Year 9 · Statistics: Reading Between the Lines of Data

Name: _____ Date: _____

This sheet helps you become a data detective! You'll practise spotting when graphs and claims are trustworthy, and when they might be tricking you. Take your time and back up your thinking with evidence.

Warm-up

1. A survey asked 20 students at Avondale College how many hours they slept last night. The results (in hours) were: 6, 7, 8, 5, 9, 7, 6, 8, 7, 10, 6, 7, 8, 5, 7, 9, 6, 8, 7, 6. What is the most common (mode) number of hours slept?

2. A bar graph starts its vertical axis at 40 instead of 0. What effect can this have on how the bars look?

3. True or false: If a coin lands on heads 6 times out of 10 flips, the coin must be unfair.

4. A pie chart shows 'Favourite takeaway in Avondale' with slices for Fish & Chips 45%, Pizza 30%, Burgers 20%, and Sushi 5%. Do these add up correctly?

Practice

5. A local newspaper headline reads: 'Ice cream sales rise as drownings increase, is ice cream dangerous?' Explain why this claim is misleading.

6. A pictograph about pets uses a picture of a dog to represent 10 pets. To show 30 cats, the designer draws one cat picture that is three times as tall AND three times as wide as a single symbol. Why does this misrepresent the data?

7. Aroha conjectures that 'most Year 9 students at her school walk to school'. She surveys the 25 students in her own maths class and finds 14 walk. Is her sample good enough to support a claim about the whole Year 9? Explain.

8. A company claims '9 out of 10 dentists recommend BrightSmile toothpaste'. What questions should you ask before believing this claim?

9. Two classes sat the same test. Class A had a median score of 72 and Class B had a median of 68, but Class A's scores ranged from 40 to 95, while Class B's ranged from 62 to 74. Which class performed more consistently, and how do you know?

10. A survey of 200 Auckland residents found 130 support a new cycleway. A report states 'The people of Auckland strongly support the cycleway.' Evaluate whether the data supports this statement.

Challenge

11. A shop advertises 'Prices slashed by up to 70%!' After visiting, you find only 2 items out of 500 have a 70% discount; most items are discounted 5–10%. Explain how the advertisement uses true data in a misleading way, and suggest a more honest statement.

12. A researcher runs an experiment giving 8 plants a new fertiliser and 8 plants water only. The fertilised plants grew an average of 12 cm; the water-only plants grew 11 cm. She claims 'the fertiliser clearly works.' Discuss two reasons to be cautious about this claim, and describe one way to improve the experiment.

Answer key (for parents and tutors)

1. A survey asked 20 students at Avondale College how many hours they slept last night. The results (in hours) were: 6, 7, 8, 5, 9, 7, 6, 8, 7, 10, 6, 7, 8, 5, 7, 9, 6, 8, 7, 6. What is the most common (mode) number of hours slept?
   Count how often each value appears: 5 appears 2 times, 6 appears 5 times, 7 appears 6 times, 8 appears 4 times, 9 appears 2 times, 10 appears 1 time. The value 7 appears most often (6 times), so the mode is 7 hours.

2. A bar graph starts its vertical axis at 40 instead of 0. What effect can this have on how the bars look?
   Starting the axis above 0 exaggerates the differences between bars. Small differences in the actual values look much larger because the bottom part of each bar is cut off. This can mislead a reader into thinking a gap is bigger than it really is.

3. True or false: If a coin lands on heads 6 times out of 10 flips, the coin must be unfair.
   False. With only 10 flips, chance (natural variation) can easily cause 6 heads even with a fair coin. A small number of trials means results can vary a lot, so we cannot conclude the coin is unfair from this alone.

4. A pie chart shows 'Favourite takeaway in Avondale' with slices for Fish & Chips 45%, Pizza 30%, Burgers 20%, and Sushi 5%. Do these add up correctly?
   Add the percentages: 45 + 30 + 20 + 5 = 100%. Yes, they add to 100%, which is correct for a pie chart because the whole circle represents all the responses (100%).

5. A local newspaper headline reads: 'Ice cream sales rise as drownings increase, is ice cream dangerous?' Explain why this claim is misleading.
   The claim confuses correlation with causation. Both ice cream sales and drownings rise in summer because of a third factor: hot weather. More people swim and buy ice cream when it is hot. Ice cream does not cause drownings, the two things happen at the same time but one does not cause the other.

6. A pictograph about pets uses a picture of a dog to represent 10 pets. To show 30 cats, the designer draws one cat picture that is three times as tall AND three times as wide as a single symbol. Why does this misrepresent the data?
   When both height and width are tripled, the area of the picture becomes 3 × 3 = 9 times larger, not 3 times larger. The reader's eye judges the size by area, so 30 cats looks like it is 9 times more than 10, badly exaggerating the difference. A correct pictograph would use three separate symbols of the same size.

7. Aroha conjectures that 'most Year 9 students at her school walk to school'. She surveys the 25 students in her own maths class and finds 14 walk. Is her sample good enough to support a claim about the whole Year 9? Explain.
   No. Her sample of one class (25 students) may not represent all of Year 9. Students in one class might live nearby, or the class may not be typical of the whole year level. In her sample 14 out of 25 (56%) walk, which is 'more than half', but to make a claim about all of Year 9 she should survey a larger, more random sample from across the whole year level.

8. A company claims '9 out of 10 dentists recommend BrightSmile toothpaste'. What questions should you ask before believing this claim?
   You should ask: How many dentists were actually surveyed (10, or thousands)? Who paid for the study, was it the company itself? Were the dentists given a choice of several brands, or just asked yes/no about one? Were they a fair, random sample? Was 'recommend' clearly defined? Without answers, the claim cannot be trusted, because a biased or tiny sample could produce this result.

9. Two classes sat the same test. Class A had a median score of 72 and Class B had a median of 68, but Class A's scores ranged from 40 to 95, while Class B's ranged from 62 to 74. Which class performed more consistently, and how do you know?
   Class B performed more consistently. Its range is 74 – 62 = 12, which is much smaller than Class A's range of 95 – 40 = 55. A smaller range (spread) means the scores were closer together, so Class B's results were more consistent even though Class A had a slightly higher median.

10. A survey of 200 Auckland residents found 130 support a new cycleway. A report states 'The people of Auckland strongly support the cycleway.' Evaluate whether the data supports this statement.
    130 out of 200 is 65%, which is a majority but not overwhelming, 35% do not support it. Also, 200 people is a small sample compared to Auckland's population of over 1.5 million, and we do not know if they were chosen randomly

or from a cycling group. The word 'strongly' overstates the finding. A fairer statement would be 'Around two-thirds of those surveyed support the cycleway,' while noting the uncertainty from the sample size and method.

11. A shop advertises 'Prices slashed by up to 70%!' After visiting, you find only 2 items out of 500 have a 70% discount; most items are discounted 5–10%. Explain how the advertisement uses true data in a misleading way, and suggest a more honest statement.
The phrase 'up to 70%' is technically true because two items really are 70% off, but it is misleading because it makes shoppers expect large discounts across the store when nearly all items are only 5–10% off. The advertisement uses an extreme, rare value to represent the whole store. A more honest statement would be: 'Most items 5–10% off, with a few selected items up to 70% off.' This gives a truer picture of the typical discount, which matters because shoppers make decisions based on the impression the ad creates.

12. A researcher runs an experiment giving 8 plants a new fertiliser and 8 plants water only. The fertilised plants grew an average of 12 cm; the water-only plants grew 11 cm. She claims 'the fertiliser clearly works.' Discuss two reasons to be cautious about this claim, and describe one way to improve the experiment.
Reason 1: The difference (12 cm vs 11 cm) is very small, only 1 cm, and could easily be due to chance variation between plants rather than the fertiliser. Reason 2: The sample is tiny (only 8 plants per group), so a couple of unusually large or small plants could shift the average; there could also be other differences such as sunlight or soil. To improve the experiment she should use many more plants (e.g. 100 per group), keep all other conditions (light, water amount, soil, plant type) the same, assign plants to groups randomly, and repeat the trial. This reduces the effect of chance and allows a fairer comparison before claiming the fertiliser works.