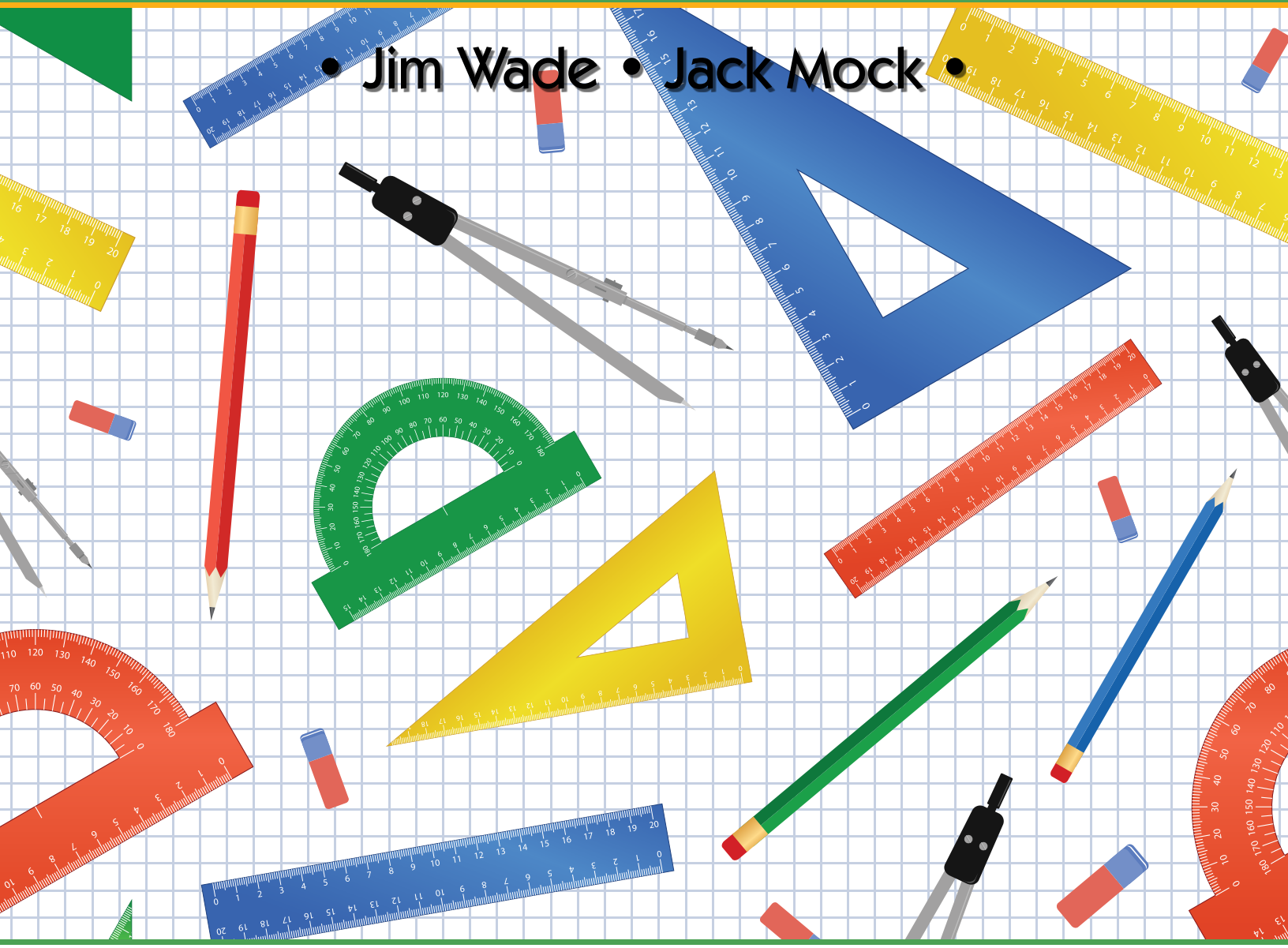
NATIONAL MATHS

YEAR 8

• Jim Wade • Jack Mock •



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Contents

Chapter 1
Year 7 Review

KEY SKILLS AND KNOWLEDGE

By the end of this chapter you should be able to:

- Add, subtract, multiply and use the laws of arithmetic correctly. (1.1)
- Find factors and multiples of numbers and solve problems using highest common factor and lowest common multiple. (1.2)
- Perform arithmetical operations on fractions. (1.3)
- Calculate with percentages, decimals and ratios. (1.4)
- Calculate simple probabilities and use Venn diagrams. (1.5)
- Simplify algebraic expressions including grouping symbols. (1.6)
- Measure length and calculate areas including squares, rectangles and triangles. (1.7)
- Perform calculations with money and use GST correctly. (1.8)
- Transform points, lines and shapes by translating, reflecting and rotating. (1.9)
- Solve linear equations by a variety of methods. (1.10)
- Calculate the volume of prisms. (1.11)
- Construct geometrical figures and determine their side and angle properties. (1.12)
- Collect, display and summarise statistical data. (1.13)

GETTING STARTED

Welcome to a new year in high school. Let us recap a few things we learned last year and see what we can still remember. If any of the following theory seems unfamiliar, see if you can borrow a year 7 textbook and brush up on what is considered to be assumed knowledge.

1. $17 \times 19 + 17 \times 21$ equals:

(A) 17×2 (B) 19×2 (C) 17×40 (D) 19×40

2. $-6 - 7$ equals:

(A) -1 (B) 1 (C) -13 (D) 13

3. Which number is not a factor of 40?

(A) 5 (B) 4 (C) 8 (D) 16

4. Which number is a multiple of 6?

(A) 72 (B) 64 (C) 58 (D) 46

5. Calculate $\frac{1}{2} + \frac{1}{3}$.

(A) $\frac{2}{5}$ (B) $\frac{1}{6}$ (C) $\frac{1}{3}$ (D) $\frac{5}{6}$

6. Calculate $(0.3)^2$.

(A) 0.9 (B) 0.09 (C) 0.06 (D) 0.6

7. Calculate 10% of \$85.

(A) \$850 (B) \$8.50 (C) \$0.85 (D) \$93.50

8. Fully simplify the ratio 8 : 12.

(A) 2 : 3 (B) 4 : 6 (C) 1 : 1.5 (D) All of these.

9. The probability of tossing a five on a normal die is:

(A) $\frac{1}{5}$ (B) $\frac{5}{6}$ (C) 0.5 (D) $\frac{1}{6}$

10. Simplify $3x + 5x$.

(A) $8x^2$ (B) $8x$ (C) $10x$ (D) $8 + 2x$

11. Calculate the area of a square with side 3 m.

(A) 3 m^2 (B) 12 m^2 (C) 6 m^2 (D) 9 m^2

12. Calculate 10% GST payable on a downlight from the electrical wholesaler at \$19.50.

(A) \$0.95
(B) \$21.45
(C) \$1.95
(D) \$0.20

13. Solve the equation $2x + 1 = 7$.

(A) $x = 4$ (B) $x = 3$ (C) $x = 2.5$ (D) $x = 6$

14. Find the volume of a cube with side length 1 cm.

(A) 1 m^3 (B) 3 m^3 (C) 6 m^3 (D) 8 m^3

1.1 Using the laws of arithmetic with integers

Do you remember the commutative and associative laws?

They can be very useful when simplifying calculation.

Here are a couple of examples to jog your memory.

Example 1: Calculate $S = 48 + 93 + 52$.

Solution: Use the commutative law to change the order.

$S = 93 + 48 + 52$

Using the associative law for addition:

$S = 93 + (48 + 52)$

$= 93 + 100 = 193$

Example 2: Does the sum 2497 + 9763 result in an odd or even total?

Solution: The last digits in each (7 and 3) are both odd. The sum of two odd numbers is even so the final digit will be even. Therefore the sum will be even.

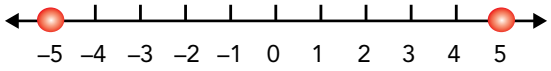
Taking short cuts with calculations

Example: Multiply 42 × 11.

Solution: Add the digits and place them in the middle. 4 + 2 = 6. The answer is 462.

Calculating with integers

Numbers on the left are smaller so –5 < 5.



Subtracting a number and adding its opposite are equivalent operations.

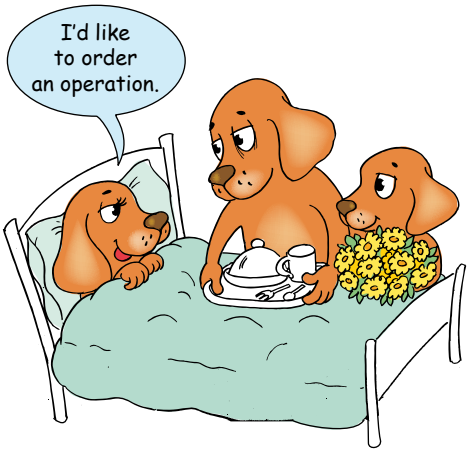
Example: Calculate: (a) –6 – 7 (b) –4 + (–3) (c) –5 – (–8)

Solution: (a) Start at –6 and go left 7 units. Answer = –13.

(b) –4 + (–3) = –4 – 3 = –7

(c) –5 – (–8) = –5 + 8 = 3

Order of operations



The following order of operations is based on the respective power of the operations, that is:

+ and – are the weak operations.

× and ÷ are stronger.

Powers and roots are the strongest.

Grouping symbols (brackets) take precedence over all.

Refer to the table.

+	–
×	÷
$()^2$	√

Weak $2 + 3 = 5$

Stronger $2 \times 3 = 6$

Strongest $2^3 = 8$

- Operations on the same level are inverses. They undo each other.
- Operations on the same level can be performed in any order.
  For example, $6 \div 20 \times 40$ or $6 \times 40 \div 20 = 12$ (the second way is easier).
- Operations from lower in the table (stronger) must be done before those higher.

Step 1: Work with the grouping symbols (inside brackets first).

Step 2: Work out any powers or roots.

Step 3: Work out multiplication or division as you work from left to right.

Step 4: Work out any addition or subtraction as you work from left to right.

Example: Evaluate $6 \times 4 + 18 \div 3$.

Solution: Multiplication and division are done first (before addition) and go from left to right.

$24 + 6 = 30$

The distributive law (for multiplication over addition and subtraction)

Example: (a) Expand $25(4 + 100)$.

(b) Calculate 54×999.

Solution: (a) $25(4 + 100) = 25 \times 4 + 25 \times 100 = 100 + 2500 = 2600$

(b) $54 \times 999 = 54 \times (1000 - 1) = 54\,000 - 54 = 53\,946$

EXERCISE 1.1

Using the laws of arithmetic with integers

1. Use the associative and commutative properties of addition and multiplication to find a quick mental arithmetic solution for these calculations.

(a) $23 + 750 + 250$ (b) $143 + 46 + 54$ (c) $53 + 136 + 47 + 64$

(d) $19 + 13 + 87 + 11$ (e) $5 \times 78 \times 2$ (f) $25 \times 59 \times 4$

(g) $5 \times 11 \times 8$ (h) $15 \times 9 \times 4$ (i) $250 \times 37 \times 4$

2. Without calculating the answer, state whether the calculation results in an odd or even integer.

(a) $4672 + 9876$ (b) $6521 + 8934$ (c) $6543 + 9879$ (d) $7658 - 5482$

(e) 143×657 (f) $99\,864 \times 6878$ (g) 7666×1007 (h) $456 \times 888 \times 29$

3. Find a short cut method for performing these calculations.

(a) 18×6 (b) 24×5 (c) 14×18 (d) 12×9 (e) 11×52

(f) $140 - 76$ (g) $220 - 98$ (h) $730 - 295$ (i) $459 - 280$ (j) 26×32

4. Use the short division process to find the quotient indicated.

(a) $9\overline{)225}$ (b) $6\overline{)384}$ (c) $8\overline{)752}$ (d) $7\overline{)735}$

5. Use long division to find the quotient and remainder of:

(a) 844 and 26 (b) 1448 and 34 (c) 2194 and 53

6. Copy and complete these magic squares.

(a)

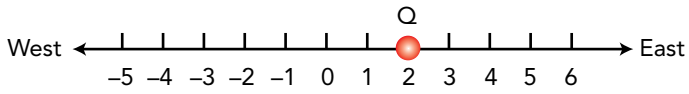
4		8
	7	
		10

(b)

13	15	5
	11	
17		

7. Starting from the point Q, 2 km east of 0, where will you be if you walk:

(a) 3 km east? (b) 5 km west? (c) 1 km east? (d) 6 km west?



8. Insert '>' or '<' between the numbers to indicate which is larger. (*Hint*: Plot the numbers on a number line and compare them.)

(a) –3, 0 (b) –1, –3 (c) –2, 4 (d) –6, –5

(e) 2, –2 (f) –19, –21 (g) 13, –8 (h) –8, –9

9. Find the answers to these additions.

(a) 15 + (–12) (b) 5 + (–8) (c) 6 + (–6) (d) –3 + 6

(e) –1 + (–4) (f) –30 + (–12) (g) –16 + (–2) (h) 6 + (–12) + 4

10. Find the answers to these subtractions.

(a) 8 – 11 (b) 5 – (–2) (c) –3 – (–4) (d) –7 – (–5)

(e) –2 – (+5) (f) –14 – (+6) (g) –2 – 8 (h) –13 – 15

11. Simplify these mixed expressions.

(a) –11 – (2 + 3) (b) –4 – (–3 + 2) (c) 5 + (–12 + 7) (d) 5 + (–3 – 7)

(e) (–4 + 5) + (–3 + 6) (f) (–5 + –3) – (6 – 8) (g) (–8 – 9) + (–1 –7) (h) (–12 + 8) – (13 – 15)

12. Find the missing number in these number sentences.

(a) 8 + ... = 0 (b) –4 + ... = 0 (c) 11 + ... = –3

(d) –5 + ... = –11 (e) 10 + ... = 2 (f) ..... + (–7) = 3

(g) ..... + 7 = –15 (h) ..... – 10 = 13 (i) ..... – (–3) = 1

13. Use the order of operation rules to find the value of each of these expressions.

(a) 10 ÷ 2 × 5 (b) 5 × 4 – 12 ÷ 3 (c) 16 – 2 × 3 × 5 (d) 4 – 15 ÷ 5

(e) 20 ÷ 5 × 4 (f) (32 ÷ 8) + (9 – 13) (g) 5 × 7 – 6 × 7 (h) 35 ÷ 7 + 42 ÷ 6

14. Evaluate (taking care with grouping symbols):

(a) (15 – 15) – 7 × 0 (b) 60 – [(4 × 7) – (5 × 7)] (c) [(13 – 5 × 3) × 2] × 11 – 7

(d) (25 ÷ 5 + 5) × [(12 – 7 × 2)] (e) [(32 ÷ 8 – 2) × 5] – (15 ÷ 3)

15. What numeral should be the missing number to make a true sentence?

(a) 25 × 4 + 15 × 4 = (..... × 4) (b) 12 × 7 + 8 × 7 = (..... × 7) (c) 58 × 3 – 8 × 3 = (..... × 3)

16. Use the distributive law (in reverse) to calculate the following.

(a) 302 × 40 – 2 × 40 (b) 38 × 24 + 2 × 24 (c) 43 × 8 – 39 × 8

17. Use the distributive law to calculate the following using mental arithmetic.

(a) 6 × 97 (b) 9 × 102 (c) 95 × 12

(d) 8 × 506 (e) 1003 × 22 (f) 17 × 99

Chapter 6
Probability

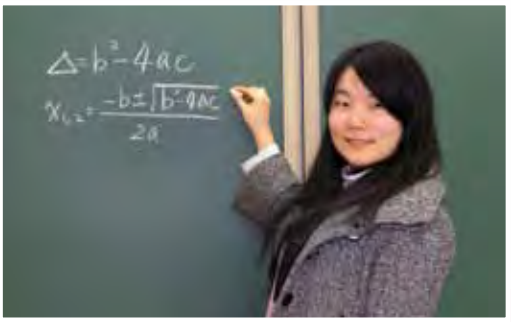
Syllabus

Identify complementary events and use the sum of probabilities to solve problems. (ACMSP204)
Describe events using language of 'at least', 'exclusive or' (A or B but not both), 'inclusive or' (A or B or both) and 'and'. (ACMSP205)
Represent events in two-way tables and Venn diagrams and solve related problems. (ACMSP292)

KEY SKILLS AND KNOWLEDGE

By the end of this chapter you should be able to:

- Calculate simple probabilities used in decision making. (6.1)
- Recognise that the sum of the probabilities of all possible outcomes of a single-step experiment is 1. (6.2)
- Understand complementary events. (6.2)
- Calculate the probability of a complementary event using the fact that the sum of the probabilities of complementary events is 1. (6.2)
- Describe compound events using the following terms: 'at least', 'at most', 'not', 'and', and 'or'. (6.3)
- Describe the effect of the use of AND and OR when using internet search engines. (6.3)
- Use set theory with probability. (6.4)
- Construct a Venn diagram to represent mutually exclusive or non-mutually exclusive events and calculate probabilities. (6.4)
- Recognise the difference between mutually exclusive and non-mutually exclusive events. (6.4)
- Classify compound events using inclusive and exclusive 'or'. (6.5)
- Recognise that the word 'or' on its own often needs a qualifier, such as 'both' or 'not both', to determine inclusivity or exclusivity. (6.5)
- Describe individual or combinations of areas in a Venn diagram using the language of 'and', 'exclusive or', 'inclusive or', 'neither' and 'not'. (6.5)
- Represent events in two-way tables and Venn diagrams and solve related problems. (6.6)
- Interpret Venn diagrams involving two variables. (6.6)
- Use the language 'and', exclusive 'or', inclusive 'or', 'neither' and 'not' to describe relationships displayed in two-way tables. (6.6)
- Construct two-way tables to represent non-mutually exclusive events involving two variables. (6.6)
- Use given data to determine missing values in a two-way table. (6.6)
- Recognise that data represented in a Venn diagram can also be represented in a two-way table. (6.6)



6.1 Simple probability and decision making

We often make decisions based on the probability of the outcomes of those decisions.

A 60% chance of rain might influence us to take our umbrella with us whereas if we are aware that the probability of choosing the 6 correct Lotto numbers from 45 balls is less than1 chance in 8 million, we may decide not to gamble.

If we toss a die and ask what is the probability of a six it is a simple one step calculation. Even if we ask what is the probability of an odd number, which means we require a 1, 3 or 5 it is still a simple calculation because all of these outcomes are equally likely. But if we construct a compound event such as an even number or a number less than 3 then the two events we have joined together are no longer equally likely.

Probability of an even number = $\frac{1}{2}$

Probability of a number less than 3 (1, 2): P = $\frac{1}{3}$

We must count up separately all of the possible outcomes and if some of the descriptions overlap (2 is both even and less than 3) then we must ensure we don't count that outcome twice. As we describe compound events by joining simple events together with words like 'and' and 'or', we need to be very careful with our use of language as it will determine how we count the outcomes.

It will also be useful if we realise that the sum of the probabilities of all possible outcomes is one and we will investigate ways in which we can use that knowledge.

Review of simple probability

Random and non-random events. Events that happen with no apparent external control and are thought to be as equally likely as any other event are termed **random events**. These would include rolling a number on a die (all numbers have the same chance of turning up) or dealing a card from a deck (all cards have the same chance of being dealt).

Events that are influenced by other factors are called **non-random events**. These include the weather (it is not equally likely to be wet or dry on any given day) and the winner of a football game (a team at the top of the table has greater skill etc and is more likely to win than a team at the bottom of the table).

The mathematical science of probability deals with random events and assumes that all outcomes are equally likely. Therefore we can use probability to predict the frequency of numbers on a die or cards dealt from a pack but we cannot use it to predict the winners of games (unless we use other statistical pointers such as the position in the table, the home ground, players injured or suspended etc).

Many random events result in a number of equally likely outcomes which can be counted to calculate their probability. A suitable definition of probability used previously is:

$$\text{P(event)} = \frac{\text{Number of ways the event can happen}}{\text{Number of outcomes in the sample space}}$$

Where the **event** is a particular result from an experiment (e.g. throwing a six).

P is the **probability** of the event occurring (often expressed as a fraction).

The **sample space** is all of the outcomes that can happen in the experiment (e.g. when tossing a die, the sample space is 1, 2, 3, 4, 5, 6).

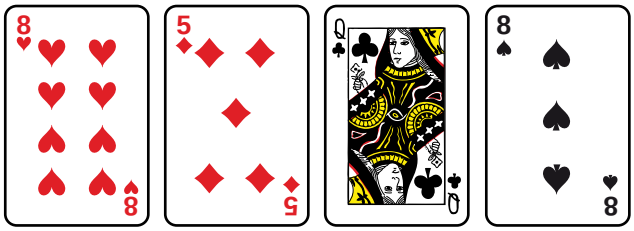
Probability has a range of values from 0 (indicating impossible) through 0.5 (an even chance or 50-50) up to a value of 1 (indicating certainty or that the particular event must occur).

Probability scale

Probability	Terms used
1	Certain, definite
…	Highly likely
…	Likely
0.5	Even chance, 50-50
…	Unlikely
…	Highly unlikely
0	Impossible

Playing cards

A normal pack of playing cards has 52 cards. They are divided into 4 suits: the red suits (hearts and diamonds) and the black suits (clubs and spades). Each suit has 13 cards consisting of 2, 3, 4, 5, 6, 7, 8, 9, 10, jack, queen, king and ace. The jack, queen and king are called picture cards.



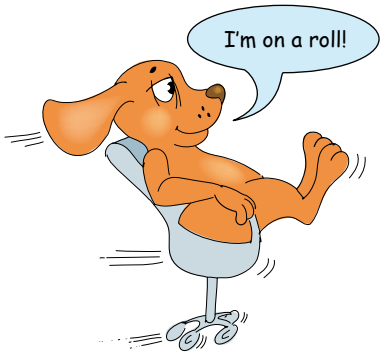
Example 1: Luciano rolls a fair, six-sided die. What is the probability of obtaining the following outcomes?

(a) The number 5.

(b) A number less than 5.

(c) An even number.

(d) A number less than 7.



Solution:

(a) $P(5) = \frac{1}{6}$ (There is only one 5 and there are six possible outcomes.)

(b) $P(< 5) = \frac{4}{6} = \frac{2}{3}$ (A 1, 2, 3 or 4 is required from the six possible outcomes.)

(c) $P(\text{even}) = \frac{3}{6} = \frac{1}{2}$ (A 2, 4 or 6 is required.)

(d) $P(< 7) = 1$ (All of the numbers on a die are less than 7 so it must happen.)

Example 2: A deck of cards is shuffled and one card is dealt. Find the probability that it is:

(a) The queen of hearts. (b) A queen. (c) A red queen.

(d) A red card. (e) A club. (f) A four or a nine.

(g) Black and a king.

Solution:

(a) P(queen of hearts) = $\frac{1}{52}$ (There is only one queen of hearts in the deck.)

(b) P(queen) = $\frac{4}{52} = \frac{1}{13}$ (There are 4 queens in the deck.)

(c) P(red queen) = $\frac{2}{52} = \frac{1}{26}$ (There are two red queens – heart and diamond.)

(d) P(red card) = $\frac{26}{52} = \frac{1}{2}$ (There are 26 red cards – half the deck.)

(e) P(club) = $\frac{13}{52} = \frac{1}{4}$ (There are 13 clubs in the deck.)

(f) P(4 or 9) = $\frac{4+4}{52} = \frac{2}{13}$ (There are 4 fours and 4 nines in a deck.)

(g) P(black and king) = $\frac{2}{52} = \frac{1}{26}$ (There are 2 cards, KS and KC that fit both.)

EXERCISE 6.1

Simple probability and decision making

1. Describe these events as impossible, very unlikely, unlikely, even chance, likely, very likely or certain.

(a) The Sun will rise in the east.

(b) When a coin is tossed it comes down heads.

(c) An odd number comes up with one roll of a die.

(d) A standard die is rolled and a 7 results.

(e) A person selected at random will live beyond age 70.

(f) There will be no road accidents over the summer vacation period.

(g) It will snow in Falls Creek next winter.

(h) An ace is the first card dealt from a deck of cards.

2. Determine the approximate probability of these events using the categories 0, 0 to 0.5, 0.5, 0.5 to 1 and 1.

(a) Next Anzac day will fall on 25 April.

(b) A baby selected at random in Australia will live beyond 2 years of age.

(c) A die is rolled and a number less than 5 results.

(d) A card dealt from a full deck will be black.

(e) A person selected at random will be left-handed.

(f) A double-headed coin will come down tails when tossed.

(g) The temperature in Hobart will be over 40°C on a summer day.

(h) It will rain heavily at some point in Darwin during the summer.

3. From a bag containing 4 black, 3 white and 4 red marbles, one is selected. Find the probability it is:

(a) White (b) Red (c) Black (d) Blue

4. The numbers 1 to 20 are written on identical cards and placed in a bag. A card is drawn at random from the bag. Find the probability that the number is:

(a) An odd number. (b) A number > 20. (c) A number ≤ 20.
(d) A number divisible by 5. (e) A number between 1 and 5. (f) A multiple of 3.
(g) 5 or 6. (h) A 2-digit number. (i) A prime number.

5. The word 'isosceles' is spelled out by writing the letters on cards which are then placed face down and mixed up. A card is selected at random. Find the probability that the letter is:

(a) E (b) A vowel. (c) A consonant.
(d) O (e) One which appears twice in the word.

6. I buy 3 brass numerals from the hardware store. These can be nailed to a house to display the house number. I buy the digits 5, 6 and 7. I now choose two of the digits at random and place them side by side to form a 2-digit number. Write out all of the possible 2-digit numbers that can be formed. Find the probability the number is:

(a) Even. (b) Odd. (c) Divisible by 5. (d) Greater than 60.

7. Gomez rolls a 12-sided die numbered 1 to 12. What is the probability the number rolled is:

(a) 5 (b) Greater than 10.
(c) Less than 5. (d) A multiple of 4.
(e) An even number greater than 7. (f) An odd number divisible by 3.
(g) A multiple of 3. (h) 5 or 6.
(i) A number between 2 and 7.

8. Claire takes the four queens from the deck and places them face down on the table. She offers you a choice of any card.

Find the probability that the card chosen is:

(a) The queen of hearts.
(b) A black queen.
(c) The queen of hearts or queen of spades.
(d) A picture card.

9. The 26 letters of the alphabet are written on separate cards and placed in a bag. One card is drawn at random. What is the probability it is:

(a) L (b) A vowel. (c) L or M. (d) A consonant.
(e) π (f) A letter from the word 'MATHS'.

10. In the quiz show 'Who wants to be a Squillionaire', the contestant must choose between 4 alternatives labelled A, B, C, and D.

Pat is sure the answer is not 'D' but she decides to have a guess at one of the other answers.

What is the probability she gets it correct?

11. The names of 5 students: Jim, Jack, Jacqueline, John and Melissa are placed in a hat and one is drawn at random. Find the probability that the name:

(a) Is Jim. (b) Is a girl's name. (c) Starts with J.
(d) A boy's name. (e) Is Norman. (f) Is Jim or Jack.

12. A card is dealt from a well-shuffled deck of playing cards. What is the probability that the card is:

(a) A 5 or a 6. (b) An ace. (c) A red card. (d) A ten.
(e) A black king. (f) A heart. (g) A picture card. (h) Less than an 8.

6.2 Complementary events and expected outcomes

Whenever an event is chosen from a sample space, all other events that are not chosen are called the complement of that event. For example if event 'A' is dealing a king from a deck of cards, then the complement of 'A' is dealing a card which is *not* a king.

Examples:

Event	*Complementary event*
Card drawn is a king.	Card drawn is not a king.
A 3, 5 or 6 is tossed on a die.	A 1, 2 or 4 is tossed on a die.
A card drawn is a heart.	A card drawn is a spade, diamond or club.
Saturday or Sunday.	Monday to Friday.
Christmas day.	Not Christmas day.
Blue area of flag.	Red area of flag.

INVESTIGATION

1. A card drawn from a deck is a spade. Identify the complementary event.

(A) Card drawn is red.
(B) Card drawn is not black.
(C) Card drawn is not a spade.
(D) Card drawn is not red.

2. From this set of events, list the events that are the complement of 'rain, hail or shine'.

Drizzle			Sleet
	Rain	Hail	
	Shine		Snow
Blizzard			

3. Calculate the probability of the event and its complement and then add them.

(a) {6 is thrown on a die} and {1, 2, 3, 4 or 5 is thrown on a die}.
(b) {My daughter will be born on a Monday} and {My daughter will be born on a day other than Monday}.

4. Complete the following statements.

(a) The sum of the probability of rain tomorrow and the probability of no rain tomorrow is ….....
(b) The sum of the probability of an event and the probability of its complementary event is equal to ….....

5. True or false? When a die is tossed, throwing a number less than 4 and throwing a number greater than 4 are complementary events.

Chapter 16
Revision Papers for Chapters 1 to 15

Here is an opportunity to revise and consolidate skills already learned to this point in the year 8 section of the course. Not only is this a chance to sharpen your skills, but also to practise the important technique of selecting the appropriate strategy to solve a mathematical problem.

Throughout the book each chapter covers topics and exercises of a similar nature. In these revision papers, problems are mixed and mingled, requiring you to make decisions on the appropriate theory to apply to each problem.

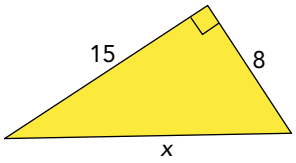
There is a range of questions within each revision paper from the easy, to the average, to the challenging. You may not be able to complete all of the questions as in the diagnostic tests, but this will help you to revisit the particular aspects of topics that caused you some difficulty and revise the concepts and skills.

We suggest you spend 75 minutes on each paper. Good luck and do your best!

Revision paper 4

Part A (multiple choice)

1. Measurements are in cm.
Calculate x.



(A) 12.69
(B) 17
(C) 23
(D) 7

2. Factorise fully $4y^2 - 10y$.
(A) $2(y^2 - 5y)$ (B) $y(4y - 10)$ (C) $4y(y - 10)$ (D) $2y(2y - 5)$

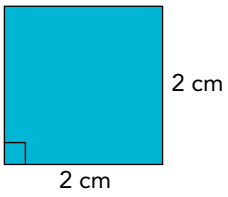
3. It takes 40 seconds to fill a 10 L bucket with water. What is the rate of flow in litres per hour?
(A) 15 (B) 90 (C) 900 (D) 1800

4. Calculate the circumference of a circle with radius 4 cm.
(A) 12.57 cm (B) 25.13 cm (C) 50.27 cm (D) 100.53 cm

5. Calculate the volume of a cylinder with radius 5 cm and height 10 cm.
(A) 2467.40 cm^3 (B) 1570.80 cm^3 (C) 785.40 cm^3 (D) 314.16 cm^3

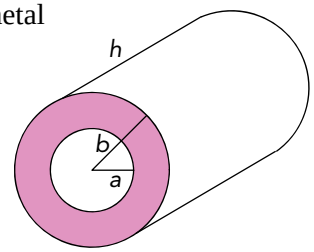
6. A semicircle has an area of 21.5 cm^2. Find its diameter to 2 decimal places.
(A) 5.23 cm (B) 10.46 cm (C) 7.40 cm (D) 3.70 cm

7. The area of this square is:



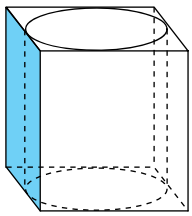
(A) 2 m^2
(B) 4000 cm^2
(C) 8 m^2
(D) 4 m^2

8. An expression for the volume of metal required to make this pipe is:



(A) $\frac{1}{2}abh$
(B) $\pi(b^2 - a^2)h$
(C) $\pi(a^2 - b^2)h$
(D) $2\pi abh$

9. A cylinder just fits inside a cube of side a cm.
The volume of the cylinder is:



(A) πa^3 (B) $\frac{1}{8}\pi a^3$
(C) $\frac{1}{4}\pi a^3$ (D) $\frac{1}{2}\pi a^3$

10. A cube has a volume of 8 cm^3. What is the surface area of this cube? (*Hint:* Draw a net.)
(A) 4 cm^2 (B) 24 cm^2 (C) 48 cm^2 (D) 384 cm^2

11. In a scale drawing of a mine, a shaft is measured on the drawing at 230 mm. If the scale is 1 : 80, what is the actual length of the shaft?
(A) 1840 m (B) 184 m (C) 1.84 m (D) 18.4 m

12. Quadrilaterals which have perpendicular diagonals are:
(A) Squares and rectangles. (B) Rectangles and rhombuses.
(C) Squares and rhombuses. (D) Rhombuses and parallelograms.

Answers

Chapter 1 Year 7 Review

Getting Started

1 C **2** C **3** D **4** A **5** D **6** B **7** B **8** A **9** D **10** B **11** D **12** C **13** B **14** A

1.1 Using the laws of arithmetic with integers

1 (a) 1023 (b) 243 (c) 300 (d) 130 (e) 780 (f) 5900 (g) 440 (h) 540 (i) 37 000 **2** (a) Even (b) Odd (c) Even (d) Even (e) Odd (f) Even (g) Even (h) Even **3** (a) 108 (b) 120 (c) 252 (d) 108 (e) 572 (f) 64 (g) 122 (h) 435 (i) 179 (j) 832 **4** (a) 25 (b) 64 (c) 94 (d) 105 **5** (a) 32 r 12 (b) 42 r 20 (c) 41 r 21

6 (a)

4	9	8
11	7	3
6	5	10

(b)

13	15	5
3	11	19
17	7	9

7 (a) 5 (b) –3 (c) 3 (d) –4 **8** (a) –3 < 0 (b) –1 > –3 (c) –2 < 4 (d) –6 < –5 (e) 2 > –2 (f) –19 > –21 (g) 13 > –8 (h) –8 > –9 **9** (a) 3 (b) –3 (c) 0 (d) 3 (e) –5 (f) –42 (g) –18 (h) –4 **10** (a) –3 (b) 7 (c) 1 (d) –2 (e) –7 (f) –20 (g) –10 (h) –28 **11** (a) –16 (b) –3 (c) 0 (d) –5 (e) 4 (f) –6 (g) –25 (h) –2 **12** (a) –8 (b) 4 (c) –14 (d) –6 (e) – 8 (f) 10 (g) –22 (h) 23 (i) –2 **13** (a) 25 (b) 16 (c) –14 (d) 1 (e) 16 (f) 0 (g) –7 (h) 12 **14** (a) 0 (b) 67 (c) –51 (d) –20 (e) 5 **15** (a) 40 (b) 20 (c) 50 **16** (a) 12 000 (b) 960 (c) 32 **17** (a) 582 (b) 918 (c) 1140 (d) 4048 (e) 22 066 (f) 1683

1.2 Factors and multiples

1 (a) Odd (b) Odd (c) Even (d) Even **2** (a) Even (b) Even (c) Even (d) Odd (e) Even (f) Even (g) Odd **3** (a) 10 (b) Yes (c) **4** (a) 4 (b) 21 **5** (a) Yes (b) Yes (c) No (d) Yes **6** (a) 2, 4, 8, 16 (b) 2, 4, 5, 10, 20 (c) 2, 3, 4, 6, 9, 12, 18, 36 (d) 2, 4, 8, 16, 32 **7** 8, 16, 24, 32, 40 **8** 12, 24, 36, 48 **9** (a) 14 (b) 12 (c) 16 (d) 22 **10** (a) 24 (b) 36 (c) 72 (d) 42 **11** (a) $24 = 2^3 \times 3$ (b) $45 = 3^2 \times 5$ (c) $96 = 2^5 \times 3$ (d) $1000 = 2^3 \times 5^3$ **12** (a) $30 = 2 \times 3 \times 5$ (b) $48 = 2^4 \times 3$ (c) $108 = 2^2 \times 3^3$ (d) $128 = 2^7$ **13** (a) 18 (b) 16 (c) 15 (d) 21 **14** 12 **15** 24 sec

1.3 Performing arithmetical operations on fractions

1 (a) $\frac{12}{16}, \frac{9}{12}$ (b) $\frac{6}{9}, \frac{10}{15}$ (c) $\frac{40}{50}, \frac{12}{15}$ **2** (a) 8 (b) 8 (c) 18 **3** (a) $\frac{4}{5}$ (b) $\frac{3}{4}$ (c) $\frac{3}{4}$ (d) $\frac{2}{3}$ **4** (a) $\frac{2}{3}$ (b) $\frac{2}{3}$ (c) $\frac{4}{5}$ (d) $\frac{3}{4}$ (e) $\frac{3}{10}$ **5** (a) $\frac{7}{2}$ (b) $\frac{23}{5}$ (c) $\frac{11}{6}$ (d) $\frac{25}{4}$ **6** (a) $3\frac{3}{4}$ (b) $3\frac{1}{3}$ (c) $3\frac{1}{3}$ **7** (a) $\frac{8}{15}$ (b) $1\frac{5}{12}$ (c) $1\frac{7}{20}$ (d) $1\frac{5}{24}$ **8** (a) $\frac{5}{12}$ (b) $\frac{1}{15}$ (c) $\frac{1}{10}$ (d) $\frac{11}{24}$ **9** $1\frac{53}{60}$ **10** $7\frac{7}{12}$ **11** (a) $1\frac{1}{4}$ (b) $1\frac{3}{20}$ (c) $\frac{1}{10}$ (d) $1\frac{11}{15}$ **12** (a) $\frac{3}{8}$ (b) $\frac{10}{21}$ (c) $\frac{3}{40}$ (d) $\frac{5}{24}$ (e) $\frac{1}{4}$ (f) $\frac{1}{4}$ (g) 1 (f) $\frac{1}{14}$ **13** $4\frac{3}{8}$ **14** $4\frac{2}{3}$

1.4 Calculating with decimals, percentages and ratios

1 (a) 9.6 (b) 24.42 (c) 13.2 (d) 1 (e) 30 (f) 11.3 (g) 180 (h) 7.1 **2** (a) 1.908 (b) 0.04 (c) 1.32 (d) 2900 (e) 0.04 (f) 0.36 (g) 1.21 (h) 0.0009 **3** (a) 3 (b) 0.7 (c) 10 (d) 20 **4** 12 **5** (a) 6.9 (b) 34.58 (c) 0.005 (d) 8.40 **6** (a) 70% (b) 30% (c) 30% (d) 40% (e) 5% (f) 2.5% (g) 12.5% (h) $8\frac{1}{3}$% (i) 150% (j) 225% (k) 475% (l) 260% **7** (a) 16% (b) 65% (c) $57\frac{1}{7}$% **8** (a) $\frac{17}{20}$ (b) $\frac{13}{20}$ **9** (a) 4 minutes (b) 6.3 million tonnes (c) 11 ha (d) $16 **10** (a) 0.37 (b) 0.65 (c) 0.03 (d) 1.05 **11** (a) 73% (b) 8% (c) 235% (d) 0.4% **12** (a) 4 : 3(b) 5 : 1 (c) 2 : 3 (d) 6 : 7 (e) 2 : 3 (f) 2 : 5 (g) 9 : 4 (h) 8 : 5 (i) 2 : 5 (j) 1 : 12 (k) 8 : 1 (l) 9 : 40 **13** (a) 3 : 8 (b) 5 : 6 (c) 27 : 14 (d) 5 : 12 (e) 9 : 8 (f) 69 : 100 (g) 41 : 20 (h) 88 : 25 (i) 1 : 3 **14** (a) 7 : 9 (b) 4 : 9 (c) 7 : 4 (d) No. % left over indicates how many do no sport.

1.5 Calculating simple probability and using Venn diagrams

1 (a) 15 (b) (i) $\frac{1}{5}$ (ii) $\frac{2}{3}$ (iii) 0 (iv) $\frac{4}{5}$ **2** $\frac{1}{3}$ **3** (a) $\frac{1}{26}$ (b) $\frac{5}{26}$ (c) $\frac{3}{26}$ **4** (a) $\frac{1}{26}$ (b) $\frac{5}{26}$ (c) $\frac{3}{26}$ (d) $\frac{3}{26}$ **5** (a) $\frac{9}{20}$ (b) $\frac{1}{4}$ (c) 0 (d) 1 (e) $\frac{11}{20}$ **6** (a) $\frac{1}{6}$ (b) $\frac{1}{3}$ (c) 100

Chapter 2 Integers and Index Laws

Getting started

1 B **2** C **3** D **4** C **5** B **6** A **7** D **8** C **9** C **10** D **11** C **12** C

2.1 Review of operations on integers

1 (a) 25 (b) 114 (c) 235 (d) –40 (e) –425 (f) 15 (g) –5 (h) 2 (i) –2 (j) 998 **2** (a) 15 (b) –25 (c) 50 (d) –5 (e) 22 (f) –25 (g) –35 (h) –1001 (i) –1001 (j) 10 **3** (a) 11 (b) –2 (c) –3 (d) –6 (e) –13 (f) –5 (g) –5 (h) –95 (i) –7 (j) –13 **4** (a) –1 (b) 7 (c) –9 (d) 1 (e) –2 (f) 8 (g) –7 (h) –1 (i) –8 (j) 12 (k) 2 (l) –1 **5** 3938 **6** –$1026.00

2.2 Multiplying integers and rational numbers

1 (a) –4 (b) –21 (c) –36 (d) –72 (e) –30 (f) –110 (g) 0 (h) –9 (i) 0 (j) –27 (k) –22 (l) –75 (m) 16 (n) 21 (o) 30 (p) 0 (q) 48 (r) –162 (s) 125 (t) –224 **2** (a) –21 (b) –72 (c) 63 (d) –100 (e) –52 (f) 32 (g) –72 (h) –125 (i) 33 (j) –63 (k) 168 (l) –120 (m) 45 (n) –45 (o) –54 (p) –28 **3** (a) –42 (b) 72 (c) –22 (d) 62 (e) 25 (f) 81 (g) 100 (h) 144 (i) −144 (j) 9 (k) −49 (l) −121 (m) −8 (n) −125 (o) 64 (p) −80 **4** (a) –4.8 (b) 6 (c) −4.4 (d) –6.2 (e) 0.16 (f) 0.64 (g) 0.09 (h) 0.0004 (i) 1.44 (j) 0.000025 (k) −0.01 (l) –1.21 (m) −0.008 (n) −0.027 (o) 0.064 (p) –0.8 **5** (a) $-\frac{1}{6}$ (b) $\frac{8}{15}$ (c) $\frac{3}{10}$ (d) $-\frac{9}{20}$ (e) $\frac{4}{9}$ (f) $-\frac{9}{16}$ (g) $-\frac{1}{4}$ (h) $-\frac{9}{40}$ (i) $\frac{2}{5}$ (j) $-\frac{3}{5}$ (k) $-\frac{1}{6}$ (l) $-\frac{1}{4}$ (m) $-3\frac{3}{4}$ (n) -3 (o) $4\frac{1}{2}$ (p) -15 **6** (a) –3.2 (b) –8.4 (c) 10.8 (d) –39 (e) –5 (f) 8.2 (g) –3 (h) 0.56 (i) 720 (j) –36 (k) 36 (l) –36 (m) 28 (n) 90 (o) –80 (p) –24 (q) 120 (r) –9 (s) –27 (t) –120 **7** (a) –8 (b) 81 (c) 64 (d) –100 000 (e) –1 (f) 1 (g) 0 (h) –1 (i) –16 (j) 1 (k) –1 **8** 5 × (–1.7) + 3 × 2.4 = –1.3 (loss). **9** Increase $0.15 **10** (a) 5 (b) 10 (c) 18 (d) 1 (e) 9 **11** (a) 0 (b) Error **12** (a) ±8 (b) 6 (c) –1 Cube has odd number of factors. **13** (a) $y = \pm 7$ (b) $x = 11$ (c) $b = \pm 6$ (d) $y = 1$ (e) $a = 8$

2.3 Dividing integers and rational numbers

1 (a) 3 (b) −3 (c) −3 (d) 3 (e) −4 (f) 4 (g) 4 (h) −4 (i) 0 (j) 5 (k) −5 (l) 1 (m) 0 (n) −5 (o) 30 (p) −40 (q) −135 (r) −1 (s) −1 (t) 1 (u) −1 (v) −3 (w) −19 (x) 5 **2** (a) −0.5 (b) 0.3 (c) −40 (d) 1.6 (e) −40 (f) −0.013 (g) −0.007 (h) 20 000 **3** (a) $-1\frac{1}{2}$ (b) $\frac{5}{6}$ (c) $\frac{8}{15}$ (d) $-\frac{4}{5}$ (e) $\frac{4}{5}$ (f) −6 (g) $-\frac{9}{20}$ (h) −1 (i) $-\frac{3}{5}$ (j) $-1\frac{11}{16}$ (k) $\frac{5}{8}$ (l) 4 **4** (a) −10 (b) −20 (c) −1 (d) −1 (e) −10 (f) 1 (g) −10 (h) 0.12 (i) −0.12 (j) −50 (k) 100 (l) 43 (m) −6 (n) 6 (o) 2 (p) −2 **5** (a) −5 (b) −2 (c) 7 (d) −2 (e) 9 (f) −8 (g) −4 (h) −4 (i) 25 (j) −8 (k) −70 (l) 106 (m) −1 (n) 4 (o) 5 (p) $1\frac{1}{3}$ (q) −1 (r) −4 (s) 2 (t) 1 (u) $-\frac{1}{2}$ **6** (a) 1, −1, −3 (b) 0, −2, −4 (c) 2, 5, 8 (d) −16, −19, −22 (e) 32, −64, 128 (f) 2, 1, $\frac{1}{2}$ (g) 2, −1, $\frac{1}{2}$ (h) −24, −48, −96 (i) −1, 1, −1 (j) −4, 2, −1 (k) −0.0002, 0.00002, −0.000002 (l) −2, −2.5, −3 **7** (a) −1 (b) −7 (c) 8 (d) 4 (e) −2 (f) −1 (g) −17 (h) −17 (i) 27 (j) 16 (k) −40 (l) 47 (m) 12 (n) 60 (o) −54 (p) 12 (q) 1 (r) 1 (s) 14 (t) −100 (u) −1 **8** (a) −8 (b) 8 (c) 11 (d) $-\frac{1}{2}$ (e) −36 (f) −3 **9** (a) +1, −6, +2, −3, +2 (b) −0.8 cm (c) Yes

2.4 Investigating the order of operations used in different digital technologies

1 (a) 11 (b) 5 (c) 60 (d) 5 (e) 2 (f) 6 (g) 34 (h) 74 (i) 5 (j) 20 (k) −10 (l) 44 **2** (a) 54 (b) 10 (c) 50 (d) 80 (e) 5 (f) 2 (g) 5 (h) 1 **3** (a) 10 (b) −4 **4** (a) −4, −9 (b) No (c) Perform a simple calculation and check mentally. (d) 14 – (9 × 2), (15 ÷ 3) – (7 × 2) **5** (a) 45 (b) 19 (c) 5 (d) 7 (e) 24 (f) 144 (g) 362 880 (h) 720 **6** (a) 7 + 9*5 (b) 18 – 6*3 (c) 3*6 + 9*7 (d) 8*4 – 6*9 (e) $52 + \frac{24}{2.5}$ (f) $6.4 - \frac{1.2}{0.4}$ (g) $\frac{1.2}{6} + \frac{0.5}{2}$ (h) $\frac{15}{3} - \frac{3}{2}$

2.5 Solving problems with negative numbers

1 21° **2** –3° **3** –7 **4** –10 cents **5** –28 **6** –10 **7** 0 **8** –4, –3, –1, 0 3, 4 **9** (a) 4 (b) 0 (c) –1 (d) –0.01 (e) 0.02 (f) 0 (g) $\frac{1}{2}$ (h) $-\frac{1}{4}$ (i) $-\frac{1}{2}$ (j) $\frac{1}{3}$ (k) –99 (l) –9 **10** 11 km/h **11** 6800 m **12** $5.13 **13** (a) Dead Sea, Lake Eyre, Katoomba, Mt Kosciuszko, Mt Everest (b) (i) 1186 m (ii) 6610 m (iii) 381 m (iv) 9237 m **14** 370 m **15** (a) 42 km (b) 42 km (c) 32 km (d) 52 km **16** (a) (i) 11° (ii) 5° (iii) 16° (b) 5° (c) –9° **17** 0.75 m **18** $2176 **19** (a) 21 m (b) 44 m **20** (a) 5 units east (b) 3 units west (c) 2 units east (d) 2 units west (e) 7 units west **21** (a) –6 and –4 (b) 6 and –8 (c) –16 and –8 **22** 10 am

Who am I?

1 –15 **2** –5

2.6 Using power, root, reciprocal and fraction keys on a calculator

1 (a) 16 (b) 27 (c) 256 (d) –32 (e) –343 (f) 25 (g) 13 (h) 23 (i) 0.15 (j) 0.54 (k) 5 (l) 12 (m) 8 (n) 11 (o) 9 (p) 0.13 (q) 0.19 (r) 0.03 (s) 0.42 (t) 0.10 (u) 0.17 (v) 0.38 (w) 0.10 (x) 0.23 (y) 12.5 **2** (a) $\frac{17}{20}$ (b) $\frac{7}{16}$ (c) $\frac{5}{6}$ (d) $9\frac{31}{32}$ (e) $2\frac{4}{23}$ (f) $2\frac{1}{4}$ (g) $20\frac{1}{4}$ (h) $56\frac{1}{4}$ **3** (a) 750 m (b) 2.5 kg **4** (a) 3 m (b) 1.872 tonnes **5** (a) 4^5 (b) 6^7 **6** (a) $3\sqrt{2}$ (b) $\left(\sqrt{3}\right)^2$ **7** (a) No (b) Yes **8** (a) 3944.0 (b) 7.1 (c) 27.6 (d) 197.2 (e) 78880.8 (f) 38.1 (g) 12.0 (h) 20420.4 (i) 0.4 (j) 280.9