

Calculus Review—Derivatives and Integrals
Math 256-01, Winter 2008

Find $f'(x)$ for each of the following.

1. $f(x) = \frac{1}{5x-2}$ $f'(x) = \frac{-5}{(5x-2)^2}$
2. $f(x) = x^2 e^{nx}$ $f'(x) = nx^2 e^{nx} + 2xe^{nx}$
3. $f(x) = x^{-n}$ $f'(x) = -nx^{-n-1}$
4. $f(x) = \cos ax$ $f'(x) = -a \sin ax$
5. $f(x) = \sin \frac{\pi}{2} x$ $f'(x) = \frac{\pi}{2} \cos \frac{\pi}{2} x$
6. $f(x) = \frac{x}{\ln x}$ $f'(x) = \frac{\ln x - 1}{(\ln x)^2}$
7. $f(x) = \arctan(ax)$ $f'(x) = \frac{a}{1+a^2 x^2}$
8. $f(x) = \ln\left(\frac{x-1}{x+1}\right)$ $f'(x) = \frac{1}{x-1} - \frac{1}{x+1}$
9. $f(x) = \sec x \tan x$ $f'(x) = \sec x \cdot \sec^2 x + \sec x \tan x \tan x$
 $= \sec^3 x + \sec x \tan^2 x$

Evaluate the following indefinite integrals.

10. $\int \frac{1}{y+5} dy = \ln|y+5| + C$
11. $\int \frac{1}{4+5t} dt = \frac{1}{5} \ln|4+5t| + C$
12. $\int \frac{1}{1+t^2} dt = \tan^{-1} t + C$
13. $\int \frac{5}{t} dt = 5 \ln|t| + C$
14. $\int \frac{5}{t^2} dt = -\frac{5}{t} + C$
15. $\int e^{-t} dt = -e^{-t} + C$
16. $\int \frac{4}{\sqrt{t}} dt = 8\sqrt{t} + C$
17. $\int \frac{1}{x \ln x} dx$ $u = \ln x$ $\int \frac{1}{u} du = \ln|u| + C$
 $du = \frac{1}{x} dx$ $\boxed{\ln|\ln x| + C}$
18. $\int x e^{-3x} dx$
 $u = x$ $v = -\frac{1}{3} e^{-3x}$
 $du = dx$ $dv = e^{-3x} dx$
 $I = -\frac{1}{3} x e^{-3x} + \frac{1}{3} \int e^{-3x} dx$
 $= \quad \quad -\frac{1}{9} e^{-3x} + C$
 $= \boxed{-\frac{1}{3} x e^{-3x} - \frac{1}{9} e^{-3x} + C}$