

- 14** **a** $P(X \leq 3) = \frac{1}{12}$, $P(4 \leq X \leq 6) = \frac{1}{3}$,
 $P(7 \leq X \leq 9) = \frac{5}{12}$, $P(X \geq 10) = \frac{1}{6}$
c $a = 5$ **d** organisers would lose \$1.17 per game
e \$2807

EXERCISE 23D.1

- 1** **a** $(p+q)^4 = p^4 + 4p^3q + 6p^2q^2 + 4pq^3 + q^4$
b $4\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right) = \frac{1}{4}$
- 2** **a** $(p+q)^5 = p^5 + 5p^4q + 10p^3q^2 + 10p^2q^3 + 5pq^4 + q^5$
b **i** $5\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right) = \frac{5}{32}$ **ii** $10\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^3 = \frac{5}{16}$
iii $\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right) = \frac{1}{32}$
- 3** **a** $\left(\frac{2}{3} + \frac{1}{3}\right)^4 = \left(\frac{2}{3}\right)^4 + 4\left(\frac{2}{3}\right)^3\left(\frac{1}{3}\right) + 6\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^2 + 4\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)^4$
b **i** $\left(\frac{2}{3}\right)^4 = \frac{16}{81}$ **ii** $6\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^2 = \frac{8}{27}$ **iii** $\frac{8}{9}$
- 4** **a** $\left(\frac{3}{4} + \frac{1}{4}\right)^5 = \left(\frac{3}{4}\right)^5 + 5\left(\frac{3}{4}\right)^4\left(\frac{1}{4}\right)^1 + 10\left(\frac{3}{4}\right)^3\left(\frac{1}{4}\right)^2 + 10\left(\frac{3}{4}\right)^2\left(\frac{1}{4}\right)^3 + 5\left(\frac{3}{4}\right)\left(\frac{1}{4}\right)^4 + \left(\frac{1}{4}\right)^5$
b **i** $10\left(\frac{3}{4}\right)^3\left(\frac{1}{4}\right)^2 = \frac{135}{512}$ **ii** $\frac{53}{512}$ **iii** $\frac{47}{128}$
- 5** **a** ≈ 0.154 **b** ≈ 0.973

EXERCISE 23D.2

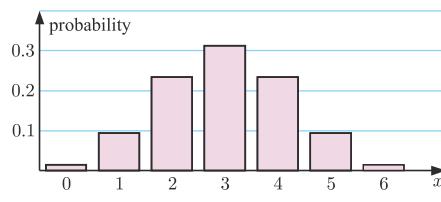
- 1** **a** The binomial distribution applies, as tossing a coin has two possible outcomes (H or T) and each toss is independent of every other toss.
b The binomial distribution applies, as this is equivalent to tossing one coin 100 times.
c The binomial distribution applies as we can draw out a red or a blue marble with the same chances each time.
d The binomial distribution does not apply as the result of each draw is dependent upon the results of previous draws.
e The binomial distribution does not apply, assuming that ten bolts are drawn without replacement. We do not have a repetition of independent trials.
- 2** **a** ≈ 0.0305 **b** ≈ 0.265 **3** ≈ 0.000864
- 4** **a** ≈ 0.268 **b** ≈ 0.800 **c** ≈ 0.200
- 5** **a** ≈ 0.476 **b** ≈ 0.840 **c** ≈ 0.160 **d** ≈ 0.996
- 6** **a** ≈ 0.231 **b** ≈ 0.723 **c** 1.25 apples
- 7** **a** ≈ 0.0280 **b** ≈ 0.00246 **c** ≈ 0.131 **d** ≈ 0.710
- 8** **a** **i** ≈ 0.998 **ii** ≈ 0.807 **b** 105 students
- 9** **a** **i** ≈ 0.290 **ii** ≈ 0.885 **b** 18.8
- 10** ≈ 0.0341 **11** at least 4 dice
- 12** **a** ≈ 0.863 **b** ≈ 0.475 **13** ≈ 0.837

EXERCISE 23D.3

- 1** **a** **i** $\mu = 3$, $\sigma = 1.22$
ii

| | | | | |
|----------|--------|--------|--------|--------|
| x_i | 0 | 1 | 2 | 3 |
| $P(x_i)$ | 0.0156 | 0.0938 | 0.2344 | 0.3125 |
- iii**

| | | | |
|----------|--------|--------|--------|
| x_i | 4 | 5 | 6 |
| $P(x_i)$ | 0.2344 | 0.0938 | 0.0156 |

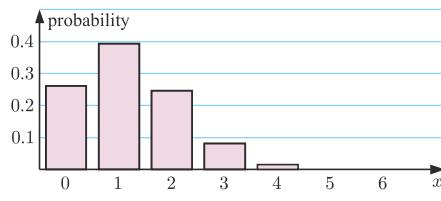


iii The distribution is bell-shaped.

- b** **i** $\mu = 1.2$, $\sigma = 0.980$

| | | | | |
|----------|--------|--------|--------|--------|
| x_i | 0 | 1 | 2 | 3 |
| $P(x_i)$ | 0.2621 | 0.3932 | 0.2458 | 0.0819 |

| | | | |
|----------|--------|--------|--------|
| x_i | 4 | 5 | 6 |
| $P(x_i)$ | 0.0154 | 0.0015 | 0.0001 |

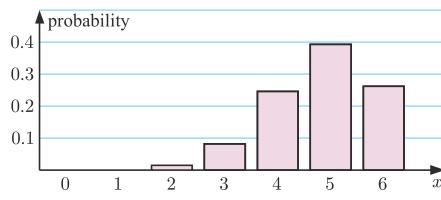


iii The distribution is positively skewed.

- c** **i** $\mu = 4.8$, $\sigma = 0.980$

| | | | | |
|----------|--------|--------|--------|--------|
| x_i | 0 | 1 | 2 | 3 |
| $P(x_i)$ | 0.0001 | 0.0015 | 0.0154 | 0.0819 |

| | | | |
|----------|--------|--------|--------|
| x_i | 4 | 5 | 6 |
| $P(x_i)$ | 0.2458 | 0.3932 | 0.2621 |



iii The distribution is negatively skewed and is the exact reflection of **b**.

- 2** $\mu = 5$, $\sigma = 1.58$

- 3** **a** $\mu = 1.2$, $\sigma = 1.07$ **b** $\mu = 28.8$, $\sigma = 1.07$

- 4** $\mu = 3.9$, $\sigma \approx 1.84$

REVIEW SET 23A

- 1** **a** $a = \frac{5}{9}$ **b** $\frac{4}{9}$ **2** 4.8 defectives

- 3** **a** $k = 0.05$ **b** 0.15 **c** 1.7

- 4** **a** $\left(\frac{3}{5} + \frac{2}{5}\right)^4 = \left(\frac{3}{5}\right)^4 + 4\left(\frac{3}{5}\right)^3\left(\frac{2}{5}\right) + 6\left(\frac{3}{5}\right)^2\left(\frac{2}{5}\right)^2 + 4\left(\frac{3}{5}\right)\left(\frac{2}{5}\right)^3 + \left(\frac{2}{5}\right)^4$

- b** **i** $\frac{216}{625}$ **ii** $\frac{328}{625}$

- 5** **a** **i** $\frac{1}{10}$ **ii** $\frac{3}{5}$ **iii** $\frac{3}{10}$ **b** $1\frac{1}{5}$

- 6** **a** £7 **b** No, she would lose £1 per game in the long run.

- 7** **a** $k = \binom{7}{x}$ **b** $\mu = \frac{7}{3} \approx 2.33$, $\sigma^2 = \frac{14}{9} \approx 1.56$