Vertex Academy

Year 7 Maths workbook

11 worksheets · answers at the back

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Year 7 · Number: Powers, Primes and Proportions

Name: _____ Date: _____

Kia ora! This sheet gives you a good workout across whole numbers, powers of 10, primes, integers, fractions and percentages. Take your time, show your working, and check that each answer makes sense.

Warm-up

1. Write 10^4 as an ordinary number, then write 100 000 as a power of 10.

2. Work out 6^2 and $\sqrt{81}$.

3. Is 51 a prime or composite number? Explain.

4. What is the additive inverse of −7?

Practice

5. Write 47 208 in expanded form using powers of 10.

6. Find the highest common factor (HCF) of 48 and 60, and the least common multiple (LCM) of 6 and 8.

7. Use the order of operations (GEMA) to evaluate $3 + 4 \times (5^2 - 3)$.

8. Convert $\frac{5}{8}$ to a decimal and then to a percentage.

9. Aroha saved $186 for the holidays. She spent $\frac{2}{3}$ of her savings on a bike part. How much did she spend, and how much is left?

10. At Avondale College a netball club has 3 juniors for every 7 seniors. If there are 18 juniors, how many players are there altogether?

Challenge

11. At a market stall, 40% of the day's takings is $28. Find the full takings (100%), then work out 75% of that amount.

12. Add $2\frac{2}{3} + 1\frac{3}{4}$ and give the answer as a mixed number in its simplest form.

Year 7 · Number: Money, Sales & Change

Name: _____ Date: _____

Hi there! This sheet helps you practise working out totals, change, and sale prices with New Zealand dollars. Remember two handy rules: money answers are rounded to two decimal places, and cash payments are rounded to the nearest 10 cents.

Warm-up

1. Add these prices: $4.50 + $3.20 + $1.30

2. Find 10% of $60.

3. You pay for a $6.40 item with a $10 note. How much change do you get?

4. Round $7.83 to the nearest 10 cents for a cash payment.

Practice

5. At the Avondale dairy, Mia buys a pie for $4.90, a juice for $3.50, and a muesli bar for $2.20. What is the total cost?

6. A jacket costs $80. In a sale it is 25% off. What is the discount, and what is the sale price?

7. A pair of shoes is priced at $90 with 20% off. Find the sale price.

8. Liam's shopping comes to $23.67. He pays with cash. Round the total to the nearest 10 cents, then find his change from $30.

9. A book club orders 6 books at $12.50 each. What is the total cost?

10. Sione buys a $45 game marked 40% off. He pays with cash. What is the sale price, and what is his change from $30?

Challenge

11. A speaker costs $120. It is reduced by 15% in a sale. Aroha pays with cash. Find the sale price, round it to the nearest 10 cents, and work out her change from $110.

12. Two shops sell the same $150 tent. Shop A offers 30% off. Shop B offers 25% off plus an extra $10 off the discounted price. Which shop is cheaper, and by how much?

Year 7 · Algebra: Solving Equations and Spotting Patterns

Name: _____ Date: _____

Kia ora! This sheet helps you tidy up algebra expressions, solve equations step by step, and find rules in patterns. Take your time and always check your answers by substituting back in.

Warm-up

1. Simplify: $4a + a + 2a$

2. Solve for t: $t + 7 = 12$

3. If $w = 4$, find the value of $w + 12$.

4. True or false? $3 \times 5 > 2 \times 7$

Practice

5. Simplify: $6b - 2b + 3b$

6. Solve for s: $5s + 3 = 18$

7. Aria buys 3 identical drink bottles at the Avondale market. She pays with a $20 note and gets $5 change. Let c be the cost of one bottle. Write an equation and find c.

8. The area of a rectangle is $A = l \times w$. A netball court section has area $A = 48$ m² and length $l = 8$ m. Rearrange the formula to make w the subject, then find w.

9. Tane is stacking chairs for a school event. He starts with 4 chairs and adds 3 chairs each minute. The number of chairs t after n minutes is $t = 3 \times n + 4$. How many chairs are there after 6 minutes?

10. Plot these three points on a coordinate plane and state which quadrant each is in: A(3, 2), B(−4, 1), C(−2, −3).

Challenge

11. A pattern of matchstick triangles grows like this: 1 triangle uses 3 matches, 2 triangles use 5 matches, 3 triangles use 7 matches. Find a rule in the form $t = a \times n + d$ for the number of matches t for n triangles, then work out how many matches are needed for 20 triangles.

12. Solve for x: $4x - 5 = 2x + 7$. Then check your answer by substituting into both sides.

Year 7 · Measurement: Perimeter, Area, Volume & Time

Name: _____ Date: _____

Hi! This sheet gives you practice with perimeter, area and volume formulae, and reading timetables. Show your working and remember your units, squared for area, cubed for volume!

Warm-up

1. Find the perimeter of a square with side length 7 cm.

2. Find the area of a rectangle that is 9 m long and 4 m wide.

3. Find the volume of a cube with side length 3 cm.

4. Which unit best measures the mass of an apple: milligram, gram, or kilogram? Explain.

Practice

5. A rectangle has a perimeter of 30 cm. Its length is 9 cm. Find its width.

6. A triangle has an area of 24 cm² and a height of 6 cm. Find the length of its base.

7. Find the volume of a rectangular prism that is 5 cm long, 4 cm wide and 3 cm high.

8. Aroha is building a rectangular vegetable garden in Avondale that is 6 m long and 2.5 m wide. She wants to put a low fence all the way around. How many metres of fencing does she need?

9. A cardboard box is a cube with a volume of 64 cm³. What is the length of one edge?

10. Tomo makes a garden path shaped like a rectangle with a triangle on one end. The rectangle is 8 m long and 3 m wide. The triangle on the end has a base of 3 m and a height of 2 m. What is the total area of the path?

Challenge

11. An L-shaped patio is made by joining two rectangles. The whole shape fits inside a 10 m by 6 m rectangle, but a 4 m by 3 m corner rectangle has been removed. Find the area and the perimeter of the L-shaped patio.

12. The 07:45 bus from New Lynn takes 35 minutes to reach Britomart. A student needs to be at Britomart by 08:30 for a study session. Does the bus arrive in time, and how many minutes to spare (or short) are there? If the student misses it and catches the next bus at 08:10 (same 35-minute trip), what time will they arrive?

Year 7 · Geometry: Sorting Triangles

Name: _____ Date: _____

Kia ora! This sheet helps you name triangles two ways, by their angles and by their sides. Grab a pencil and let's classify some shapes!

Warm-up

1. Name the type of triangle that has one right angle (a 90° corner).

2. How many sides of an equilateral triangle are equal in length?

3. A triangle has one angle that is bigger than 90°. What is this type called?

4. An isosceles triangle has how many equal sides?

Practice

5. A triangle has angles of 60°, 60° and 60°. Classify it by BOTH its angles and its sides.

6. A triangle has angles of 90°, 45° and 45°. Classify it by BOTH its angles and its sides.

7. A triangle has side lengths 5 cm, 7 cm and 9 cm, all different, and its largest angle is 100°. Classify it by BOTH its angles and its sides.

8. Aria is cutting a triangular flag for her waka ama club. Two of its angles are 70° and 70°. What is the third angle, and is the flag isosceles?

9. Tane draws a triangle with angles 35°, 55° and 90°. Is this an acute, right or obtuse triangle? Explain.

10. A garden bed at Avondale Primary is shaped like a triangle. All three sides measure 4 m, and one angle is 60°. Classify the triangle by BOTH its sides and its angles, and find the other two angles.

Challenge

11. An isosceles triangle has one angle of 40°. There are TWO different triangles this could be. Find both sets of three angles.

12. Can a triangle be both right (one 90° angle) and equilateral at the same time? Explain your reasoning using angle facts.

Year 7 · Geometry: Shapes, Angles and Moves

Name: _____ Date: _____

Hi there! This sheet helps you practise moving shapes around the grid, finding missing angles, and working with 3D shapes and their nets. Take your time and draw a picture whenever it helps.

Warm-up

1. A regular hexagon has 6 sides. What is the size of one exterior angle?

2. The interior angles of a triangle are 55° and 80°. What is the third angle?

3. Two angles sit on a straight line. One is 130°. What is the other (its supplement)?

4. How many faces does a cube have, and what 2D shape is each face?

Practice

5. Triangle ABC has vertices A(1, 1), B(4, 1) and C(1, 3). It is translated 2 units right and 3 units up. Write the new coordinates.

6. A point P(3, 2) is reflected across the y-axis. Where does it land?

7. The point Q(2, 5) is rotated 90° clockwise about the origin (0, 0). Find its new position.

8. Find the interior angle sum of a regular octagon (8 sides), then find the size of one interior angle.

9. Aroha is building a model triangular prism for a school project. List the 2D shapes that make up its faces and say how many of each she needs.

10. On a street in Avondale, two straight roads cross. Where they meet, one angle measures 118°. Find the size of the angle directly opposite it, and the size of the angle next to it (on a straight line).

Challenge

11. Two parallel fence lines are crossed by a straight diagonal path (a transversal). One angle the path makes with the top fence is $3x + 10$ degrees. The co-interior (same-side interior) angle it makes with the bottom fence is $2x + 20$ degrees. Co-interior angles between parallel lines add to 180°. Find x and both angles.

12. At a point on a straight line, three adjacent angles sit together and make up the straight line. Their sizes are $2x$, $3x$, and $x + 40$ degrees. Set up and solve an equation to find x, then find each angle.

Year 7 · Statistics: Averages, Spread and Data

Name: _____ Date: _____

Hi! This sheet helps you get confident finding the mean, median, mode and range, and thinking about the kinds of data we collect. Take your time and show your working.

Warm-up

1. Find the mean of 4, 6, 8, 10 and 12.

2. Find the median of 3, 7, 9, 2 and 5.

3. Find the mode of 2, 4, 4, 5, 7, 4 and 9.

4. Find the range of 12, 5, 18, 9 and 3.

Practice

5. Sort each of these variables into categorical, discrete numerical, or continuous numerical: (a) favourite ice cream flavour, (b) number of brothers and sisters, (c) height in centimetres, (d) eye colour.

6. In five netball games the Avondale team scored 8, 12, 10, 6 and 14 goals. Find the mean number of goals per game.

7. Six lunchtime temperatures (°C) were recorded: 18, 21, 19, 23, 20 and 22. Find the median temperature.

8. The shoe sizes of seven students are 5, 6, 5, 7, 8, 5 and 6. Find the mode and the range.

9. Mrs Patel's class wanted to answer the question 'Are our feet the same length?' They measured six feet (in mm): 220, 235, 228, 240, 225 and 232. Find the mean foot length and the range.

10. Six friends in Avondale save this much pocket money each week: $5, $8, $6, $10, $8 and $11. Find the mean, median and mode of the amounts saved.

Challenge

11. The mean of five rugby scores is 15. Four of the scores are 12, 18, 10 and 20. What is the fifth score?

12. The heights (cm) of seven students are 142, 150, 138, 155, 148, 160 and 145. (a) Find the median and the range. (b) A new student who is 165 cm tall joins the group. What is the new median?

Year 7 · Statistics: Picturing Data

Name: _____ Date: _____

Hi! This sheet helps you choose the right graph for different kinds of data, read graphs carefully, and spot outliers. Take your time and label everything neatly.

Warm-up

1. Name the type of graph best used to show categorical data such as favourite school lunch (pie, sandwich, sushi, wrap).

2. A time-series graph is used to show data collected over what?

3. True or false: an outlier is a data point that is very much bigger or smaller than most of the others.

4. Which average is pulled towards an outlier: the mean or the median?

Practice

5. Aroha asked her class their favourite fruit. Apple = 8, Feijoa = 5, Mandarin = 6, Kiwifruit = 3. What type of graph should she use, and what should she put on each axis?

6. A shop in Avondale records its ice-cream sales each month over summer: Nov = 120, Dec = 180, Jan = 210, Feb = 160. Which graph shows the trend over time, and describe the trend.

7. A graph is supposed to show data. Write down two things a good data visualisation should let a viewer work out straight away.

8. Here are the number of pets owned by 9 students: 1, 2, 1, 0, 2, 1, 3, 2, 9. Which value is an outlier, and does it need to be an error?

9. A teacher wants to compare boys' and girls' choices of favourite sport in one graph. Which two graph types could she use, and what does each show best?

10. The times (in minutes) students took to run 2 km were: 11, 12, 11, 13, 12, 25. Find the mean and the median, then explain which better describes a typical time.

Challenge

11. A café tracks flat-white sales for two workers over a week: Mon–Fri. Wiremu: 20, 22, 21, 23, 24. Sina: 18, 40, 19, 20, 21. Sina's total looks high. Explain using an outlier, and say which graph would best let a manager compare the two workers day by day.

12. A class made 30 test scores. When they drew a dot plot, all dots were between 60 and 80 except one dot at 15. The mean was 68 and the median was 70. Explain why the mean is lower than the median, and describe how removing the 15 would change each.

Year 7 · Statistics: Reading the Story in Data

Name: _____ Date: _____

This sheet helps you pull the story out of data, finding the middle, measuring the spread, spotting shapes and skew, and noticing when a graph is trying to trick you. Take your time and show your working!

Warm-up

1. Find the median of these numbers: 5, 2, 8, 3, 7.

2. Find the range of: 15, 22, 9, 31, 18.

3. Find the mean of: 4, 6, 8, 10.

4. Find the median of: 10, 4, 7, 2, 9, 6.

Practice

5. A Year 7 class was asked "How many brothers and sisters do you have?" The results were: three students said 0, eight said 1, six said 2, three said 3, one said 4, and one said 5 (22 students in total). Find the median and range, and describe the shape of the data.

6. Mia scored these goals in her 7 netball games: 4, 6, 5, 8, 6, 7, 6. What is the median number of goals, and what is the range?

7. A bar graph at Avondale Intermediate shows favourite lunches: pies 12, sushi 18, sandwiches 15, hot chips 25, fruit 8. Which is the most popular and which is the least popular lunch, and how many students were surveyed altogether?

8. Six friends timed how long it took to walk to Vertex Academy (in minutes): 12, 13, 11, 14, 12, 45. Work out the range. Is there an outlier, and how does it affect the range?

9. A cereal advertisement shows a bar chart claiming "Brand X has WAY more fibre!" but the chart has no title, no numbers on the vertical axis, and no units. Explain why this graph cannot be interpreted accurately.

10. In a spelling test most students scored highly, but a few scored quite low: 4, 6, 7, 8, 8, 9, 9, 9, 10, 10. Describe the shape of this data (symmetrical or skewed, and which way).

Challenge

11. Two hockey teams recorded their goals over 5 games. Kererū: 20, 22, 21, 23, 24. Tūī: 5, 40, 22, 10, 38. Find the median and range for each team, then say which team is more consistent and why.

12. Six numbers, written in order from smallest to largest, are: 3, 7, x, 12, 15, 20. The median of the six numbers is 10. Find the value of x, then work out the range.

Year 7 · Probability: Testing Your Luck with Experiments

Name: _____ Date: _____

Hi! This sheet is all about experimental probability, what actually happens when you run a chance experiment, and how it compares to what we expect. Grab a coin, a die, and something to record your results, and let's find out!

Warm-up

1. Aroha tossed a coin 40 times and got 22 heads. Write the experimental probability of getting heads as a fraction.

2. Write 11/20 as a decimal.

3. A spinner has 4 equal-sized colours: red, blue, green and yellow. What is the theoretical probability of landing on blue?

4. In 50 rolls of a die, the number 6 came up 9 times. What is the experimental probability of rolling a 6?

Practice

5. Tama rolled an ordinary six-sided die 30 times and recorded these results: 1 appeared 4 times, 2 appeared 6 times, 3 appeared 5 times, 4 appeared 3 times, 5 appeared 7 times, 6 appeared 5 times. Calculate the experimental probability of rolling a 5.

6. For the same 30 rolls above, what is the theoretical probability of rolling a 5, and how does it compare to the experimental result?

7. Explain what would likely happen to the experimental probability of rolling a 5 if Tama rolled the die 600 times instead of 30.

8. Mereana runs a chance experiment by tossing a coin 100 times. She gets 46 heads and 54 tails. Find the experimental probability of heads and of tails, then compare each to its theoretical probability.

9. At the Avondale Primary gala, a game uses a bag with 3 red counters and 2 blue counters. Ravi draws a counter, records the colour, and puts it back, doing this 40 times. He records 26 reds and 14 blues. What is the experimental probability of red, and what is the theoretical probability of red?

10. Sione suspects a die is weighted. He rolls it 120 times and the number 3 comes up 40 times. What is the experimental probability of rolling a 3, and does this support his suspicion? Explain.

Challenge

11. Two students test the same spinner with 3 equal sections (A, B, C). Ana does 30 spins and gets A: 14, B: 9, C: 7. Ben does 300 spins and gets A: 104, B: 98, C: 98. The theoretical probability of each section is 1/3 ≈ 0.33. Whose results are closer to the theoretical probability, and what does this show?

12. A game charges $2 to spin a wheel with 10 equal sections: 9 sections say 'Lose' and 1 says 'Win $15'. In 200 spins, the wheel landed on 'Win' 18 times. (a) Find the experimental probability of winning. (b) Compare it to the theoretical probability. (c) Over these 200 spins, did the game organiser make or lose money?

Year 7 · Probability: What Are the Chances?

Name: _____ Date: _____

Hi! This sheet helps you work out theoretical probability, the chance of something happening when every outcome is equally likely. You'll write your answers as fractions, decimals and percentages, compare events, and use complements. Take your time and show your thinking!

Warm-up

1. A fair six-sided dice is rolled. What is the probability of rolling a 4? Write your answer as a fraction.

2. A bag has 10 marbles: 3 are red. Write P(red) as a fraction, a decimal, and a percentage.

3. Using the same bag of 10 marbles (3 red), what is the probability of NOT drawing a red marble?

4. A fair coin is flipped. What is the probability of it landing on heads? Give a fraction, decimal and percentage.

Practice

5. A spinner has 8 equal sections numbered 1 to 8. Find the probability of spinning a number greater than 5. Give your answer as a fraction, decimal and percentage.

6. The Avondale Primary gala sells 200 raffle tickets. Mere buys 8 tickets. If one winning ticket is drawn, what is the probability that Mere wins? Give a fraction in simplest form and a percentage.

7. A bag of lollies has 20 lollies: 5 pineapple, 7 jaffas and 8 eskimos. One lolly is taken without looking. Find P(jaffa), then say whether a pineapple or an eskimo is more likely, and explain.

8. A letter is chosen at random from the word AVONDALE. Find P(the letter is A) and P(the letter is a vowel). Which event is more likely?

9. The MetService forecast says the probability of rain in Auckland tomorrow is 0.65. What is the probability it does NOT rain? Give a decimal and a percentage.

10. Two fair coins are flipped. Draw a tree diagram or list to show all outcomes, then find P(two heads) and P(at least one head).

Challenge

11. Two fair dice are rolled and their numbers added. Make a table of all the possible totals, then find P(total is 8) and P(total is at least 10). Which total event is more likely?

12. A bag holds 40 marbles. The probability of drawing a green marble is 0.3 and the probability of drawing a blue marble is 1/4. The rest of the marbles are yellow. What is the probability of drawing yellow, and how many yellow marbles are in the bag?

Answer key (for parents and tutors)

1. Write 10^4 as an ordinary number, then write 100 000 as a power of 10.
   10^4 means 10 × 10 × 10 × 10 = 10 000. 100 000 has 5 zeros, so 100 000 = 10^5.

2. Work out 6^2 and $\sqrt{81}$.
   6^2 = 6 × 6 = 36. $\sqrt{81}$ asks 'what number times itself gives 81?' 9 × 9 = 81, so $\sqrt{81}$ = 9.

3. Is 51 a prime or composite number? Explain.
   51 = 3 × 17, so it has factors 1, 3, 17 and 51, more than two factors. That makes 51 a composite number.

4. What is the additive inverse of −7?
   The additive inverse is the number that adds to give 0. −7 + 7 = 0, so the additive inverse of −7 is 7.

5. Write 47 208 in expanded form using powers of 10.
   Break it into place values: 40 000 + 7000 + 200 + 8. Using powers of 10: 4 × 10^4 + 7 × 10^3 + 2 × 10^2 + 8. (The tens place is 0, so it is not written.)

6. Find the highest common factor (HCF) of 48 and 60, and the least common multiple (LCM) of 6 and 8.
   48 = 2 × 2 × 2 × 2 × 3 and 60 = 2 × 2 × 3 × 5. The shared factors are 2 × 2 × 3 = 12, so HCF = 12. For the LCM of 6 and 8: multiples of 8 are 8, 16, 24… and 24 is the first that 6 also divides (6 × 4 = 24). So LCM = 24.

7. Use the order of operations (GEMA) to evaluate 3 + 4 × (5^2 − 3).
   Grouped/brackets first: inside the brackets do the exponent, 5^2 = 25, then 25 − 3 = 22. Next multiply: 4 × 22 = 88. Finally add: 3 + 88 = 91.

8. Convert ⅝ to a decimal and then to a percentage.
   Divide: 5 ÷ 8 = 0.625 (a terminating decimal). To make a percentage, multiply by 100: 0.625 × 100 = 62.5%. So ⅝ = 0.625 = 62.5%.

9. Aroha saved $186 for the holidays. She spent ⅔ of her savings on a bike part. How much did she spend, and how much is left?
   ⅔ of 186: first ⅓ = 186 ÷ 3 = 62, then ⅔ = 62 × 2 = 124. She spent $124. Money left = 186 − 124 = $62.

10. At Avondale College a netball club has 3 juniors for every 7 seniors. If there are 18 juniors, how many players are there altogether?
    The juniors went from 3 to 18, which is × 6 (18 ÷ 3 = 6). Scale the seniors the same way: 7 × 6 = 42 seniors. Altogether = 18 + 42 = 60 players.

11. At a market stall, 40% of the day's takings is $28. Find the full takings (100%), then work out 75% of that amount.
    If 40% = $28, then 1% = 28 ÷ 40 = $0.70. So 100% = 0.70 × 100 = $70 (the full takings). Now 75% of $70: 75% = ¾, and ¾ of 70 = (70 ÷ 4) × 3 = 17.5 × 3 = $52.50.

12. Add 2⅔ + 1¾ and give the answer as a mixed number in its simplest form.
    Use a common denominator of 12: ⅔ = ⁸⁄₁₂ and ¾ = ⁹⁄₁₂. Add whole numbers: 2 + 1 = 3. Add fractions: ⁸⁄₁₂ + ⁹⁄₁₂ = ¹⁷⁄₁₂ = 1 ⁵⁄₁₂. Combine: 3 + 1 ⁵⁄₁₂ = 4 ⁵⁄₁₂. Since 5 and 12 share no common factor, 4 ⁵⁄₁₂ is already in simplest form.

Answer key (for parents and tutors)

1. Add these prices: $4.50 + $3.20 + $1.30
   $4.50 + $3.20 = $7.70, then $7.70 + $1.30 = $9.00. Total = $9.00.
2. Find 10% of $60.
   10% means divide by 10. $60 ÷ 10 = $6. Answer: $6.00.
3. You pay for a $6.40 item with a $10 note. How much change do you get?
   $10.00 − $6.40 = $3.60. Change = $3.60.
4. Round $7.83 to the nearest 10 cents for a cash payment.
   The digit after the tens-of-cents is 3, so round down. $7.83 rounds to $7.80.
5. At the Avondale dairy, Mia buys a pie for $4.90, a juice for $3.50, and a muesli bar for $2.20. What is the total cost?
   $4.90 + $3.50 = $8.40, then $8.40 + $2.20 = $10.60. Total = $10.60.
6. A jacket costs $80. In a sale it is 25% off. What is the discount, and what is the sale price?
   25% of $80 = $80 ÷ 4 = $20 discount. Sale price = $80 − $20 = $60.00.
7. A pair of shoes is priced at $90 with 20% off. Find the sale price.
   20% of $90 = $90 ÷ 5 = $18 discount. Sale price = $90 − $18 = $72.00.
8. Liam's shopping comes to $23.67. He pays with cash. Round the total to the nearest 10 cents, then find his change from $30.
   $23.67 rounds to $23.70 (the 7 rounds up). Change = $30.00 − $23.70 = $6.30.
9. A book club orders 6 books at $12.50 each. What is the total cost?
   6 × $12.50 = $75.00. Total = $75.00.
10. Sione buys a $45 game marked 40% off. He pays with cash. What is the sale price, and what is his change from $30?
    40% of $45 = $45 × 0.4 = $18 discount. Sale price = $45 − $18 = $27.00. Change from $30 = $30.00 − $27.00 = $3.00.
11. A speaker costs $120. It is reduced by 15% in a sale. Aroha pays with cash. Find the sale price, round it to the nearest 10 cents, and work out her change from $110.
    15% of $120: 10% is $12 and 5% is $6, so 15% = $18 discount. Sale price = $120 − $18 = $102.00. It already ends in .00, so no rounding change: $102.00. Change from $110 = $110.00 − $102.00 = $8.00.
12. Two shops sell the same $150 tent. Shop A offers 30% off. Shop B offers 25% off plus an extra $10 off the discounted price. Which shop is cheaper, and by how much?
    Shop A: 30% of $150 = $45 off, so price = $150 − $45 = $105.00. Shop B: 25% of $150 = $37.50 off, so $150 − $37.50 = $112.50, then − $10 = $102.50. Compare: Shop B ($102.50) is cheaper than Shop A ($105.00). Difference = $105.00 − $102.50 = $2.50. Shop B is cheaper by $2.50.

Answer key (for parents and tutors)

1. Simplify: $4a + a + 2a$
   Add the like terms: $4a + a + 2a$. Count the a's: $4 + 1 + 2 = 7$, so the answer is $7a$.

2. Solve for t: $t + 7 = 12$
   Use the inverse of adding 7, which is subtracting 7. $t = 12 - 7 = 5$. Check: $5 + 7 = 12$. ✓

3. If $w = 4$, find the value of $w + 12$.
   Substitute $w = 4$: $4 + 12 = 16$.

4. True or false? $3 \times 5 > 2 \times 7$
   Work out each side: $3 \times 5 = 15$ and $2 \times 7 = 14$. Since $15 > 14$, the statement is TRUE.

5. Simplify: $6b - 2b + 3b$
   Collect like terms: $6b - 2b = 4b$, then $4b + 3b = 7b$. The answer is $7b$.

6. Solve for s: $5s + 3 = 18$
   First subtract 3 from both sides: $5s = 18 - 3 = 15$. Then divide both sides by 5: $s = 15 \div 5 = 3$. Check: $5 \times 3 + 3 = 15 + 3 = 18$. ✓

7. Aria buys 3 identical drink bottles at the Avondale market. She pays with a $20 note and gets $5 change. Let c be the cost of one bottle. Write an equation and find c.
   The 3 bottles cost $20 - 5 = $15. Equation: $3c = 15$. Divide both sides by 3: $c = 15 \div 3 = $5. Each bottle costs $5. Check: $3 \times 5 = 15$, and $20 - 15 = 5$ change. ✓

8. The area of a rectangle is $A = l \times w$. A netball court section has area $A = 48$ m² and length $l = 8$ m. Rearrange the formula to make w the subject, then find w.
   Divide both sides of $A = lw$ by l to make w the subject: $w = A \div l$. Substitute the numbers: $w = 48 \div 8 = 6$ m. Check: $8 \times 6 = 48$ m². ✓

9. Tane is stacking chairs for a school event. He starts with 4 chairs and adds 3 chairs each minute. The number of chairs t after n minutes is $t = 3 \times n + 4$. How many chairs are there after 6 minutes?
   Substitute $n = 6$ into $t = 3 \times n + 4$: $t = 3 \times 6 + 4 = 18 + 4 = 22$ chairs.

10. Plot these three points on a coordinate plane and state which quadrant each is in: A(3, 2), B(−4, 1), C(−2, −3).
    A(3, 2): right and up, so first quadrant (top right). B(−4, 1): left and up, so second quadrant (top left). C(−2, −3): left and down, so third quadrant (bottom left). Plot by moving along the x-axis first, then up or down for y.

11. A pattern of matchstick triangles grows like this: 1 triangle uses 3 matches, 2 triangles use 5 matches, 3 triangles use 7 matches. Find a rule in the form $t = a \times n + d$ for the number of matches t for n triangles, then work out how many matches are needed for 20 triangles.
    Look at the increase: 3, 5, 7 goes up by 2 each time, so $a = 2$. To find d, use $n = 1$: $t = 2 \times 1 + d = 3$, so $2 + d = 3$, giving $d = 1$. The rule is $t = 2 \times n + 1$. For 20 triangles: $t = 2 \times 20 + 1 = 40 + 1 = 41$ matches. Check with $n = 3$: $2 \times 3 + 1 = 7$. ✓

12. Solve for x: $4x - 5 = 2x + 7$. Then check your answer by substituting into both sides.
    Get the x terms on one side by subtracting $2x$ from both sides: $4x - 2x - 5 = 7$, which gives $2x - 5 = 7$. Add 5 to both sides: $2x = 12$. Divide by 2: $x = 6$. Check: left side $4 \times 6 - 5 = 24 - 5 = 19$; right side $2 \times 6 + 7 = 12 + 7 = 19$. Both sides equal 19. ✓

Answer key (for parents and tutors)

1. Find the perimeter of a square with side length 7 cm.
   Use $P = 4l$. $P = 4 \times 7 = 28$ cm.
2. Find the area of a rectangle that is 9 m long and 4 m wide.
   Use $A = lw$. $A = 9 \times 4 = 36$ m².
3. Find the volume of a cube with side length 3 cm.
   Use $V = l^3$. $V = 3 \times 3 \times 3 = 27$ cm³.
4. Which unit best measures the mass of an apple: milligram, gram, or kilogram? Explain.
   Gram. An apple has a mass of roughly 150 g. Milligrams are far too small (used for tiny amounts) and kilograms are too large for a single apple.
5. A rectangle has a perimeter of 30 cm. Its length is 9 cm. Find its width.
   Use $P = 2(l + w)$. $30 = 2(9 + w)$, so $15 = 9 + w$, giving $w = 15 - 9 = 6$ cm.
6. A triangle has an area of 24 cm² and a height of 6 cm. Find the length of its base.
   Use $A = \frac{1}{2}bh$. $24 = \frac{1}{2} \times b \times 6 = 3b$, so $b = 24 \div 3 = 8$ cm.
7. Find the volume of a rectangular prism that is 5 cm long, 4 cm wide and 3 cm high.
   Use $V = lwh$. $V = 5 \times 4 \times 3 = 60$ cm³.
8. Aroha is building a rectangular vegetable garden in Avondale that is 6 m long and 2.5 m wide. She wants to put a low fence all the way around. How many metres of fencing does she need?
   Perimeter $P = 2(l + w) = 2(6 + 2.5) = 2 \times 8.5 = 17$ m of fencing.
9. A cardboard box is a cube with a volume of 64 cm³. What is the length of one edge?
   Use $V = l^3$. We need the number that cubed gives 64. Since $4 \times 4 \times 4 = 64$, the edge length is 4 cm.
10. Tomo makes a garden path shaped like a rectangle with a triangle on one end. The rectangle is 8 m long and 3 m wide. The triangle on the end has a base of 3 m and a height of 2 m. What is the total area of the path?
    Rectangle area = $lw = 8 \times 3 = 24$ m². Triangle area = $\frac{1}{2}bh = \frac{1}{2} \times 3 \times 2 = 3$ m². Total area = $24 + 3 = 27$ m².
11. An L-shaped patio is made by joining two rectangles. The whole shape fits inside a 10 m by 6 m rectangle, but a 4 m by 3 m corner rectangle has been removed. Find the area and the perimeter of the L-shaped patio.
    Area: full rectangle = $10 \times 6 = 60$ m². Removed corner = $4 \times 3 = 12$ m². L-shape area = $60 - 12 = 48$ m². Perimeter: walking around the L, the six sides are 10, 6, 6, 3, 4, and 3 metres. (The full outer length 10 and full outer width 6, then the step in is 3 down and 4 across for the notch, then 3 up, then back along the remaining 6.) Adding: $10 + 6 + 6 + 3 + 4 + 3 = 32$ m.
12. The 07:45 bus from New Lynn takes 35 minutes to reach Britomart. A student needs to be at Britomart by 08:30 for a study session. Does the bus arrive in time, and how many minutes to spare (or short) are there? If the student misses it and catches the next bus at 08:10 (same 35-minute trip), what time will they arrive?
    First bus: 07:45 + 35 min = 08:20. This is before 08:30, so yes it arrives in time, with 08:30 − 08:20 = 10 minutes to spare. Second bus: 08:10 + 35 min = 08:45. That would arrive 15 minutes late (after 08:30).

Answer key (for parents and tutors)

1. Name the type of triangle that has one right angle (a 90° corner).
   A right triangle. It has exactly one angle measuring 90°.
2. How many sides of an equilateral triangle are equal in length?
   All three sides are equal in length. (Its three angles are also all 60°.)
3. A triangle has one angle that is bigger than 90°. What is this type called?
   An obtuse triangle. It has one angle greater than 90° (an obtuse angle).
4. An isosceles triangle has how many equal sides?
   At least two equal sides. The two angles opposite those equal sides (the base angles) are also equal.
5. A triangle has angles of 60°, 60° and 60°. Classify it by BOTH its angles and its sides.
   By angles: all three are less than 90°, so it is acute. By sides: three equal 60° angles mean three equal sides, so it is equilateral. Answer: an acute, equilateral triangle.
6. A triangle has angles of 90°, 45° and 45°. Classify it by BOTH its angles and its sides.
   By angles: it has one 90° angle, so it is a right triangle. By sides: the two 45° angles are equal, so the two sides opposite them are equal, it is isosceles. Answer: a right, isosceles triangle.
7. A triangle has side lengths 5 cm, 7 cm and 9 cm, all different, and its largest angle is 100°. Classify it by BOTH its angles and its sides.
   By sides: all three sides are different, so it is scalene. By angles: one angle is 100°, which is greater than 90°, so it is obtuse. Answer: an obtuse, scalene triangle.
8. Aria is cutting a triangular flag for her waka ama club. Two of its angles are 70° and 70°. What is the third angle, and is the flag isosceles?
   Angles in a triangle add to 180°. Third angle = 180° − 70° − 70° = 40°. Two angles are equal (70° and 70°), so the sides opposite them are equal, yes, the flag is isosceles.
9. Tane draws a triangle with angles 35°, 55° and 90°. Is this an acute, right or obtuse triangle? Explain.
   It has one angle of exactly 90°, so it is a right triangle. The other angles (35° and 55°) are acute, but a single 90° angle makes it a right triangle.
10. A garden bed at Avondale Primary is shaped like a triangle. All three sides measure 4 m, and one angle is 60°. Classify the triangle by BOTH its sides and its angles, and find the other two angles.
    All three sides are equal, so it is equilateral. Every equilateral triangle has three 60° angles, so the other two angles are also 60° each. Since all angles are less than 90°, it is also acute. Answer: an acute, equilateral triangle with angles 60°, 60°, 60°.
11. An isosceles triangle has one angle of 40°. There are TWO different triangles this could be. Find both sets of three angles.
    Case 1: the 40° angle is the odd angle (the apex), so the two equal base angles share the rest: 180° − 40° = 140°, and 140° ÷ 2 = 70°. Angles: 40°, 70°, 70°. Case 2: the 40° angle is one of the equal base angles, so there are two 40° angles: 40° + 40° = 80°, and the third angle = 180° − 80° = 100°. Angles: 40°, 40°, 100°. Both are valid isosceles triangles.
12. Can a triangle be both right (one 90° angle) and equilateral at the same time? Explain your reasoning using angle facts.
    No. An equilateral triangle must have three equal angles, and since they add to 180°, each is 180° ÷ 3 = 60°. A right triangle needs a 90° angle. Because an equilateral triangle's angles are all 60°, it can never contain a 90° angle. So a triangle cannot be both right and equilateral.

Answer key (for parents and tutors)

1. A regular hexagon has 6 sides. What is the size of one exterior angle?
   Exterior angle = 360° ÷ number of sides = 360° ÷ 6 = 60°. So one exterior angle is 60°.

2. The interior angles of a triangle are 55° and 80°. What is the third angle?
   The interior angles of a triangle add to 180°. Third angle = 180° − 55° − 80° = 180° − 135° = 45°.

3. Two angles sit on a straight line. One is 130°. What is the other (its supplement)?
   Angles on a straight line add to 180°. Other angle = 180° − 130° = 50°.

4. How many faces does a cube have, and what 2D shape is each face?
   A cube has 6 faces, and each face is a square.

5. Triangle ABC has vertices A(1, 1), B(4, 1) and C(1, 3). It is translated 2 units right and 3 units up. Write the new coordinates.
   A translation of 2 right and 3 up adds 2 to each x and 3 to each y. A(1, 1) → (3, 4); B(4, 1) → (6, 4); C(1, 3) → (3, 6).

6. A point P(3, 2) is reflected across the y-axis. Where does it land?
   Reflecting across the y-axis keeps the y-coordinate the same and changes the sign of the x-coordinate. P(3, 2) → (−3, 2).

7. The point Q(2, 5) is rotated 90° clockwise about the origin (0, 0). Find its new position.
   For a 90° clockwise rotation about the origin, the point (x, y) moves to (y, −x). Q(2, 5) → (5, −2).

8. Find the interior angle sum of a regular octagon (8 sides), then find the size of one interior angle.
   Interior angle sum = 180(n − 2)° = 180 × (8 − 2)° = 180 × 6 = 1080°. One interior angle = 1080° ÷ 8 = 135°.

9. Aroha is building a model triangular prism for a school project. List the 2D shapes that make up its faces and say how many of each she needs.
   A triangular prism has 2 triangular faces (the two ends) and 3 rectangular faces (the sides). So Aroha needs 2 triangles and 3 rectangles, 5 faces in total.

10. On a street in Avondale, two straight roads cross. Where they meet, one angle measures 118°. Find the size of the angle directly opposite it, and the size of the angle next to it (on a straight line).
    The angle directly opposite is a vertical angle, so it is equal: 118°. The angle next to it lies on a straight line (they are supplementary): 180° − 118° = 62°.

11. Two parallel fence lines are crossed by a straight diagonal path (a transversal). One angle the path makes with the top fence is $3x + 10$ degrees. The co-interior (same-side interior) angle it makes with the bottom fence is $2x + 20$ degrees. Co-interior angles between parallel lines add to 180°. Find x and both angles.
    Co-interior angles add to 180°, so $(3x + 10) + (2x + 20) = 180$. Combine: $5x + 30 = 180$. Subtract 30: $5x = 150$. Divide by 5: $x = 30$. First angle = $3(30) + 10 = 90 + 10 = 100°$. Second angle = $2(30) + 20 = 60 + 20 = 80°$. Check: $100° + 80° = 180°$. ✓

12. At a point on a straight line, three adjacent angles sit together and make up the straight line. Their sizes are $2x$, $3x$, and $x + 40$ degrees. Set up and solve an equation to find x, then find each angle.
    Angles on a straight line add to 180°, so $2x + 3x + (x + 40) = 180$. Combine like terms: $6x + 40 = 180$. Subtract 40: $6x = 140$... check: that would not be whole, so recompute. $6x = 140$ gives $x \approx 23.3$, not tidy, let me re-add: $2x + 3x + x = 6x$, plus 40, equals 180. $6x = 140$, $x = 23\frac{1}{3}$. To keep it tidy, use the intended totals: the angles are $2x$, $3x$, and $x + 40$. $6x + 40 = 180$, so $6x = 140$ and $x = 23\frac{1}{3}°$. Then $2x = 46\frac{2}{3}°$, $3x = 70°$, and $x + 40 = 63\frac{1}{3}°$. Check: $46\frac{2}{3} + 70 + 63\frac{1}{3} = 180°$. ✓

Answer key (for parents and tutors)

1. Find the mean of 4, 6, 8, 10 and 12.
   Add them: 4 + 6 + 8 + 10 + 12 = 40. There are 5 numbers, so mean = 40 ÷ 5 = 8.

2. Find the median of 3, 7, 9, 2 and 5.
   Sort the numbers: 2, 3, 5, 7, 9. There are 5 values, so the middle one is the 3rd value. Median = 5.

3. Find the mode of 2, 4, 4, 5, 7, 4 and 9.
   The mode is the value that appears most often. 4 appears three times, more than any other. Mode = 4.

4. Find the range of 12, 5, 18, 9 and 3.
   Range = highest value − lowest value = 18 − 3 = 15.

5. Sort each of these variables into categorical, discrete numerical, or continuous numerical: (a) favourite ice cream flavour, (b) number of brothers and sisters, (c) height in centimetres, (d) eye colour.
   (a) Favourite ice cream flavour = categorical (it puts people in groups). (b) Number of brothers and sisters = discrete numerical (you count it). (c) Height in centimetres = continuous numerical (you measure it). (d) Eye colour = categorical (it puts people in groups).

6. In five netball games the Avondale team scored 8, 12, 10, 6 and 14 goals. Find the mean number of goals per game.
   Total goals = 8 + 12 + 10 + 6 + 14 = 50. There are 5 games, so mean = 50 ÷ 5 = 10 goals per game.

7. Six lunchtime temperatures (°C) were recorded: 18, 21, 19, 23, 20 and 22. Find the median temperature.
   Sort them: 18, 19, 20, 21, 22, 23. There are 6 values (an even amount), so the median is the mean of the two middle values (the 3rd and 4th): (20 + 21) ÷ 2 = 41 ÷ 2 = 20.5 °C.

8. The shoe sizes of seven students are 5, 6, 5, 7, 8, 5 and 6. Find the mode and the range.
   Mode: size 5 appears three times, more than any other, so mode = 5. Range = highest − lowest = 8 − 5 = 3.

9. Mrs Patel's class wanted to answer the question 'Are our feet the same length?' They measured six feet (in mm): 220, 235, 228, 240, 225 and 232. Find the mean foot length and the range.
   Total = 220 + 235 + 228 + 240 + 225 + 232 = 1380 mm. Mean = 1380 ÷ 6 = 230 mm. Range = 240 − 220 = 20 mm. Because the range is 20 mm, the feet are not all the same length.

10. Six friends in Avondale save this much pocket money each week: $5, $8, $6, $10, $8 and $11. Find the mean, median and mode of the amounts saved.
    Mean: total = 5 + 8 + 6 + 10 + 8 + 11 = $48, so mean = 48 ÷ 6 = $8. Median: sort them 5, 6, 8, 8, 10, 11; the two middle values (3rd and 4th) are 8 and 8, so median = (8 + 8) ÷ 2 = $8. Mode: $8 appears twice, more than any other, so mode = $8.

11. The mean of five rugby scores is 15. Four of the scores are 12, 18, 10 and 20. What is the fifth score?
    If the mean of 5 scores is 15, the total must be 15 × 5 = 75. The four known scores add to 12 + 18 + 10 + 20 = 60. So the fifth score = 75 − 60 = 15.

12. The heights (cm) of seven students are 142, 150, 138, 155, 148, 160 and 145. (a) Find the median and the range. (b) A new student who is 165 cm tall joins the group. What is the new median?
    (a) Sort the heights: 138, 142, 145, 148, 150, 155, 160. There are 7 values, so the median is the 4th value = 148 cm. Range = 160 − 138 = 22 cm. (b) With the new student there are 8 heights: 138, 142, 145, 148, 150, 155, 160, 165. The median is the mean of the 4th and 5th values: (148 + 150) ÷ 2 = 298 ÷ 2 = 149 cm.

Answer key (for parents and tutors)

1. Name the type of graph best used to show categorical data such as favourite school lunch (pie, sandwich, sushi, wrap).
   A bar graph (or a dot plot). Categorical data groups things into named categories, so a bar graph with one bar per category is a good choice.

2. A time-series graph is used to show data collected over what?
   Over time. A time-series graph plots a variable against time (for example, temperature each day, or sales each month) so you can see trends going up or down.

3. True or false: an outlier is a data point that is very much bigger or smaller than most of the others.
   True. An outlier sits well away from the main cluster of data, much higher or much lower than the rest.

4. Which average is pulled towards an outlier: the mean or the median?
   The mean. Because the mean uses the size of every value, a very large or very small outlier drags it towards itself. The median (middle value) is barely affected.

5. Aroha asked her class their favourite fruit. Apple = 8, Feijoa = 5, Mandarin = 6, Kiwifruit = 3. What type of graph should she use, and what should she put on each axis?
   Favourite fruit is categorical data, so a bar graph (or dot plot) is best. The horizontal axis shows the fruit categories (Apple, Feijoa, Mandarin, Kiwifruit) and the vertical axis shows the frequency (number of students), going 0, 2, 4, 6, 8. Each bar height matches its count.

6. A shop in Avondale records its ice-cream sales each month over summer: Nov = 120, Dec = 180, Jan = 210, Feb = 160. Which graph shows the trend over time, and describe the trend.
   This is time-series data (values collected over time), so use a time-series graph with months on the horizontal axis and sales on the vertical axis, joining the points with lines. The trend rises from November to a peak in January (120 → 180 → 210), then falls in February to 160, sales climb through early summer and start dropping as summer ends.

7. A graph is supposed to show data. Write down two things a good data visualisation should let a viewer work out straight away.
   Any two of: (1) what the variable(s) is/are (what is being measured or grouped); (2) who the data was collected from (the group of people or things); (3) the units for numerical variables; (4) the frequency, proportions, patterns or trends. A clear title and labelled axes usually provide these.

8. Here are the number of pets owned by 9 students: 1, 2, 1, 0, 2, 1, 3, 2, 9. Which value is an outlier, and does it need to be an error?
   9 is the outlier, most students have 0 to 3 pets, but one student has 9, which is far above the others. It does not have to be an error; that student may genuinely own 9 pets (for example, a family that fosters animals). Outliers can be real, rare events.

9. A teacher wants to compare boys' and girls' choices of favourite sport in one graph. Which two graph types could she use, and what does each show best?
   She could use a clustered (grouped) bar graph or a stacked bar graph, because this is paired categorical data (sport AND gender). A clustered bar graph places the boys' and girls' bars side by side for each sport, making it easy to compare the two groups directly. A stacked bar graph puts one on top of the other in a single bar per sport, making the total for each sport easy to see.

10. The times (in minutes) students took to run 2 km were: 11, 12, 11, 13, 12, 25. Find the mean and the median, then explain which better describes a typical time.
    Mean = (11 + 12 + 11 + 13 + 12 + 25) ÷ 6 = 84 ÷ 6 = 14 minutes. Median: order them 11, 11, 12, 12, 13, 25; middle two are 12 and 12, so median = 12 minutes. The 25 is an outlier that pulls the mean up to 14. The median (12) better describes a typical time because it is not affected by the one very slow runner.

11. A café tracks flat-white sales for two workers over a week: Mon–Fri. Wiremu: 20, 22, 21, 23, 24. Sina: 18, 40, 19, 20, 21. Sina's total looks high. Explain using an outlier, and say which graph would best let a manager compare the two workers day by day.
    Wiremu's total = 20+22+21+23+24 = 110. Sina's total = 18+40+19+20+21 = 118. Sina looks higher only because of

Tuesday's 40, which is an outlier, her other days (18–21) are actually a bit lower than Wiremu's. Sina's mean = 118 ÷ 5 = 23.6, but her median = 20 (order: 18,19,20,21,40), so the median shows her typical day is around 20. To compare the two workers each day, a clustered bar graph works best: for each day, place Wiremu's and Sina's bars side by side, making the Tuesday spike easy to spot.

12. A class made 30 test scores. When they drew a dot plot, all dots were between 60 and 80 except one dot at 15. The mean was 68 and the median was 70. Explain why the mean is lower than the median, and describe how removing the 15 would change each.
The score of 15 is a low outlier far below the main cluster (60–80). Because the mean uses every value's size, this very low score drags the mean down to 68, while the median (middle value) stays at 70 in the main group, so the mean ends up lower than the median. If the 15 is removed: the mean would rise (it is no longer being pulled down, moving closer to 70), while the median would change only slightly, since taking away one end value barely shifts the middle of the ordered data. This shows the median is more resistant to outliers than the mean.

Answer key (for parents and tutors)

1. Find the median of these numbers: 5, 2, 8, 3, 7.
   Put them in order: 2, 3, 5, 7, 8. There are 5 numbers, so the median is the middle (3rd) value. Median = 5.

2. Find the range of: 15, 22, 9, 31, 18.
   Range = largest – smallest = 31 – 9 = 22.

3. Find the mean of: 4, 6, 8, 10.
   Add them: 4 + 6 + 8 + 10 = 28. Divide by how many (4): 28 ÷ 4 = 7. Mean = 7.

4. Find the median of: 10, 4, 7, 2, 9, 6.
   Put them in order: 2, 4, 6, 7, 9, 10. There are 6 numbers (even), so the median is halfway between the 3rd and 4th values: (6 + 7) ÷ 2 = 6.5. Median = 6.5.

5. A Year 7 class was asked "How many brothers and sisters do you have?" The results were: three students said 0, eight said 1, six said 2, three said 3, one said 4, and one said 5 (22 students in total). Find the median and range, and describe the shape of the data.
   List in order there are 22 values. The median is halfway between the 11th and 12th values. Counting up: values 1–3 are 0, values 4–11 are 1, values 12–17 are 2. So the 11th value = 1 and the 12th value = 2. Median = (1 + 2) ÷ 2 = 1.5 siblings. Range = 5 – 0 = 5 siblings. Shape: most students have a small number of siblings, with a long thin tail stretching out to the larger values (4 and 5). The right tail tapers more slowly, so the data is positively skewed (skewed to the right).

6. Mia scored these goals in her 7 netball games: 4, 6, 5, 8, 6, 7, 6. What is the median number of goals, and what is the range?
   Put the scores in order: 4, 5, 6, 6, 6, 7, 8. There are 7 games, so the median is the middle (4th) value = 6 goals. Range = 8 – 4 = 4 goals. So on a typical game Mia scored about 6 goals, and her scores varied over a range of 4 goals.

7. A bar graph at Avondale Intermediate shows favourite lunches: pies 12, sushi 18, sandwiches 15, hot chips 25, fruit 8. Which is the most popular and which is the least popular lunch, and how many students were surveyed altogether?
   Compare the frequencies. The tallest bar is hot chips with 25, so hot chips is the most popular (most frequent). The shortest bar is fruit with 8, so fruit is the least popular (least frequent). Total surveyed = 12 + 18 + 15 + 25 + 8 = 78 students.

8. Six friends timed how long it took to walk to Vertex Academy (in minutes): 12, 13, 11, 14, 12, 45. Work out the range. Is there an outlier, and how does it affect the range?
   Range = 45 – 11 = 34 minutes. The value 45 is an outlier, it is far away from the other times, which are all close to 11–14 minutes. Because of this one unusual value, the range of 34 makes the walk times look far more spread out than they really are. If we set the outlier aside, the other five times (11, 12, 12, 13, 14) have a range of only 14 – 11 = 3 minutes, which better describes the group. It would be worth checking whether the 45 was a mistake or a genuine special case (e.g. someone stopped on the way).

9. A cereal advertisement shows a bar chart claiming "Brand X has WAY more fibre!" but the chart has no title, no numbers on the vertical axis, and no units. Explain why this graph cannot be interpreted accurately.
   Without a vertical axis scale and units we cannot tell how much fibre each bar represents, we don't know if the difference is 1 gram or 10 grams. Without a title or axis labels we don't even know for sure what is being measured or in what units. A bar that looks 'twice as tall' might only be a tiny real difference, especially if the axis doesn't start at zero. Because these key parts are missing, the graph may be misleading and hiding information, so we cannot draw a fair conclusion from it.

10. In a spelling test most students scored highly, but a few scored quite low: 4, 6, 7, 8, 8, 9, 9, 9, 10, 10. Describe the shape of this data (symmetrical or skewed, and which way).
    Look at where the values pile up. Most scores are bunched at the high end (8, 9, 10), with a longer thin tail stretching down to the low scores (4, 6). The left tail tapers more slowly than the right tail, so the data is negatively skewed (skewed to the left).

11. Two hockey teams recorded their goals over 5 games. Kererū: 20, 22, 21, 23, 24. Tūī: 5, 40, 22, 10, 38. Find the median and range for each team, then say which team is more consistent and why.
Kererū in order: 20, 21, 22, 23, 24 → median = 22 (middle value); range = 24 − 20 = 4. Tūī in order: 5, 10, 22, 38, 40 → median = 22 (middle value); range = 40 − 5 = 35. Both teams have the same median (22), so their 'typical' scores are similar. However, Kererū's range is only 4 while Tūī's range is 35, meaning Tūī's scores are much more spread out. Kererū is the more consistent team, because their scores stay close to the median from game to game, while Tūī swings between very low and very high scores.

12. Six numbers, written in order from smallest to largest, are: 3, 7, x, 12, 15, 20. The median of the six numbers is 10. Find the value of x, then work out the range.
With 6 numbers the median is halfway between the 3rd and 4th values, which are x and 12. So (x + 12) ÷ 2 = 10. Multiply both sides by 2: x + 12 = 20. Subtract 12: x = 8. (Check: 8 sits correctly between 7 and 12, so the list stays in order.) The full set is 3, 7, 8, 12, 15, 20. Range = 20 − 3 = 17.

Answer key (for parents and tutors)

1. Aroha tossed a coin 40 times and got 22 heads. Write the experimental probability of getting heads as a fraction.
   Experimental probability = number of heads ÷ total tosses = 22 ÷ 40 = 22/40, which simplifies to 11/20.
2. Write 11/20 as a decimal.
   11 ÷ 20 = 0.55. (You can also think of it as 55/100 = 0.55.)
3. A spinner has 4 equal-sized colours: red, blue, green and yellow. What is the theoretical probability of landing on blue?
   There are 4 equal outcomes and only 1 is blue, so the theoretical probability = 1/4 = 0.25.
4. In 50 rolls of a die, the number 6 came up 9 times. What is the experimental probability of rolling a 6?
   Experimental probability = 9 ÷ 50 = 9/50 = 0.18.
5. Tama rolled an ordinary six-sided die 30 times and recorded these results: 1 appeared 4 times, 2 appeared 6 times, 3 appeared 5 times, 4 appeared 3 times, 5 appeared 7 times, 6 appeared 5 times. Calculate the experimental probability of rolling a 5.
   Experimental probability of a 5 = number of 5s ÷ total rolls = 7 ÷ 30 = 7/30 ≈ 0.23. (Check: 4+6+5+3+7+5 = 30 rolls, so the total is correct.)
6. For the same 30 rolls above, what is the theoretical probability of rolling a 5, and how does it compare to the experimental result?
   Theoretical probability = 1/6 ≈ 0.17. The experimental result was 7/30 ≈ 0.23, which is a bit higher than 1/6. They differ because 30 trials is a fairly small number, so random chance made 5 come up a little more often than expected.
7. Explain what would likely happen to the experimental probability of rolling a 5 if Tama rolled the die 600 times instead of 30.
   With many more trials, the experimental probability would get closer to the theoretical probability of 1/6 ≈ 0.17. This is the Law of Large Numbers: as the number of trials increases, the experimental probability moves nearer to the theoretical probability.
8. Mereana runs a chance experiment by tossing a coin 100 times. She gets 46 heads and 54 tails. Find the experimental probability of heads and of tails, then compare each to its theoretical probability.
   Experimental P(heads) = 46/100 = 0.46. Experimental P(tails) = 54/100 = 0.54. The theoretical probability of each is 1/2 = 0.5. Both results are close to 0.5, but not exactly, because even 100 trials still has some random variation. With more tosses they would be expected to get even closer to 0.5.
9. At the Avondale Primary gala, a game uses a bag with 3 red counters and 2 blue counters. Ravi draws a counter, records the colour, and puts it back, doing this 40 times. He records 26 reds and 14 blues. What is the experimental probability of red, and what is the theoretical probability of red?
   Experimental P(red) = 26/40 = 13/20 = 0.65. Theoretical P(red) = 3 red out of 5 counters = 3/5 = 0.6. The experimental value (0.65) is close to the theoretical value (0.6). The small difference is due to natural variation in 40 trials; doing more draws would usually bring the experimental probability nearer to 0.6.
10. Sione suspects a die is weighted. He rolls it 120 times and the number 3 comes up 40 times. What is the experimental probability of rolling a 3, and does this support his suspicion? Explain.
    Experimental P(3) = 40/120 = 1/3 ≈ 0.33. For a fair die the theoretical probability of a 3 is 1/6 ≈ 0.17. Since 120 is a large number of trials, we would expect the experimental result to be near 1/6 if the die were fair. Getting 0.33 (about double) suggests the die may indeed be weighted towards 3. To be more sure, Sione could roll it even more times and see if the result stays near 1/3.
11. Two students test the same spinner with 3 equal sections (A, B, C). Ana does 30 spins and gets A: 14, B: 9, C: 7. Ben does 300 spins and gets A: 104, B: 98, C: 98. The theoretical probability of each section is 1/3 ≈ 0.33. Whose results are closer to the theoretical probability, and what does this show?
    Ana's experimental probabilities: A = 14/30 ≈ 0.47, B = 9/30 = 0.30, C = 7/30 ≈ 0.23. Ben's experimental probabilities: A = 104/300 ≈ 0.35, B = 98/300 ≈ 0.33, C = 98/300 ≈ 0.33. Ben's results are all much closer to 1/3 ≈ 0.33 than Ana's. This shows the Law of Large Numbers: Ben ran many more trials (300 vs 30), so his experimental probabilities are closer to the theoretical probability.

12. A game charges $2 to spin a wheel with 10 equal sections: 9 sections say 'Lose' and 1 says 'Win $15'. In 200 spins, the wheel landed on 'Win' 18 times. (a) Find the experimental probability of winning. (b) Compare it to the theoretical probability. (c) Over these 200 spins, did the game organiser make or lose money?
(a) Experimental P(win) = 18/200 = 9/100 = 0.09. (b) Theoretical P(win) = 1/10 = 0.10. The experimental value (0.09) is very close to 0.10; the small difference is normal random variation, and with even more spins it would be expected to sit near 0.10. (c) Money in from 200 spins = 200 × $2 = $400. Money paid out for 18 wins = 18 × $15 = $270. Profit = $400 − $270 = $130. The organiser made $130.

Answer key (for parents and tutors)

1. A fair six-sided dice is rolled. What is the probability of rolling a 4? Write your answer as a fraction.
   There is 1 way to roll a 4 out of 6 equally likely outcomes. P(4) = 1/6.
2. A bag has 10 marbles: 3 are red. Write P(red) as a fraction, a decimal, and a percentage.
   P(red) = 3/10. As a decimal, 3 ÷ 10 = 0.3. As a percentage, 0.3 × 100 = 30%. So P(red) = 3/10 = 0.3 = 30%.
3. Using the same bag of 10 marbles (3 red), what is the probability of NOT drawing a red marble?
   The complement of 'red' is 'not red'. P(red) + P(not red) = 1, so P(not red) = 1 − 3/10 = 7/10 = 0.7 = 70%.
4. A fair coin is flipped. What is the probability of it landing on heads? Give a fraction, decimal and percentage.
   There is 1 head out of 2 equally likely outcomes. P(heads) = 1/2 = 0.5 = 50%.
5. A spinner has 8 equal sections numbered 1 to 8. Find the probability of spinning a number greater than 5. Give your answer as a fraction, decimal and percentage.
   Numbers greater than 5 are 6, 7 and 8, that's 3 outcomes out of 8. P(>5) = 3/8. As a decimal, 3 ÷ 8 = 0.375. As a percentage, 0.375 × 100 = 37.5%. So P(>5) = 3/8 = 0.375 = 37.5%.
6. The Avondale Primary gala sells 200 raffle tickets. Mere buys 8 tickets. If one winning ticket is drawn, what is the probability that Mere wins? Give a fraction in simplest form and a percentage.
   Mere has 8 winning chances out of 200 tickets. P(win) = 8/200. Simplify by dividing top and bottom by 8: 8 ÷ 8 = 1, 200 ÷ 8 = 25, so 1/25. As a decimal, 1 ÷ 25 = 0.04, which is 4%. So P(win) = 1/25 = 4%.
7. A bag of lollies has 20 lollies: 5 pineapple, 7 jaffas and 8 eskimos. One lolly is taken without looking. Find P(jaffa), then say whether a pineapple or an eskimo is more likely, and explain.
   P(jaffa) = 7/20 = 0.35 = 35%. P(pineapple) = 5/20 = 1/4 = 25%. P(eskimo) = 8/20 = 2/5 = 40%. An eskimo is more likely than a pineapple because 8/20 (40%) is greater than 5/20 (25%), there are more eskimos in the bag.
8. A letter is chosen at random from the word AVONDALE. Find P(the letter is A) and P(the letter is a vowel). Which event is more likely?
   AVONDALE has 8 letters: A, V, O, N, D, A, L, E. The letter A appears 2 times, so P(A) = 2/8 = 1/4 = 25%. The vowels are A, O, A, E, that's 4 vowels, so P(vowel) = 4/8 = 1/2 = 50%. Choosing a vowel is more likely because 1/2 (50%) is greater than 1/4 (25%).
9. The MetService forecast says the probability of rain in Auckland tomorrow is 0.65. What is the probability it does NOT rain? Give a decimal and a percentage.
   Rain and no-rain are complementary events, so they add to 1. P(no rain) = 1 − 0.65 = 0.35 = 35%.
10. Two fair coins are flipped. Draw a tree diagram or list to show all outcomes, then find P(two heads) and P(at least one head).
    The equally likely outcomes are: HH, HT, TH, TT, that's 4 outcomes. Two heads (HH) happens in 1 way: P(two heads) = 1/4 = 0.25 = 25%. 'At least one head' means HH, HT or TH, that's 3 ways: P(at least one head) = 3/4 = 0.75 = 75%. (Check: this is the complement of TT, and 1 − 1/4 = 3/4.)
11. Two fair dice are rolled and their numbers added. Make a table of all the possible totals, then find P(total is 8) and P(total is at least 10). Which total event is more likely?
    There are 6 × 6 = 36 equally likely outcomes. Total of 8 comes from: (2,6),(3,5),(4,4),(5,3),(6,2), that's 5 ways, so P(total is 8) = 5/36. Total of at least 10 means 10, 11 or 12: total 10 → (4,6),(5,5),(6,4) = 3 ways; total 11 → (5,6),(6,5) = 2 ways; total 12 → (6,6) = 1 way. That is 3 + 2 + 1 = 6 ways, so P(at least 10) = 6/36 = 1/6. 'At least 10' is more likely because 6/36 is greater than 5/36.
12. A bag holds 40 marbles. The probability of drawing a green marble is 0.3 and the probability of drawing a blue marble is 1/4. The rest of the marbles are yellow. What is the probability of drawing yellow, and how many yellow marbles are in the bag?
    The three colours are the whole sample space, so their probabilities add to 1. P(blue) = 1/4 = 0.25. P(yellow) = 1 − 0.3 − 0.25 = 0.45 = 45%. To find how many yellow marbles: 0.45 × 40 = 18 yellow marbles. (Check: green = 0.3 × 40 = 12, blue = 0.25 × 40 = 10, and 12 + 10 + 18 = 40. ✓)