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

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

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

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

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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