

# Derivatives of Complicated Functions

## Worksheet - Answer Key

Find the derivatives of the following functions.

1.  $f(x) = x^3 \sin(x) + x \ln(e^\pi)$

$$f'(x) = 3x^2 \sin(x) + x^3 \cos(x) + \pi$$

2.  $f(x) = (2^x + x)(x^2 + 1)$

$$f'(x) = 2^x (\ln(2)(x^2 + 1) + 2x) + 3x^2 + 1$$

3.  $g(x) = \frac{\tan(x) - x}{e^x}$

$$g'(x) = e^{-x} (\tan^2(x) - \tan(x) + x - 1)$$

4.  $w(x) = (\sin^2(x) - 1) \left(x^3 - \frac{1}{x}\right)$

$$w'(x) = 2 \cos(x) \sin(x) \left(x^3 - \frac{1}{x}\right) - \cos^2(x) \left(3x^2 + \frac{1}{x^2}\right)$$

5.  $h(x) = \frac{xe^x + x^2}{x^3 - 5x^2 + x}$

$$h'(x) = \frac{(x^2 - 7x + 6)e^x - x^2 + 1}{(x^2 - 5x + 1)^2}$$

6.  $u(z) = z^2 \cos(z)e^z$

$$u'(z) = e^z (z^2 \cos(z) - z^2 \sin(z) + 2z \cos(z))$$

7.  $k(u) = \tan^2(u) \ln(u)$

$$k'(u) = \frac{\tan^2(u)}{u} + \ln(u)(2 \tan(u) \sec^2(u))$$

8.  $g(y) = y \ln(y) + \frac{2^y}{y}$

$$g'(y) = 1 + \ln(y) + \frac{(y \ln(2) - 1)2^y}{y^2}$$

9.  $f(x) = \frac{5e^x + \ln(x^2)}{x^2}$

$$f'(x) = 5e^x$$

10.  $u(z) = \frac{z \cos(z)}{\sqrt{z}}$

$$u'(z) = \frac{\cos(z)}{2\sqrt{z}} - \sqrt{z} \sin(z)$$

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