

## Derivative and Integral Practice Worksheet (KEY)

Find  $\frac{dy}{dx}$ .

1.  $y = \ln x$

$$\frac{dy}{dx} = \frac{1}{x}$$

2.  $y = -4 \sin x$

$$\frac{dy}{dx} = -4 \cos x$$

3.  $y = \ln(-\cos x)$

$$\frac{dy}{dx} = \frac{1}{-\cos x} \cdot \sin x$$

$$\frac{dy}{dx} = -\tan x$$

4.  $y = 4^x$

$$\ln y = x \ln 4$$

$$\frac{1}{y} \frac{dy}{dx} = \ln 4$$

$$\frac{dy}{dx} = (\ln 4) 4^x$$

5.  $y = \frac{(3x-1)(5x+12)}{4x-8}$

$$\ln y = \ln(3x-1) + \ln(5x+12) - \ln(4x-8)$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{3}{3x-1} + \frac{5}{5x+12} - \frac{4}{4x-8}$$

$$\frac{dy}{dx} = \left( \frac{3}{3x-1} + \frac{5}{5x+12} - \frac{1}{x-2} \right) \left( \frac{(3x-1)(5x+12)}{4x-8} \right)$$

6.  $y = \tan(\ln x)$

$$\frac{dy}{dx} = \sec^2(\ln x) \left( \frac{1}{x} \right)$$

7.  $y = \frac{1}{x}$

$$y = x^{-1}$$

$$\frac{dy}{dx} = -x^{-2} = -\frac{1}{x^2}$$

8.  $y = 4^6$

$$\frac{dy}{dx} = 0$$

9.  $y = e^{x \ln 3}$  (OR)  $y = e^{x \ln 3}$

$$\frac{dy}{dx} = e^{x \ln 3} \cdot \ln 3$$

$$y = e^{\ln 3^x}$$

$$y = 3^x$$

$$\frac{dy}{dx} = e^{\ln 3^x} \cdot \ln 3$$

$$\ln y = x \ln 3$$

$$\frac{1}{y} \frac{dy}{dx} = \ln 3$$

$$\frac{dy}{dx} = 3^x \cdot \ln 3$$

$$\frac{dy}{dx} = 3^x \cdot \ln 3$$

10.  $y = \tan^2(3x)$

$$\frac{dy}{dx} = 2 \tan(3x) \cdot \sec^2(3x) \cdot 3$$

$$\frac{dy}{dx} = 6 \tan(3x) \cdot \sec^2(3x)$$

11.  $\cos y = e^x$

$$-\sin y \frac{dy}{dx} = e^x$$

$$\frac{dy}{dx} = \frac{e^x}{-\sin y}$$

12.  $y = e^{x^5}$

$$\frac{dy}{dx} = e^{x^5} \cdot 5x^4$$

13.  $y = x^{e^5}$

$$\frac{dy}{dx} = e^5 \cdot x^{e^5-1}$$

14.  $y = e^{5x}$

$$\frac{dy}{dx} = 5e^{5x}$$

15.  $y = e^x(3x-2)$

$$\frac{dy}{dx} = (3x-2)(e^x) + (e^x)(3)$$

$$\boxed{\frac{dy}{dx} = 3x \cdot e^x + e^x}$$

16.  $y = \tan e^x$

$$\boxed{\frac{dy}{dx} = e^x \cdot \sec^2(e^x)}$$

17.  $y = 1000(1.03^x)$

$$\ln y = \ln 1000 + x \ln 1.03$$

$$\frac{1}{y} \frac{dy}{dx} = \ln 1.03$$

$$\boxed{\frac{dy}{dx} = (\ln 1.03)(1000)(1.03^x)}$$

18.  $y = (\sin x)^{3x}$

$$\ln y = 3x \cdot \ln(\sin x)$$

$$\frac{1}{y} \frac{dy}{dx} = (\ln(\sin x))(3) + (3x) \left( \frac{\cos x}{\sin x} \right)$$

$$\boxed{\frac{dy}{dx} = (3 \ln(\sin x) + 3x \cot x) ((\sin x)^{3x})}$$

19.  $y = \ln(\tan x)$

$$\frac{dy}{dx} = \frac{1}{\tan x} \cdot \sec^2 x$$

$$\frac{dy}{dx} = \frac{\cos x}{\sin x} \cdot \frac{1}{\cos^2 x}$$

$$\boxed{\frac{dy}{dx} = \frac{1}{\sin x \cos x} = \csc x \sec x}$$

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

$$\frac{dy}{dx} = -(2x-5)^{-2} (2)$$

$$\boxed{\frac{dy}{dx} = \frac{-2}{(2x-5)^2}}$$

21.  $y = x^5 \ln 4x$

$$\frac{dy}{dx} = (\ln 4x)(5x^4) + (x^5) \left( \frac{4}{4x} \right)$$

$$\boxed{\frac{dy}{dx} = 5x^4 \ln 4x + x^4}$$

22.  $y = \int_2^x \cos 4t \, dt$

$$g(x) = \int \cos 4t \, dt$$

$$g'(x) = \cos 4x$$

$$y = g(x) - g(2)$$

$$\frac{dy}{dx} = g'(x) - 0$$

$$\boxed{\frac{dy}{dx} = \cos 4x}$$

23.  $y = \int_3^{x^2} \sec^3 t \, dt$

$$g(x) = \int \sec^3 t \, dt$$

$$g'(x) = \sec^3 x$$

$$y = g(x^2) - g(3)$$

$$\frac{dy}{dx} = g'(x^2) \cdot 2x - 0$$

$$\boxed{\frac{dy}{dx} = (\sec^3(x^2))(2x)}$$

24.  $y = \int_0^{\sin x} \sqrt[3]{t} \, dt$

$$g(x) = \int \sqrt[3]{t} \, dt$$

$$g'(x) = \sqrt[3]{x}$$

$$y = g(\sin x) - g(0)$$

$$\frac{dy}{dx} = g'(\sin x) \cdot \cos x - 0$$

$$\boxed{\frac{dy}{dx} = (\sqrt[3]{\sin x}) \cos x}$$

$$25. \quad y = \frac{\ln x}{x}$$

$$\frac{dy}{dx} = \frac{(x)\left(\frac{1}{x}\right) - (\ln x)(1)}{x^2}$$

$$\boxed{\frac{dy}{dx} = \frac{1 - \ln x}{x^2}}$$

**Integrate.**

$$26. \quad \int \frac{5}{x} dx$$

$$\boxed{= 5 \ln|x| + C}$$

$$27. \quad \int \frac{1}{3x} dx$$

$$\boxed{= \frac{1}{3} \ln|x| + C}$$

$$\boxed{= \frac{1}{3} \ln|3x| + C}$$

$$28. \quad \int \frac{x^3}{5 - 3x^4} dx$$

$$\boxed{= -\frac{1}{12} \ln|5 - 3x^4| + C}$$

$$29. \quad \int \frac{\sin x}{\cos x} dx$$

$$\boxed{= -\ln|\cos x| + C}$$

$$30. \quad \int \tan x dx$$

$$= \int \frac{\sin x}{\cos x} dx$$

$$\boxed{= -\ln|\cos x| + C}$$

$$31. \quad \int e^{4x} dx$$

$$\boxed{= \frac{1}{4} e^{4x} + C}$$

$$32. \quad \int x^3 e^{x^4} dx$$

$$\boxed{= \frac{1}{4} e^{x^4} + C}$$

$$33. \quad \int \ln(e^{5x}) dx$$

$$= \int 5x dx$$

$$\boxed{= \frac{5}{2} x^2 + C}$$

$$34. \quad \int 5 dx$$

$$\boxed{= 5x + C}$$

$$35. \quad \int \cot 3x dx$$

$$= \int \frac{\cos 3x}{\sin 3x} dx$$

$$\boxed{= \frac{1}{3} \ln|\sin 3x| + C}$$