2.2 / Practice workbook

The Derivative Function and the Tangent Line

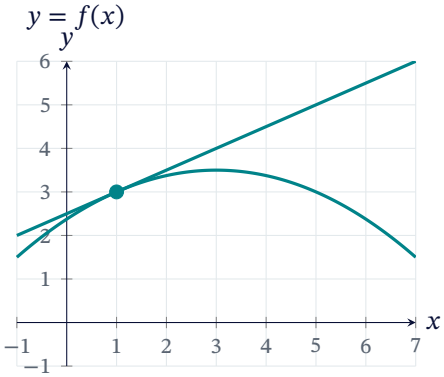
Practice

Problems 1–7 / Show your reasoning

1 Let $f(x) = \sqrt{3x+1}$. (a) Use the definition of the derivative to find $f'(x)$. (b) Find $f'(5)$.

2 For $y = f(x)$, the rate of change of y with respect to x at $x = 4$ is -2, and the graph of f passes through $(4, 7)$. (a) Write the first fact in two different derivative notations. (b) Write an equation of the line tangent to the graph of f at $x = 4$.

3 The graph of f and the line tangent to the graph of f at $x = 1$ are shown. The tangent line passes through the points $(1, 3)$ and $(3, 4)$. What is the value of $f'(1)$?



A. $\frac{1}{2}$
B. 3
C. 2
D. $-\frac{1}{2}$

4 Let $f(x) = 3 - x^3$. Which of the following is an equation of the line tangent to the graph of f at $x = -1$?

A. $y = -3(x+1)$
B. $y = 4 + 3(x+1)$
C. $y = 4 - 3(x+1)$
D. $y = 4 - 3x^2(x+1)$

5

For a function f, $\lim_{x \to 3} \dfrac{f(x) - f(3)}{x - 3} = 5$.
Which of the following must be true?
I. $\lim_{h \to 0} \dfrac{f(3 + h) - f(3)}{h} = 5$
II. The line tangent to the graph of f at $x = 3$ has slope 5.
III. $f(3) = 5$

A. I and III only
B. II only
C. I and II only
D. I, II, and III

2.2 / AP-style free response

Problem 6 ➤ */ Show the work and the reasons a grader looks for.*

For $h \neq 0$, the average rate of change of a function f over the interval from $x = 2$ to $x = 2 + h$ is $A(h) = 7 + 3h + h^2$. Also, $f(2) = 1$.

(a) Find $f'(2)$. Show the work that leads to your answer.

(b) Find the average rate of change of f over the interval $2 \leq x \leq 4$.

(c) Write an equation of the line tangent to the graph of f at $x = 2$.

2.2 / AP-style free response

Problem 7 ➤ */ Show the work and the reasons a grader looks for.*

Let $f(x) = x^2 - 6x + 5$. The definition of the derivative gives $f'(x) = 2x - 6$.

(a) Find the point on the graph of f where the tangent line is parallel to the line $2x - y = 7$.

(b) Write an equation for that tangent line.

2.2 / Answer key

The Derivative Function and the Tangent Line

1 (a) $f'(x) = \dfrac{3}{2\sqrt{3x+1}}$; (b) $\frac{3}{8}$

2 (a) $f'(4) = -2$ and $\left.\dfrac{dy}{dx}\right|_{x=4} = -2$; (b) $y = 7 - 2(x-4)$

3 (A)

4 (C)

5 (C)

6 (a) 7; (b) 17; (c) $y = 1 + 7(x-2)$

7 (a) $(4, -3)$; (b) $y = -3 + 2(x-4)$