Graphs of Functions and Derivatives Worksheet: Verify Slope-Sign Correspondence

Original tasks 1, 2, 3 / complete keys

Task 1

A function graph increases on (-3, 0), decreases on (0, 5), and has a local maximum at x = 0. A proposed derivative graph is positive on (-3, 0), negative on (0, 5), and zero at x = 0. Verify the pair.

Answer: The pair is valid.

Reason: The function rises where the derivative is positive, falls where the derivative is negative, and has a local maximum where the derivative is zero and changes from positive to negative.

Check: Make a sign table for the three intervals and confirm each sign matches the function's direction.

Task 2

A function graph decreases on (-1, 2), increases on (2, 6), and has a local minimum at x = 2. A proposed derivative graph is negative on (-1, 2), positive on (2, 6), and zero at x = 2. Verify the pair.

Answer: The pair is valid.

Reason: The function falls where the derivative is negative, rises where the derivative is positive, and has a local minimum where the derivative is zero and changes from negative to positive.

Check: Check the sign change at x = 2 from negative to positive and confirm the interval signs.

Task 3

A function graph increases on (0, 3) and decreases on (3, 7), with a local maximum at x = 3. A proposed derivative graph is negative on (0, 3), positive on (3, 7), and zero at x = 3. Verify the pair.

Answer: The pair is not valid.

Reason: The derivative graph has the wrong signs: it is negative where the function rises and positive where the function falls. The sign change at x = 3 is also reversed for a local maximum.

Check: Compare each interval sign with the function's direction; both intervals fail.

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Original tasks 4 / complete keys

Task 4

A function graph increases on (-4, -1), has a horizontal tangent at x = -1 without changing direction, and continues increasing on (-1, 2). A proposed derivative graph is positive on (-4, -1), zero at x = -1, and positive on (-1, 2). Verify the pair.

Answer: The pair is valid.

Reason: The function rises on both sides of x = -1, so the derivative is positive on both intervals. The zero at x = -1 matches the horizontal tangent, and no sign change is required because there is no extremum.

Check: Confirm the derivative is positive on both intervals and zero at x = -1 without a sign change.

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Source rubric / reflection

- [ ] Increasing intervals on the function graph are matched to positive values on the derivative graph.
- [ ] Decreasing intervals on the function graph are matched to negative values on the derivative graph.
- [ ] Each local maximum is matched to a zero on the derivative graph with a positive-to-negative sign change.
- [ ] Each local minimum is matched to a zero on the derivative graph with a negative-to-positive sign change.
- [ ] Sharp corners are noted as points where the derivative is undefined, not forced to zero.
- [ ] Notation is clear and consistent; alternative valid notations are accepted.

Reflection: What did you check, what did you change, and what will you try next?