

For this worksheet, you will need to know the differentiation rules for sums, products, reciprocals, and quotients. You also need to know that  $\frac{d}{dx} \ln x = \frac{1}{x}$ . Try to treat constants as such to simplify the calculations, e.g.,  $\frac{5}{x} = 5(\frac{1}{x})$ .

(1) Differentiate the following functions.

(a)  $f(x) = x^5 \cos x$ .

(b)  $u = (2x + 1)5^x$

(c)  $g(s) = s^{\frac{5}{3}} - 2se^s$

(d)  $h(t) = \frac{1}{4}t^2 \ln t$ .

(e)  $y = \frac{1}{x^3 + 3x + 1}$

(f)  $y = \frac{4}{e^t + 1}$

(g)  $w = \frac{x}{x^2 + 2}$

(h)  $y = \frac{x \sin x}{2^x + 1}$

(2) Find the tangent line at the indicated point.

(a)  $y = xe^x - 1$  at  $x = 0$

(b)  $y = x \ln x$  at  $x = 1$

(3) Use the rules to derive the formulas for the derivatives of the following functions.

(a)  $\tan x$

(b)  $\sec x$

(c)  $\cot x$

(d)  $\csc x$