

Differentiation Practice

For 1–21 below, find $\frac{dy}{dx}$. For 22–25 below, find $\frac{d^2y}{dx^2}$.

1. $y = x^3 - \frac{5}{x} + \pi$

2. $y = \sqrt{2x} + \sqrt[3]{x+1}$

3. $y = (x^2 + 4x)^{\frac{3}{2}}$

4. $y = (x-1)^5(x^2+2)^{13}$

5. $y = \frac{x^3-x}{x^2-9}$

6. $y = (4x + \frac{1}{x^2})^3$

7. $y = x^3(x^2+1)\sqrt{x-1}$

8. $y = (x^2+1)(3x+1)$

9. $y = \sqrt{\frac{1}{2}x^3}$

10. $y = (x^2+1)(x+1)^2$

11. $y = (\sqrt[3]{x} - x)^{\frac{4}{3}}$

12. $y = \sqrt[5]{3x^4 + x^2}$

13. $y = (x^{78} - 77x)^{87} - x^{87}$

14. $y = \left(\frac{x^2+2}{3}\right)^2$

15. $y = \sqrt{\frac{x^2+9}{x+3}}$

16. $y = \frac{(\sqrt{x}-1)(x+1)}{3x^2}$

17. $y = 3^{-\pi^2}$

18. $y = (x^2 - x)^{-2}$

19. $y = \frac{x+\sqrt{x}}{x^2+\pi}$

20. $y = (x^2 - x)\sqrt{5x+1}$

21. $y = \frac{1}{x^3+2x}$

For the next four, find $\frac{d^2y}{dx^2}$ (aka y'' , aka $f''(x)$):

22. $y = (x^2+1)(x^2-1)$

23. $y = 4\pi(x^2 + \frac{1}{x})$

24. $y = \frac{\sqrt{x}}{1-x}$

25. $y = (\sqrt{x}-1)^{100}$

Practice with e and \log

26. Compute each of the following numbers without a calculator:

(a) $\ln 1$ (b) $\ln e^{6.7}$ (c) $\log 10$ (d) $\log 0.1$ (e) $\log 1000$ (f) $\ln(-3)$

27. Simplify the following expressions without using a calculator.

(a) $\ln\left(\frac{1}{e^2}\right)$ (b) $e^{2\ln 4}$ (c) $\ln\left(\frac{\sqrt{e}}{e^3}\right)$ (d) $e^{2\ln\sqrt{2}}$

28. Express the exponential function $y = 3^t$ in the form $y = e^{kt}$ for some k .

29. Solve the equation $d = 10 \ln\left(\frac{I}{I_0}\right)$ for I .