Exercises: Derivatives

1–3 ■ Use the definition of the derivative to find $f'(x_0)$ for the given function and the given value of x_0.

1. $f(x) = 3x^2 + 2,\ x_0 = 2$

2. $f(x) = 1/x,\ x_0 = 3$

3. $f(x) = 2\sqrt{x},\ x_0 = 25$

4. Use the definition of the derivative to find a general formula for $f'(x)$ if $f(x) = 4x^2 + 1$.

5–12 ■ Use the power rule to compute the derivative of the given function.

5. x^3

6. $\sqrt{x}$

7. $\dfrac{1}{x}$

8. $\dfrac{1}{x^2}$

9. $\sqrt[3]{x}$

10. $\dfrac{1}{\sqrt{x}}$

11. $x^2\sqrt{x}$

12. $\sqrt[3]{x^2}$

13–18 ■ Find the derivative of the given function.

13. $5x^4 - 3\sqrt{x} + 4$

14. $\dfrac{x^2}{5} + 3e^x + \sin x$

15. $\dfrac{8}{x^5} + 6x - \sqrt{2}$

16. $x\sqrt{2} + x\sqrt[3]{x} + \cos(\pi/8)$

17. $e^2x^3 - 4\cos x$

18. $\dfrac{\tan x}{\pi} + \dfrac{2}{\sqrt{x}}$

19. Find the equation of the tangent line to the graph of $y = x^3 - 6x + 8$ at the point $(1,3)$.

20. Find the equation of the tangent line to the graph of $y = \sqrt[3]{x}$ at $x = 8$.

21. Find the equation of the tangent line to the graph of $y = 4\sin x$ at $x = 5\pi/6$.

22. Find the equation of the tangent line to the graph of $y = e^x$ at $x = \ln 3$.

23–26 ■ Use the product rule to find the derivative of the given function.

23. $x^3 \sin x$

24. $4x^2 + \sqrt{x}\tan x$

25. $1 + 4e^x \cos x$

26. $x \sin x \cos x$

27–30 ■ Use the quotient rule to find the derivative of the given function. Simplify your answers.

27. $\dfrac{x^3}{x^2+1}$

28. $\dfrac{2x}{1+\sqrt{x}}$

29. $\dfrac{3\sin x + 1}{x - 1}$

30. $\dfrac{e^x}{1+\cos x}$