $= 0.0301$ A1 N4
- [6]
- (b) The required probability
 $= P(W > 850) \times P(W > 850)$ (M1) for valid approach
 $= 0.0083943057 \times 0.0083943057$
 $= 0.00007046436819$
 $= 0.0000705$ A1 N2
- [2]
- (c) (i) The required expected number
 $= 0.0083943057 \times 100$ (A1) for correct formula
 $= 0.83943057$
 $= 0.839$ A1 N2
- (ii) Let X : Number of big fish in the selected sample
 $X \sim B(100, 0.0083943057)$ (R1) for binomial distribution
 The required probability
 $= P(X > 2)$ (M1) for valid approach
 $= 1 - P(X \leq 2)$ (A1) for correct value
 $= 0.0525121075$
 $= 0.0525$ A1 N4
- [6]

2. (a) (i) Let X be the volume of a randomly selected milk soda.
The required probability
 $= P(X < 335)$ (M1) for valid approach
 $= 0.0062096799$
 $= 0.00621$ A1 N2
- (ii) $P(X > 330 | X < 335)$ (R1) for correct probability
 $= \frac{P(X > 330 \cap X < 335)}{P(X < 335)}$ (A1) for correct formula
 $= \frac{P(330 < X < 335)}{P(X < 335)}$
 $= \frac{0.0057805633}{0.0062096799}$ (A1) for correct values
 $= 0.9308955362$
 $= 0.931$ A1 N4
[6]
- (b) The required probability
 $= 2 \times P(X < 335) \times (1 - P(X < 335))$ (M1) for valid approach
 $= 2 \times 0.00620967 \times (1 - 0.00620967)$ (A1) for substitution
 $= 0.01234222$
 $= 0.0123$ A1 N3
[3]
- (c) (i) The required expected number
 $= 0.00620967 \times 60$ (A1) for correct formula
 $= 0.3725802$
 $= 0.373$ A1 N2
- (ii) Let X : Number of required milk soda
 $X \sim B(60, 0.00620967)$ (R1) for binomial distribution
The required probability
 $= P(X < 3)$ (M1) for valid approach
 $= P(X \leq 2)$ (A1) for correct value
 $= 0.9937046328$
 $= 0.994$ A1 N4
[6]

3. (a) (i) $P(L < t) = 0.15$ (M1) for valid approach
 $t = 66.89069986$
 $t = 66.9$ A1 N2
- (ii) $P(L < 65 | L < t)$ (R1) for correct probability
 $= \frac{P(L < 65 \cap L < t)}{P(L < t)}$ (A1) for correct formula
 $= \frac{P(L < 65)}{P(L < t)}$
 $= \frac{0.0477903304}{0.15}$ (A1) for correct values
 $= 0.3186022024$
 $= 0.319$ A1 N4 [6]
- (b) The required probability
 $= 2 \times P(L < t) \times (1 - P(L < t))$ (M1) for valid approach
 $= 2 \times 0.15 \times (1 - 0.15)$ (A1) for substitution
 $= 0.255$ A1 N3 [3]
- (c) (i) The variance
 $= 25 \times 0.15 \times (1 - 0.15)$ (A1) for correct formula
 $= 3.1875$ A1 N2
- (ii) $X \sim B(25, 0.15)$ (R1) for binomial distribution
The required probability
 $= P(X \geq 4)$ (M1) for valid approach
 $= 1 - P(X \leq 3)$ (A1) for correct value
 $= 0.5288787147$
 $= 0.529$ A1 N4 [6]

4. (a) (i) Let W be the weight of watermelons
 $P(W > t) = 0.1$ (M1) for valid approach
 $t = 9.512620627$
 $t = 9.51$ A1 N2
- (ii) $P(W < 9.8 | W > t)$ (R1) for correct probability
 $= \frac{P(W < 9.8 \cap W > t)}{P(W > t)}$ (A1) for correct formula
 $= \frac{P(t < W < 9.8)}{P(W > t)}$
 $= \frac{0.0772500031}{0.1}$ (A1) for correct values
 $= 0.772500031$
 $= 0.773$ A1 N4 [6]
- (b) The required probability
 $= P(W > t) \times P(W > t) \times P(W > t)$ (M1) for valid approach
 $= 0.001$ A1 N2 [2]
- (c) (i) The variance
 $= 52 \times 0.1 \times (1 - 0.1)$ (A1) for correct formula
 $= 4.68$ A1 N2
- (ii) $X \sim B(52, 0.1)$ (R1) for binomial distribution
The required probability
 $= P(13 \leq X \leq 26)$ (M1) for valid approach
 $= P(X \leq 26) - P(X \leq 12)$ (A1) for correct value
 $= 0.0014868739$
 $= 0.00149$ A1 N4 [6]