Section 3.1: TANGENTS AND DERIVATIVES

- Find the **derivative of a function** at the point x_0 by finding $\lim\limits_{h \to 0} \frac{f(x_0+h)-f(x_0)}{h}$.
- Know that the <u>derivative of a function</u> at a point x_0 is equal to the <u>slope of the tangent line</u> at x_0, which is also equal to the <u>slope of the curve</u> at x_0, which is also equal to the <u>instantaneous rate of change</u> at x_0.
- Find the **equation of a tangent line** to a curve.

Section 3.2A: THE GENERAL FORM OF THE DERIVATIVE & DIFFERENTIABILITY

- Find the **general form of the derivative** of a function, and use the general form to find the value of the derivative at specified values of x.
- Know that when a function is **increasing**, the derivative is positive; when a function is **decreasing**, the derivative is negative; and when a function is **not changing** (<u>constant</u>), the derivative is zero.
- Recognize situations which cause a function to be **non-differentiable**: <u>corners, cusps, vertical tangents, and discontinuities.</u>

Section 3.2B: GRAPHS OF DERIVATIVES

- Draw the **graph of the derivative** of a linear piecewise function.
- Draw the **graph of a function** given the graph of its derivative, if the function is a linear piecewise function which starts at a specified point.
- **Interpret derivative graphs** to gain information about the original function.
- **Match** function graphs with derivative graphs.

Practice Problems:

Problems 1–6: Find the general form of the derivative of each function. (SHOW ALL WORK ON A SEPARATE SHEET OF PAPER.)

1. $f(x) = -4x - 9$

2. $f(x) = (x + 1)(x - 2)$

3. $f(x) = x^3 - 5$

4. $f(x) = 3x^2 + 5x$

5. $f(x) = \frac{2-x}{3}$

6. $f(x) = \sqrt{4x - 5}$

Problems 7–10: Use the answer from problem #2 above (which should be $f'(x) = 2x - 1$) to answer the questions below. (SHOW ALL WORK ON A SEPARATE SHEET OF PAPER.)
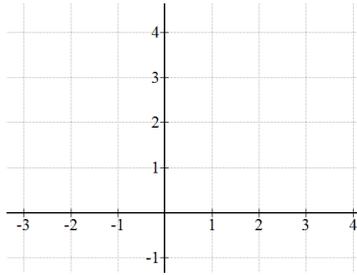
7. Is $f(x)$ increasing or decreasing at $x = -2$?

8. Is $f(x)$ increasing or decreasing at $x = 3$?

9. Is there ever a point at which $f(x)$ is not changing? If so, where?

10. Find the equation of the tangent line at the point $(3, 4)$.

Problems 11–12: Use the graph of $f(x)$ shown to the right.

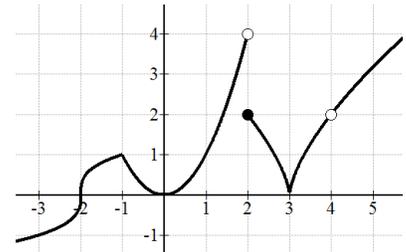11. List any values of x for which $f(x)$ is not differentiable.
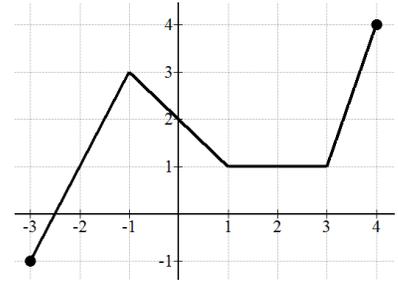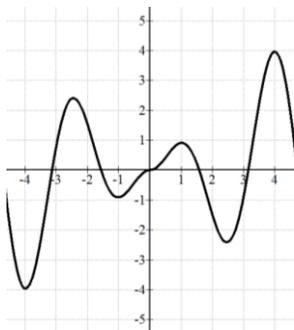
12. Draw a graph of $f'(x)$ on the blank graph.

Problems 13–14: Use the graph of $f(x)$ shown to the right.
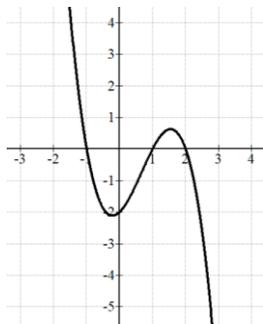
13. Specify the points where $f(x)$ is discontinuous.

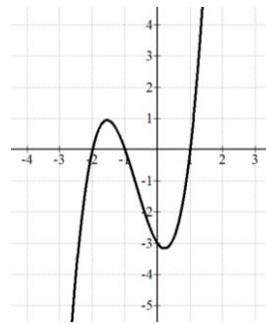14. Specify the points where $f(x)$ is continuous but not differentiable.

Problem 15: Match the graphs of the functions on the top row with the graphs of their derivatives on the bottom row by writing the letter of the correct derivative graph on the line below the function graph.
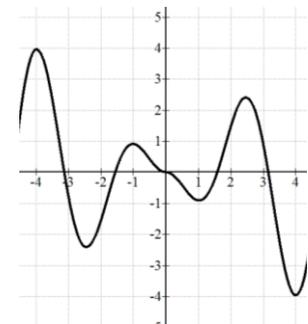
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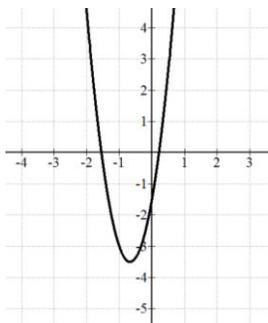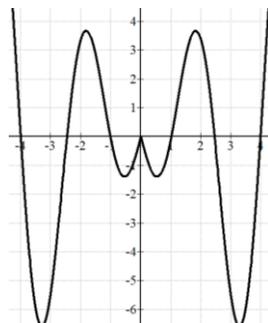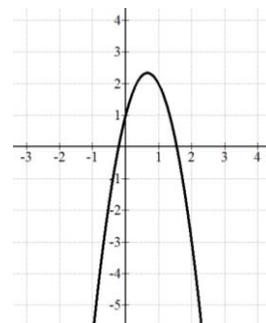
A   B   C   D