

2.1 Derivative Basics: Form B Assessment

Name: _____

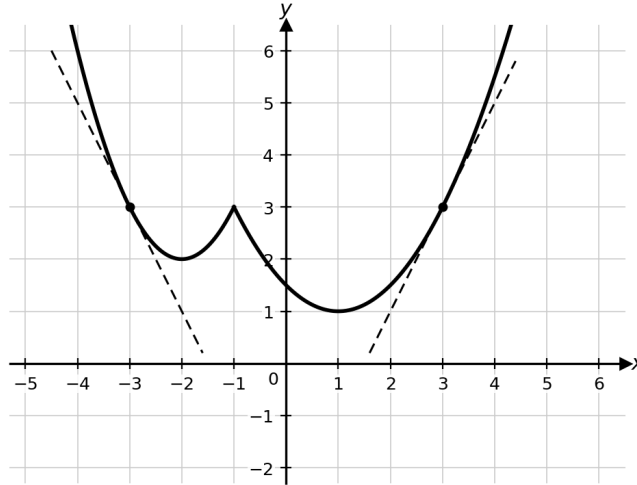
Time: 60 minutes No calculator 100 points

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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 B1. The dashed lines are tangent to the graph of f at $x = -3$ and $x = 3$.

Figure B1: $y = f(x)$ (dashed: tangent lines 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 $f(x) = 2\sqrt{x} - x$. Find an equation of the line tangent to the graph of f at $x = 4$. (5 pts)

3. Let $q(x) = \sqrt{x^2 + 16}$. The line tangent to the graph of q at the point $(3, q(3))$ passes through the point $(-2, 2)$. Find $q'(3)$. **(5 pts)**

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

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

- (a) Find $w'(-1)$. **(3 + 2 pts)**

- (b) Find $w(-1)$.

5. Let $g(x) = x^4 - 3x^2 + 2x$, so that $g'(x) = 4x^3 - 6x + 2$. Find $g(-1)$. **(2 pts)**

Part III. Definition of the derivative. Show work.

6. Let $f(x) = \frac{5}{x+1}$. 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 $g(x) = x^3 - 2x$. 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) $\lim_{h \rightarrow 0} \frac{\sqrt{9+h} - 3}{-h}$

(b) $\lim_{x \rightarrow \pi} \frac{\cos x + 1}{x - \pi}$

Part IV. Differentiation rules. Show work.

9. Find each derivative.

(3 each, 6 pts)

(a) $a(x) = \cos\left(\frac{\pi}{3}\right) + 5$. Find $a'(x)$.

(b) Let $g(x) = x^3 + 2x$, and let $m(x) = g(-1)$ for every x . Find $m'(x)$.

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

(3 each, 12 pts)

(a) $f(x) = \frac{8}{x^2} + 3 \sin x$

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

(c) $f(x) = 4\sqrt{x} - x\sqrt{x}$

(d) $f(x) = (x + 2)(x - 5) - 2 \cos x$

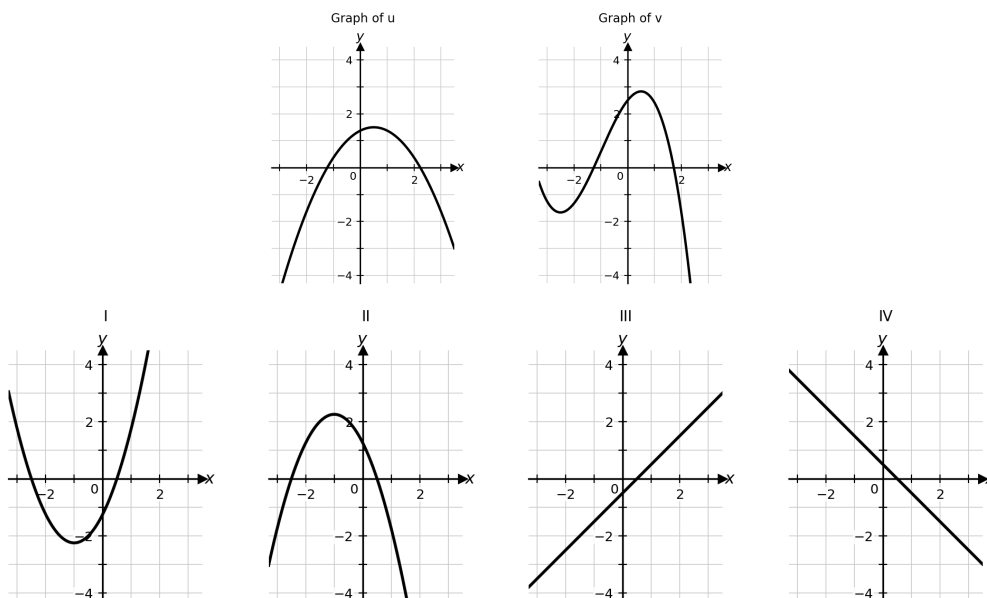
11. Let $f(x) = 4 \cos x + x^3$. Find $f'\left(\frac{\pi}{2}\right)$.

(5 pts)

12. Let $f(x) = x - 2\sin x$. Find every x in the interval $[0, \pi)$ 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 B4 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)

