7.7 Justifying a Claim About the Difference of Two Means Based on a Confidence Interval

Name: _____ Class: _____ Date: _____ **Total: 18 marks**

KEY WORDS difference of means • plausible • observational study • cause • narrower • weight loss

Objective

Build the skills to answer exam questions on **justifying a claim about a difference of means from a confidence interval** .

You must be able to:

- use an interval for $\mu_1 - \mu_2$ to decide whether the means differ
- say which mean is larger from the interval
- state the scope of the conclusion from the study design

1 Key knowledge and worked examples

■ Zero, again

idea	rule
zero inside	a difference of 0 is plausible: no convincing evidence that the means differ
zero outside	all plausible differences have one sign, so one mean is larger
how large	the ends of the interval give the smallest and largest plausible differences

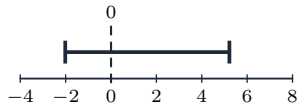
Worked example. A 95% interval for $\mu_1 - \mu_2$ of $(-6.0, -1.5)$: every plausible difference is negative, so μ_2 is larger, by between 1.5 and 6.0.

Answer shapes: state where 0 lies, then the conclusion in context.

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2 Practice

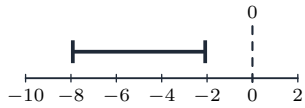
2.1 A 95% interval for $\mu_1 - \mu_2$ is $(-2.1,\ 5.3)$. Decide whether there is convincing evidence that the means differ. [2]



2.2 A 95% interval for $\mu_1 - \mu_2$ is $(1.4,\ 6.2)$. Decide whether there is convincing evidence that the means differ. [2]



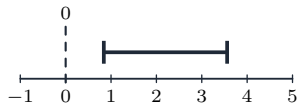
2.3 A 95% interval for $\mu_1 - \mu_2$ is $(-8,\ -2)$. State which mean is larger, and by how much it plausibly is. [2]



3 Exam-style questions

3.1 In an experiment, volunteers were randomly assigned to a new diet or the usual diet. A 95% interval for $\mu_{\text{new}} - \mu_{\text{usual}}$, the difference in mean weight loss, is $(0.8,\ 3.6)$ kg.

(a) Interpret the interval. [2]

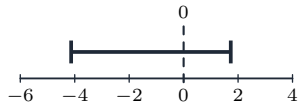


(b) Explain whether the interval supports the claim that the new diet leads to more weight loss. [2]

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3.2 From random samples of students at two schools, a 95% interval for $\mu_A - \mu_B$, the difference in mean test scores, is $(-4.2, 1.8)$ points.

(a) Interpret the interval. [2]



(b) A newspaper says school A has a lower mean score. Explain whether the interval supports this. [2]

(c) Explain why, even with an interval below 0, we could not say that school A *causes* lower scores. [2]

(d) Describe one way to get a narrower interval. [2]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

no; 0 is inside the interval, so no difference is plausible

2.2

yes; the whole interval is above 0, so $\mu_1 > \mu_2$

2.3

μ_2 is larger; by between 2 and 8 units

3.1

(a) we are 95% confident that the interval from 0.8 to 3.6 kg captures the true difference in mean weight loss (new minus usual); so the new diet gives between 0.8 and 3.6 kg more weight loss on average

(b) yes; the whole interval is above 0, and the random assignment means the diet causes the difference, for volunteers like these

3.2

(a) we are 95% confident that the interval from -4.2 to 1.8 points; captures the true difference in mean scores of all students (school A minus school B)

(b) no; 0 is inside the interval, so no difference is plausible

(c) this is an observational study: students were not randomly assigned to schools; other variables, such as family income, could cause the difference

(d) take larger random samples from each school; this reduces the standard error