

16. a) i) $\frac{1}{38\,955\,840}$ ii) $\frac{1}{78\,960\,960}$ iii) $\frac{1}{146\,611\,080}$
 b) The probability of cracking the safe decreases as the five different numbers are chosen from a greater range of number.
18. The probability that at least two people have the same birthday as you is approximately 0.5687.
19. a) not throwing a sum of 7 on consecutive rolls
 b) three different letters being arranged in alphabetical order
 c) two out of five friends having the same birth month

Extend

20. 3.1664×10^{-7}
21. Answers may vary. Any scenario that has $n(A) = 1$ and $n(S) = {}_{15}P_r$. For example, winning first prize similar to question 20.
22. a) approximately 0.0947
 b) approximately 6.9613×10^{-5}
23. a) approximately 0.0188
 b) approximately 0.1004
24. a) approximately 2.2355×10^{-6}
 b) approximately 0.0026

Chapter 2 Review, pages 96–97

1. 27 possible outcomes

2.

| Second Die \ First Die | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|------------------------|---|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

The sum of 9 occurs eight times. There is only one occurrence of the sum 2 and sum 16.

3. a) 60 possible outcomes b) (Q, K, A) c) 60
4. a) 100 000 b) 800 000 s, or about 9.3 days
5. a) 360
 b) Ryan has 432 choices to configure his computer. Increasing the number of choices for any option will increase the total number of possible configurations.
6. 150
7. 60
8. a) and b)

| | | | | | | |
|--|---|----|-----|-----|-----|-----|
| | | 1 | | | | |
| | 2 | | 2 | | | |
| | 3 | 6 | | 6 | | |
| | 4 | 12 | 24 | 24 | | |
| | 5 | 20 | 60 | 120 | 120 | |
| | 6 | 30 | 120 | 360 | 720 | 720 |

The first term in row n is n . To obtain the remaining terms in row n , multiply all the terms in the row above by n .

- c) Answers may vary. The last term in row n equals $n!$. The last two terms in each row are equal.

9. 87 091 200
10. a) 144 b) 576 c) 5040
11. 576

12. 60
13. a) approximately 2.7557×10^{-7}
 b) $1 - 2.7557 \times 10^{-7}$
14. a) $\frac{1}{30}$ b) $\frac{2}{15}$ c) $\frac{29}{30}$
15. a) approximately 8.4165×10^{-8}
 b) $1 - 8.4165 \times 10^{-8}$

Chapter 2 Test Yourself, pages 98–99

1. C 2. D 3. A
4. ${}_9P_{10}$ is not defined, $n < r$.

$${}_9P_{10} = \frac{9!}{(9-10)!}$$

$$= \frac{9!}{(-1)!}$$
5. a) 24 possible outcomes b) 6
6. 1152 7. 95 040 8. $\frac{1}{56}$
9. a) 40 320 b) 25 200
10. 32 659 200
11. a) 3 575 880 b) 3 156 000 c) 1 806 000
12. a) $\frac{1}{456\,976}$ b) $\frac{1}{358\,800}$
13. approximately 0.9345
14. a) 311 875 200 b) 158 146 560
 c) approximately 3.6938×10^{-6}
 d) approximately 3.5013×10^{-5}

Chapter 3 Combinations

Prerequisite Skills, pages 102–103

1. a) 40 320 b) 60 480 c) 144 d) 151 200
 e) 1320 f) 35 g) 330 h) 504 504
2. a) $n!$ is a product of sequential natural numbers with the form $n! = n(n-1)(n-2) \times \dots \times 2 \times 1$.
 b) The number of permutations of r items from a collection of n items is written as ${}_nP_r$ or $P(n, r)$.

$${}_nP_r = \frac{n!}{(n-r)!}, n \geq r$$
3. a) $\frac{7!}{4!}$ b) $\frac{100!}{8!}$ c) $\frac{n!}{(n-6)!}$ d) $\frac{15!}{(15-r)!}$
4. a) 40 320 b) 6720 c) 1716
5. a) 39 916 800 b) 86 400
6. a) 40 320 b) 336
7. a) The first and last terms are 1. The remaining terms are the sum of the two adjacent terms in the row above.

| | | | | | | | | |
|--|--|---|---|----|----|----|---|---|
| | | | 1 | | | | | |
| | | 1 | | 1 | | | | |
| | | 1 | 2 | 1 | | | | |
| | | 1 | 3 | 3 | 1 | | | |
| | | 1 | 4 | 6 | 4 | 1 | | |
| | | 1 | 5 | 10 | 10 | 5 | 1 | |
| | | 1 | 6 | 15 | 20 | 15 | 6 | 1 |

- b) Answers may vary. Consider the top of the triangle row 0. Then, the sum of entries in row n equals 2^n . The second diagonal contains the counting numbers 1, 2, 3, 4, 5, ...
8. a) $\frac{1}{8}$ b) $\frac{1}{8}$ c) $\frac{1}{8}$ d) $\frac{3}{8}$
9. a) approximately 0.0060 b) approximately 0.2549
 c) approximately 0.3077
10. a) $\frac{1}{18}$ b) $\frac{1}{18}$ c) $\frac{1}{9}$
 d) approximately 1.5619×10^{-16}