Here are three sample questions for the **"Statistics"** topic in Queensland's Year 10 Mathematics syllabus (Statistics and Probability). This topic often involves analyzing and interpreting statistical reports and data displays.

Sample Questions: Statistics

Question 1: Evaluating Statistical Reports and Claims (Extended Response/Reasoning)

A local newspaper article includes the following headline and accompanying bar graph:

Headline: "Local Gym's New Workout Dramatically Increases Strength!"

The bar graph shows the average weight lifted by 10 participants **before** a 6-week program (Average: 50 kg) and **after** the program (Average: 75 kg).

a) Identify one piece of crucial information that is missing from the report that would allow you to evaluate the claim.

b) Explain one potential source of bias or misleading data in this study.

Solution:

a) Missing Information:
A crucial piece of missing information is a **control group**. Without a group of similar participants who did *not* do the new workout (or who did a different, standard workout), there is no way to tell if the strength increase was due to the new program, or simply due to:

- The placebo effect.
- The natural progression of lifting over time.
- General exercise and diet changes over 6 weeks.

b) Potential Source of Bias/Misleading Data:

- **Sample Size/Selection Bias:** The sample size is only 10 participants, which is too small to generalize the results to the entire population. The participants might have been cherry-picked (non-randomly selected) for being highly motivated or having prior training experience, leading to inflated results.
- **Voluntary Response Bias (if participants chose the workout):** People who volunteer for a specific program are often more committed, which can skew the results.

Concept: Critiquing statistical reports by identifying missing information (like a control group) and potential biases in sampling methods.

Next

Question 2: Calculating and Comparing Standard Deviation (Short Answer/Calculation)

The prices of milk (in
) at two different supermarkets were recorded over 5 weeks:

- **Supermarket A:**
  $2.10, 2.30, 2.20, 2.10, 2.30$
- **Supermarket B:**
  $2.20, 2.20, 2.20, 2.20, 2.20$

a) Calculate the mean price for Supermarket A and Supermarket B.

b) Without performing the full calculation, explain which supermarket has a lower standard deviation and why.

Solution:

a) Calculate the mean ($\bar{x}$):

- **Supermarket A:**

$$\bar{x}_A = \frac{2.10 + 2.30 + 2.20 + 2.10 + 2.30}{5} = \frac{11.00}{5} = \$2.20$$

- **Supermarket B:**

$$\bar{x}_B = \frac{2.20 + 2.20 + 2.20 + 2.20 + 2.20}{5} = \frac{11.00}{5} = \$2.20$$

b) Explain the Standard Deviation (SD):

- **Supermarket B** has a lower standard deviation (in fact, $\text{SD} = 0$).
- **Reason:** The standard deviation measures the average distance of the data points from the mean. Since all the prices in Supermarket B are identical and equal to the mean ($\$2.20$), there is no variation, resulting in a standard deviation of zero. Supermarket A's prices vary around the mean, so it will have a positive standard deviation.

Final Answer: a) $2.20 for both Supermarket A and Supermarket B.

b) **Supermarket B** has a lower standard deviation (zero) because all its data values are exactly equal to the mean, indicating no spread or variation.

Concept: Calculating the mean and understanding that a lower standard deviation implies less variability or greater consistency in the data set.

Question 3: Conditional Probability (Multiple Choice/Interpretation)

In a high school, 60% of students study Science (S), and 45% study English (E). 35% of students study both Science and English (S and E).

If a student is randomly selected, and it is known that they study Science, what is the probability that this student also studies English?

A. $\frac{0.35}{0.60}$
B. $\frac{0.60}{0.35}$
C. 0.45×0.60
D. 0.35

Solution:

This is a problem of **Conditional Probability**, represented as $P(E|S)$ (the probability of English, given Science).

The formula is:

$$P(E|S) = \frac{P(E \text{ and } S)}{P(S)}$$

Where:

- $P(E \text{ and } S) = 0.35$ (Students who study both)
- $P(S) = 0.60$ (Students who study Science)

Calculation:

$$P(E|S) = \frac{0.35}{0.60}$$

Answer: A

Concept: Applying the principles of conditional probability to real-world scenarios, understanding the notation $P(A|B)$, and knowing the formula $\frac{P(A \text{ and } B)}{P(B)}$.

Next