

1. Differentiate: $f(x) = 3 \ln x$
2. Differentiate: $f(x) = 4 \log_{\frac{2}{3}} x$
3. Differentiate: $f(x) = -\sin x$
4. Differentiate: $f(x) = -5 \ln x$
5. Differentiate: $f(x) = 3 \left(\frac{4}{5}\right)^x$
6. Differentiate: $f(x) = -5 \log x$
7. Differentiate: $f(x) = (5)^x$
8. Differentiate: $f(x) = -4e^x$
9. Differentiate: $f(x) = -5e^x$
10. Differentiate: $f(x) = -\log x$

- Answers:
1. $\frac{x}{3}$
 2. $\frac{4}{x} \ln \left(\frac{3}{2}\right)$
 3. $-\cos x$
 4. $-\frac{x}{5}$
 5. $3 \ln \left(\frac{5}{4}\right) \left(\frac{5}{4}\right)^x$
 6. $-\frac{5}{x} \ln 10$
 7. $\frac{5^x}{x} \ln 5$
 8. $-4e^x$
 9. $-5e^x$
 10. $-\frac{1}{x \ln 10}$

Solutions:

1. $f'(x) = \frac{d}{dx}f(x) = \frac{d}{dx}[3 \ln x]$ ◀ Apply: $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x)$
 $= (3)\frac{d}{dx} \ln x$ ◀ Apply: $\frac{d}{dx} \ln x = \frac{1}{x}$
 $= (3)\frac{1}{x}$ ◀ Simplify:
 $= \frac{3}{x}$ $\therefore \frac{d}{dx}[3 \ln x] = \frac{3}{x}$
2. $f'(x) = \frac{d}{dx}f(x) = \frac{d}{dx}[4 \log_{\frac{2}{3}} x]$ ◀ Apply: $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x)$
 $= (4)\frac{d}{dx} \log_{\frac{2}{3}} x$ ◀ Apply: $\frac{d}{dx} \log_b x = \frac{1}{(\ln b)x}$
 $= (4)\frac{1}{(\ln \frac{2}{3})x}$ ◀ Simplify:
 $= \frac{4}{(\ln \frac{2}{3})x}$ $\therefore \frac{d}{dx}[4 \log_{\frac{2}{3}} x] = \frac{4}{(\ln \frac{2}{3})x}$
3. $f'(x) = \frac{d}{dx}f(x) = \frac{d}{dx}[-\sin x]$ ◀ Apply: $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x)$
 $= (-1)\frac{d}{dx} \sin x$ ◀ Apply: $\frac{d}{dx} \sin x = \cos x$
 $= (-1) \cos x$ ◀ Simplify:
 $= -\cos x$ $\therefore \frac{d}{dx}[-\sin x] = -\cos x$
4. $f'(x) = \frac{d}{dx}f(x) = \frac{d}{dx}[-5 \ln x]$ ◀ Apply: $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x)$
 $= (-5)\frac{d}{dx} \ln x$ ◀ Apply: $\frac{d}{dx} \ln x = \frac{1}{x}$
 $= (-5)\frac{1}{x}$ ◀ Simplify:
 $= \frac{-5}{x}$ $\therefore \frac{d}{dx}[-5 \ln x] = \frac{-5}{x}$
5. $f'(x) = \frac{d}{dx}f(x) = \frac{d}{dx}[3 \left(\frac{4}{5}\right)^x]$ ◀ Apply: $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x)$
 $= (3)\frac{d}{dx} \left(\frac{4}{5}\right)^x$ ◀ Apply: $\frac{d}{dx}b^x = (\ln b)b^x$
 $= (3) \left(\ln \frac{4}{5}\right) \left(\frac{4}{5}\right)^x$ ◀ Simplify:
 $= 3 \left(\ln \frac{4}{5}\right) \left(\frac{4}{5}\right)^x$ $\therefore \frac{d}{dx}[3 \left(\frac{4}{5}\right)^x] = 3 \left(\ln \frac{4}{5}\right) \left(\frac{4}{5}\right)^x$
6. $f'(x) = \frac{d}{dx}f(x) = \frac{d}{dx}[-5 \log x]$ ◀ Apply: $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x)$
 $= (-5)\frac{d}{dx} \log x$ ◀ Apply: $\frac{d}{dx} \log x = \frac{1}{(\ln 10)x}$

$$= (-5) \frac{1}{(\ln 10)x} \quad \blacktriangleleft \text{Simplify:}$$

$$= \frac{-5}{(\ln 10)x} \quad \therefore \frac{d}{dx}[-5 \log x] = \frac{-5}{(\ln 10)x}$$

$$7. f'(x) = \frac{d}{dx} f(x) = \frac{d}{dx} [(5)^x] \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} c f(x) = c \frac{d}{dx} f(x)$$

$$= (1) \frac{d}{dx} (5)^x \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} b^x = (\ln b) b^x$$

$$= (1) (\ln 5) (5)^x \quad \blacktriangleleft \text{Simplify:}$$

$$= (\ln 5) (5)^x \quad \therefore \frac{d}{dx} [(5)^x] = (\ln 5) (5)^x$$

$$8. f'(x) = \frac{d}{dx} f(x) = \frac{d}{dx} [-4e^x] \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} c f(x) = c \frac{d}{dx} f(x)$$

$$= (-4) \frac{d}{dx} e^x \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} e^x = e^x$$

$$= (-4)e^x \quad \blacktriangleleft \text{Simplify:}$$

$$= -4e^x \quad \therefore \frac{d}{dx} [-4e^x] = -4e^x$$

$$9. f'(x) = \frac{d}{dx} f(x) = \frac{d}{dx} [-5e^x] \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} c f(x) = c \frac{d}{dx} f(x)$$

$$= (-5) \frac{d}{dx} e^x \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} e^x = e^x$$

$$= (-5)e^x \quad \blacktriangleleft \text{Simplify:}$$

$$= -5e^x \quad \therefore \frac{d}{dx} [-5e^x] = -5e^x$$

$$10. f'(x) = \frac{d}{dx} f(x) = \frac{d}{dx} [-\log x] \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} c f(x) = c \frac{d}{dx} f(x)$$

$$= (-1) \frac{d}{dx} \log x \quad \blacktriangleleft \text{Apply: } \frac{d}{dx} \log x = \frac{1}{(\ln 10)x}$$

$$= (-1) \frac{1}{(\ln 10)x} \quad \blacktriangleleft \text{Simplify:}$$

$$= \frac{-1}{(\ln 10)x} \quad \therefore \frac{d}{dx} [-\log x] = \frac{-1}{(\ln 10)x}$$