

2.1 Derivative Basics: Form D Assessment

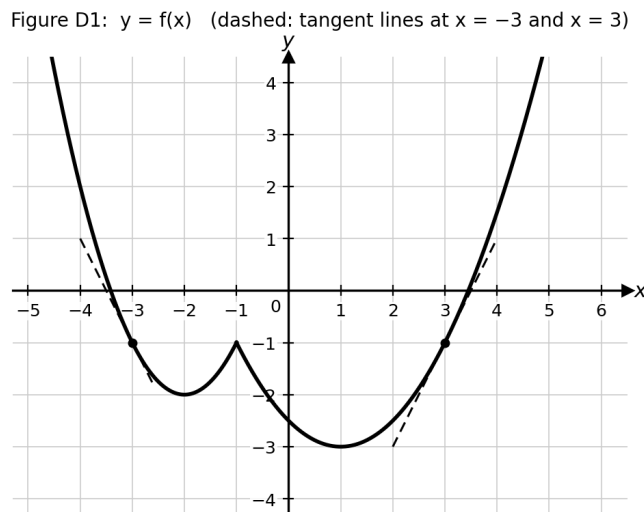
Name: _____

Time: 60 minutes No calculator 100 points

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Answer exactly the question asked. Show work on every problem in Parts II–IV.
If a derivative does not exist, write DNE. If a function value does not exist, write *undefined*.
Angles are in radians.

Part I. Graph. Questions 1(a)–1(f) refer to Figure D1. The dashed lines are tangent to the graph of f at $x = -3$ and $x = 3$.



1. Use the figure to answer each part.

(a) $f'(3)$ _____

(b) $f(-3)$ _____

(c) $f'(1)$ _____

(d) $f'(-1)$ _____

(e) Every open interval within $(-5, 6)$ on which $f'(x) < 0$: _____

(f) Write $f'(3)$, $f'(-3)$, and 0 in order from least to greatest: _____

(2 pts each for (a)–(d), 3 pts each for (e)–(f); 14 pts)

Part II. Tangent lines and values. Show work.

2. Let $f(x) = x^3 + 2x^2 - x$. Find an equation of the line tangent to the graph of f at $x = -2$. (5 pts)

3. Let $g(x) = x^2 + 8\sqrt{x}$. Find the y -intercept of the line tangent to the graph of g at $x = 4$. **(5 pts)**

4. The line tangent to the graph of a function w at $x = 1$ has equation

$$y = 6 - 2(x - 1) + 4x.$$

(a) Find $w'(1)$.

(b) Find $w(1)$.

(3 + 2 pts)

5. Let $k(x) = 2 \sin x + x^2$, so that $k'(x) = 2 \cos x + 2x$. Find $k(\pi)$.

(2 pts)

Part III. Definition of the derivative. Show work.

6. Let $f(x) = \frac{1}{2x+1}$. Use the definition

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

to find $f'(x)$. An answer found with differentiation rules instead of the definition earns at most 2 points. **(8 pts)**

7. Let $g(x) = x^3 + 2x^2$. Use the definition

$$g'(c) = \lim_{x \rightarrow c} \frac{g(x) - g(c)}{x - c}$$

with $c = 1$ to find $g'(1)$. An answer found with differentiation rules instead of the definition earns at most 2 points. **(8 pts)**

8. Evaluate each limit.

(6 each, 12 pts)

(a) $\lim_{h \rightarrow 0} \frac{(-1 + h)^4 - 1}{h}$

(b) $\lim_{x \rightarrow \pi/2} \frac{\cos x}{x - \pi/2}$

Part IV. Differentiation rules. Show work.

9. Find each derivative.

(3 each, 6 pts)

(a) $a(x) = 2 \sin\left(\frac{\pi}{6}\right)$. Find $a'(x)$.

(b) Let $f(x) = x^2 - 5x$, and let $m(x) = f(3)$ for every x . Find $m'(x)$.

10. Find $f'(x)$ for each function.

(3 each, 12 pts)

(a) $f(x) = \frac{10}{x^5} - 2 \cos x$

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

(c) $f(x) = 6\sqrt[3]{x} + \frac{1}{x^2}$

(d) $f(x) = (x - 4)(x + 4) + 5 \sin x$

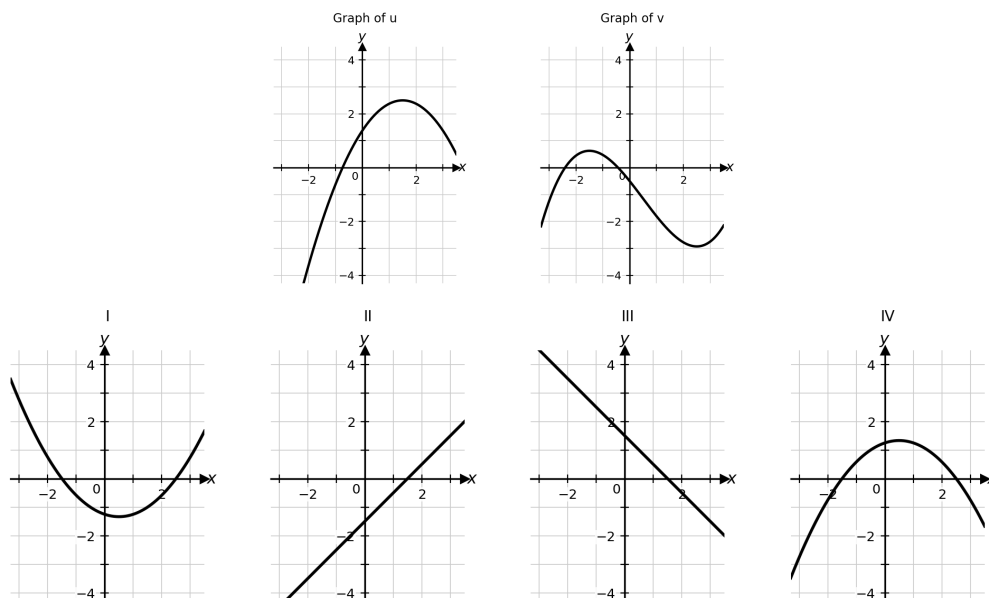
11. Let $f(x) = 5 \cos x - 2x^2$. Find $f'\left(\frac{\pi}{3}\right)$.

(5 pts)

12. Let $f(x) = x^3 - 12x$. Find every x in the interval $[-1, 3]$ at which the graph of f has a horizontal tangent line. **(6 pts)**

Part V. Graphs of derivatives.

13. The graphs of u and v are shown, followed by four graphs labeled I–IV. **(3 each, 6 pts)**



- (a) The graph of u' is graph _____ (b) The graph of v' is graph _____

14. Figure D4 shows the graph of k , which is made of straight line segments and continues in the same way beyond the window. On the grid at the right, sketch the graph of k' . Use open circles where k' does not exist. **(6 pts)**

