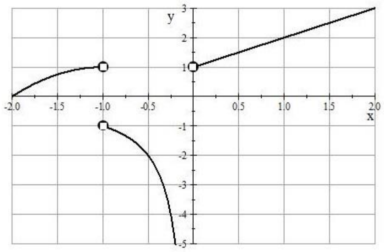
The diagram below shows the graph of the *derivative* function for a function $y = f(x)$. This diagram is used in Problems 1 and 2.



Problem 1.____________ Based on this diagram, at what input values does the function f have a local maximum output?

(a) Only at $x = 0$

(b) Only at $x = -1$

(c) At $x = 0$ and $x = -1$

(d) At $x = -2$ and $x = 0$

(e) At $x = 2$

Problem 2.____________ On what input intervals will the *second derivative* function $a = f''(x)$ have positive output?

(a) The function f'' does not have positive output

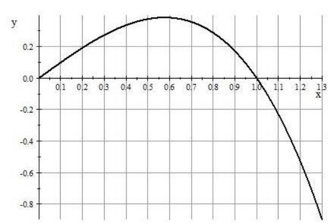
(b) The interval $-1 < x < 0$

(c) The set $-1 < x < +\infty$

(d) The set $-\infty < x < -1 \cup 0 < x < +\infty$

(e) The function f'' has positive output for all x values.

Problem 3.____________ The diagram below shows the graph of a function $y = f(x)$. Based on this diagram, which of the following statements is true?



I. The second derivative function has only negative output on the input interval shown.
II. The first derivative function has positive output only on the input interval $0 \le x < 0.6$.
III. The first derivative function has positive output on the input interval shown.
IV. The second derivative function has negative output only on the input interval $0.6 < x \le 1.3$.

(a) Only Statement I is true.

(b) Only Statement II is true.

(c) Only Statement IV is true.

(d) Only Statements III and IV are true.

(e) Only Statements I and II are true.

Problem 4.____________ Suppose that the function $y = f(x)$ satisfies the conditions of the Mean Value Theorem on the input interval $-2 \le x \le 3$, and suppose that $f(-2) = 4$ and $f(3) = 8$. Which of the following statements must be true for at least one input value $x = a$ in this input interval?

(a) $f'(a) = 4$

(b) $f'(a) = 5$

(c) $f'(a) = \frac{4}{5}$

(d) $f'(a) = -2$

(e) $f'(a) = \frac{8}{3}$

Let $y = f(x)$ be a function whose derivative function is given by the formula below. Problems 5 and 6 refer to this function.

$$y = f'(x) = \begin{cases} \frac{3}{x^2} & \text{if} \quad x < -2 \\ \frac{x}{x-2} & \text{if} \quad -2 < x < 3 \\ -x & \text{if} \quad 3 < x \end{cases}$$

Problem 5.____________ What is the formula for the second derivative function $a = f''(x)$ on the input interval $x < -2$?

(a) The second derivative cannot be computed.

(b) $f''(x) = 1$

(c) $f''(x) = -\frac{2}{(x-2)^2}$

(d) $f''(x) = -\frac{6}{x^3}$

(e) $f''(x) = \frac{3}{2x}$

Problem 6.____________ Which of the following statements is true?

I. The function f does not have any local extrema.
II. The function f has a local maximum output at the input value $x = 3$.
III. The function f has a local minimum output at the input value $x = 2$.

(a) Only Statemet I is true.

(b) Only Statement II is true.

(c) Only Statement III is true.

(d) Statements II and III are both true.

(e) None of these statements is true.

Problem 7.____________ If $y = f(x) = \sqrt{x}$, then what is the formula for $a = f''(x)$?

(a) $f''(x) = -\frac{1}{4}x^{-3/2}$

(b) $f''(x) = \frac{3}{x\sqrt{x}}$

(c) $f''(x) = \frac{1}{2\sqrt{x}}$

(d) $f''(x) = 3x$

(e) $f''(x) = 2x^{3/2}$

Problem 8.____________ Suppose we know that the point $(2, -4)$ lies on the graph of a function $y = f(x)$, and suppose we also know that $f'(2) = 5$. What is the formula for the tangent line to the graph of f at the point $(2, -4)$?

(a) $y - 5 = -4(x - 2)$

(b) $y = 2(x - 5) - 4$

(c) $y = 5(x - 2) - 4$

(d) $y - 2 = 5(x + 4)$

(e) $y = 4(x + 2) - 5$

Problem 9. Consider the function $y = f(x) = 3x^{-1}$.

Part (a). Construct the formula for the function $r = g_4(h)$ that gives the average rate of change for the function f on the input interval from $x = 4$ to $x = 4 + h$.

Part (b). Use the formula for the function g_4 and the limit definition of the derivative to compute the value of $f'(4)$.

Problem 10. Let $y = f(x) = 4x^3 - x^{1/3}$. Use the Sum Rule and the Constant Multiple Rule along with the specific derivative formulas we have developed to construct the formula for $r = f'(x)$.

Problem 11. Let $y = f(x) = x^2 \cdot 3^x$. Use the Product Rule along with the specific derivative formulas we have developed to construct the formula for $r = f'(x)$.

Problem 12. Consider the function

$$y = f(x) = \frac{x^2 - 3}{4 - x^2}$$

Part (a). Use the Quotient Rule and the specific derivative formulas we have developed to construct the formula for $r = f'(x)$.

Part (b). Construct the formula for the tangent line to the graph of the function f at the point $\left(-1, f(-1)\right)$.

Problem 13. Consider the function $y = f(x) = 2x^3 + 3x^2 - 12x + 5$.

Part (a). Use the Sum and Constant Multiple Rules, along with the special derivative formulas we have developed to construct the formula for $r = f'(x)$.

Part (b). At what input values will the tangent line to the graph of f be horizontal?

Part (c). At what input values will the tangent line to the graph of f have slope $m = -12$?

Part (d). What is the formula for the tangent line to the graph of f at the point $(0, f(0))$?

Problem 14. Consider the function $f(x) = 4x^{-1}e^{x}$. What is the formula for the function $a = f''(x)$?

Problem 15. The graph of a function $y = f(x)$ is shown below. On the grid provided, sketch the graph of the function $a = f''(x)$.