

2.1 Derivative Basics: Form E Assessment

Name: _____

Time: 60 minutes No calculator 100 points

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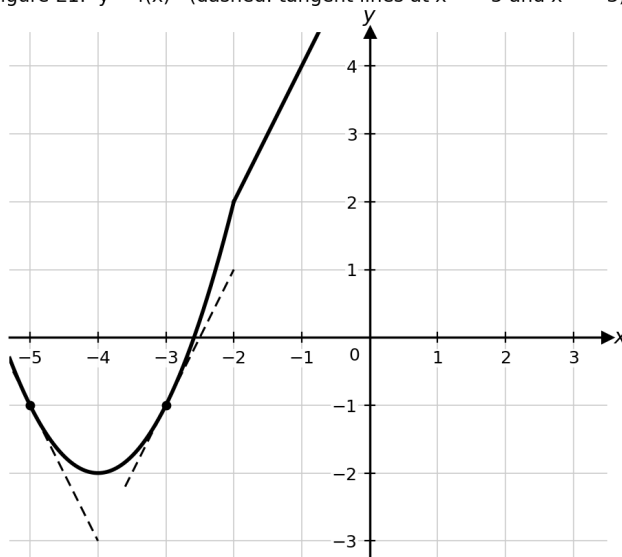
Answer exactly the question asked. Show work on every problem in Parts II–IV.

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 E1. The dashed lines are tangent to the graph of f at $x = -5$ and $x = -3$.

Figure E1: $y = f(x)$ (dashed: tangent lines at $x = -5$ and $x = -3$)



1. Use the figure to answer each part.

(a) $f(-5)$ _____

(b) $f'(-3)$ _____

(c) $f'(-4)$ _____

(d) $f'(-2)$ _____

(e) Every open interval within $(-5, 3)$ on which $f'(x) > 0$: _____

(f) Write $f'(-5)$, $f'(-1)$, 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. A function g has $g(-2) = 5$ and $g'(-2) = -3$. Find an equation of the line tangent to the graph of g at $x = -2$. (5 pts)

3. Let $r(x) = \frac{4}{x} + x^2$. Find an equation of the line tangent to the graph of r at $x = -1$. (5 pts)

4. The line tangent to the graph of a function w at $x = -2$ has equation

$$y - 1 = 4(x + 2) - 3x - 2.$$

(a) Find $w'(-2)$.

(b) Find $w(-2)$.

(3 + 2 pts)

5. Let $m(x) = x^3 - 4x$, so that $m'(x) = 3x^2 - 4$. Find $m(2)$. (2 pts)

Part III. Definition of the derivative. Show work.

6. Let $f(x) = -\frac{4}{x+3}$. 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 $g(x) = x^4 - x$. 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) $\lim_{h \rightarrow 0} \frac{\sin(\pi + h)}{h}$

(b) $\lim_{x \rightarrow 4} \frac{\frac{1}{x} - \frac{1}{4}}{x - 4}$

Part IV. Differentiation rules. Show work.

9. Find each derivative.

(3 each, 6 pts)

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

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

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

(3 each, 12 pts)

(a) $f(x) = -\frac{3}{x^4} + \sin x$

(b) $f(x) = \frac{8x^6 - 2x^3}{2x^3}$

(c) $f(x) = 9\sqrt[3]{x^4} - 2\sqrt{x}$

(d) $f(x) = (x - 1)(x^2 + x + 1) - \cos x$

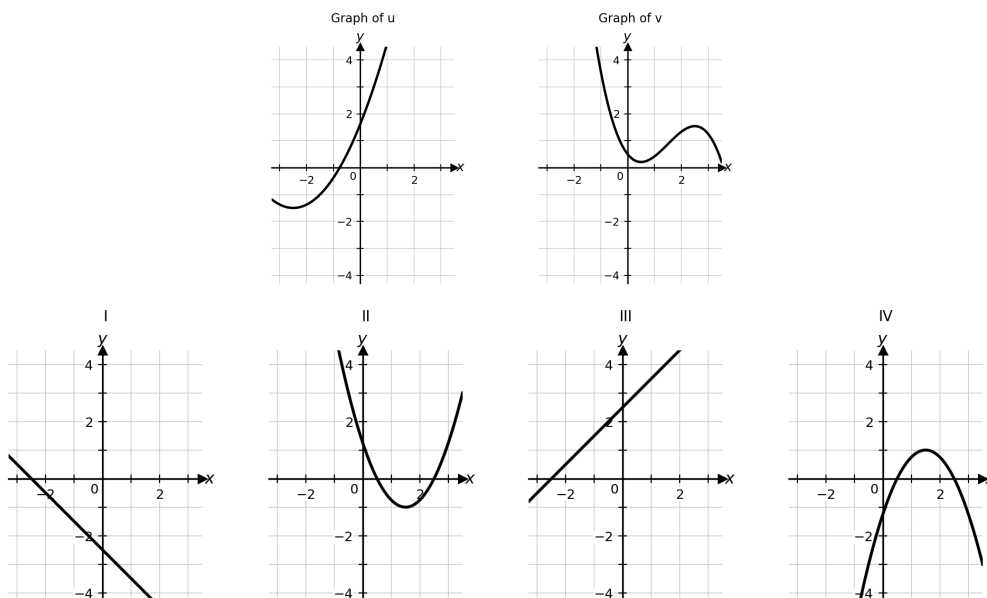
11. Let $f(x) = 3 \sin x + 2 \cos x$. Find $f'\left(\frac{\pi}{6}\right)$.

(5 pts)

12. Let $f(x) = 2 \sin x + x$. Find every x in the interval $(0, 2\pi)$ 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 E4 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)

