

2.1 Derivative Basics: Form C Assessment

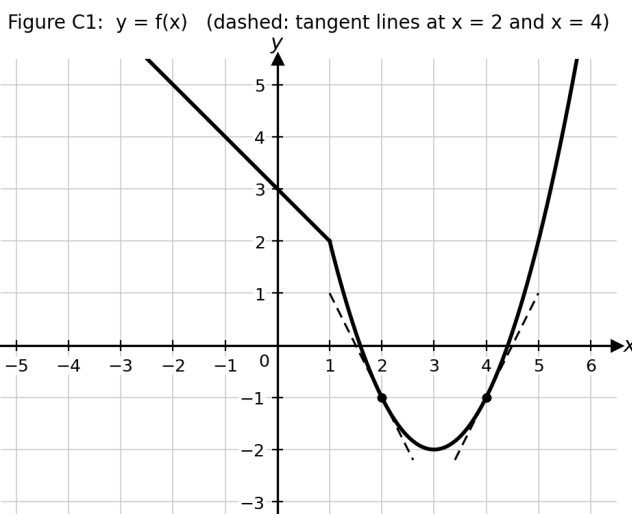
Name: _____

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 C1. The dashed lines are tangent to the graph of f at $x = 2$ and $x = 4$.



1. Use the figure to answer each part.

(a) $f(2)$ _____

(b) $f'(4)$ _____

(c) $f'(3)$ _____

(d) $f'(1)$ _____

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

(f) Write $f'(-1)$, $f'(4)$, 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 $f(x) = x^3 - 3x^2 + 5$. Find an equation of the line tangent to the graph of f at $x = 2$. (5 pts)

3. Let $r(x) = 3 \sin x + x^2$. Find an equation of the line tangent to the graph of r at $x = 0$. **(5 pts)**

4. The line tangent to the graph of a function w at $x = 3$ has equation

$$y + 4 = -2(x - 3) + 5(x - 3).$$

(a) Find $w'(3)$.

(b) Find $w(3)$.

(3 + 2 pts)

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

(2 pts)

Part III. Definition of the derivative. Show work.

6. Let $f(x) = \frac{2}{3-x}$. 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 $g(x) = \sqrt{x}$. Use the definition

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

with $c = 9$ to find $g'(9)$. 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) $\lim_{h \rightarrow 0} \frac{(2+h)^3 - 8}{3h}$

(b) $\lim_{x \rightarrow \pi/2} \frac{\sin x - 1}{x - \pi/2}$

Part IV. Differentiation rules. Show work.

9. Find each derivative.

(3 each, 6 pts)

(a) $a(x) = \pi^3$. Find $a'(x)$.

(b) Let $f(x) = x^2 + \sin x$, and let $m(x) = f(\pi)$ for every x . Find $m'(x)$.

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

(3 each, 12 pts)

(a) $f(x) = 3x^4 - \frac{5}{x}$

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

(c) $f(x) = 7 - \frac{4}{\sqrt{x}} + \cos x$

(d) $f(x) = (3x - 1)^2 + x$

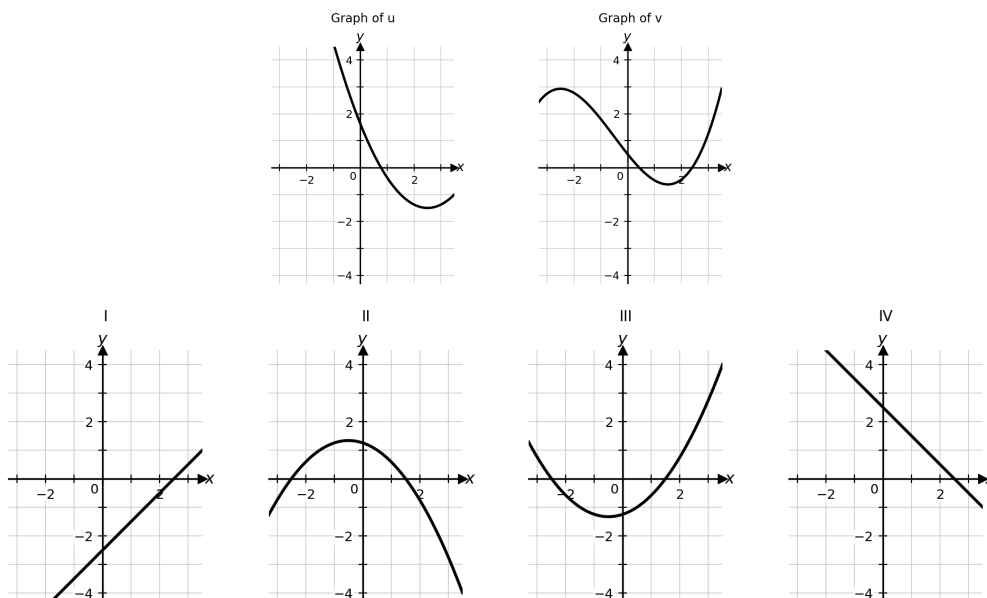
11. Let $f(x) = 2 \sin x + 3x$. Find $f'(\frac{2\pi}{3})$.

(5 pts)

12. Let $f(x) = \sqrt{3}x + 2\cos x$. Find every x in the interval $(\frac{\pi}{2}, 2\pi)$ 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 C4 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)**

