

12.3 Exercises

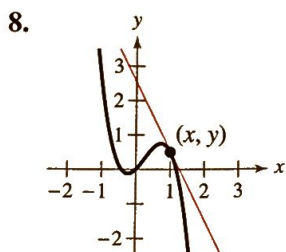
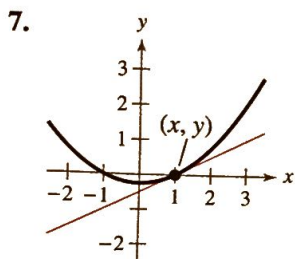
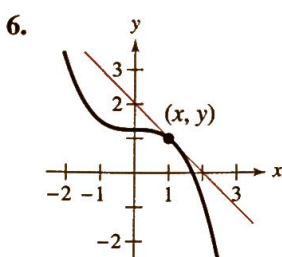
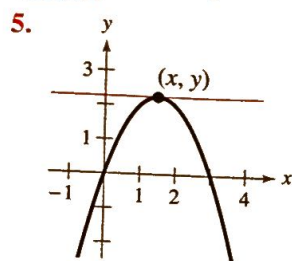
See CalcChat.com for tutorial help and worked-out solutions to odd-numbered exercises.

Vocabulary: Fill in the blanks.

- _____ is a branch of mathematics that studies rates of change of functions.
- The _____ to the graph of a function at a point is the line whose slope best approximates the slope of the graph at the point.
- The slope of the tangent line to a graph at $(x, f(x))$ is given by $m =$ _____.
- The _____ $f'(x)$ is the formula for the slope of the tangent line to the graph of f at the point $(x, f(x))$.

Skills and Applications

Approximating the Slope of a Graph In Exercises 5–8, use the figure to approximate the slope of the graph at the point (x, y) .



Approximating the Slope of a Tangent Line In Exercises 9–14, sketch a graph of the function and the tangent line at the point $(1, f(1))$. Use the graph to approximate the slope of the tangent line.

9. $f(x) = x^2 - 2$

10. $f(x) = x^2 - 2x + 1$

11. $f(x) = \sqrt{2-x}$

12. $f(x) = \sqrt{x+3}$

13. $f(x) = \frac{4}{x+1}$

14. $f(x) = \frac{3}{2-x}$



Finding the Slope of a Graph In Exercises 15–22, use the limit process to find the slope of the graph of the function at the specified point.

15. $g(x) = x^2 - 6x$, $(1, -5)$

16. $f(x) = 10x - 2x^2$, $(3, 12)$

17. $g(x) = 9 - 3x$, $(2, 3)$

18. $h(x) = 3x + 4$, $(-1, 1)$

19. $g(x) = \frac{4}{x}$, $(2, 2)$

20. $g(x) = \frac{1}{x-4}$, $(3, -1)$

21. $h(x) = \sqrt{x}$, $(9, 3)$

22. $h(x) = \sqrt{x+8}$, $(-4, 2)$



Finding a Formula for the Slope of a Graph In Exercises 23–28, find a formula for the slope of the graph of f at the point $(x, f(x))$. Then use it to find the slope at the two given points.

23. $f(x) = 4 - x^2$

(a) $(0, 4)$

(b) $(-1, 3)$

25. $f(x) = \frac{1}{x+4}$

(a) $(0, \frac{1}{4})$

(b) $(-2, \frac{1}{2})$

27. $f(x) = \sqrt{x-1}$

(a) $(5, 2)$

(b) $(10, 3)$

24. $f(x) = x^3$

(a) $(1, 1)$

(b) $(-2, -8)$

26. $f(x) = \frac{1}{x+2}$

(a) $(0, \frac{1}{2})$

(b) $(-1, 1)$

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

(a) $(5, 1)$

(b) $(8, 2)$



Finding a Derivative In Exercises 29–42, find the derivative of the function.

29. $f(x) = 6$

30. $f(x) = -8$

31. $g(x) = 2x - 7$

32. $f(x) = -5x + 1$

33. $f(x) = 2x^2 + 3x$

34. $f(x) = x^2 - 3x + 4$

35. $f(x) = x^{-2}$

36. $f(x) = x^{-3}$

37. $f(x) = \sqrt{x-7}$

38. $g(x) = \sqrt{x+9}$

39. $h(x) = \frac{1}{x+1}$

40. $f(x) = \frac{1}{x-8}$

41. $f(x) = \frac{1}{\sqrt{x-4}}$

42. $h(x) = \frac{1}{\sqrt{x+1}}$



Using the Derivative In Exercises 43–50, (a) find the slope of the graph of f at the given point, (b) find an equation of the tangent line to the graph at the point, and (c) graph the function and the tangent line.

43. $f(x) = x^2 - 1$, $(2, 3)$

44. $f(x) = 6x - x^2$, $(1, 5)$

45. $f(x) = x^3 - 2x$, $(1, -1)$

46. $f(x) = x^3 - x^2$, $(2, 4)$