Derivative Exam

Compute $f'(x)$ for each of the following:

1. $f(x) = e^{3x} \cos(2x)$

$$f'(x) = 3e^{3x}\cos(2x) - 2e^{3x}\sin 2x$$

2. $f(x) = 4x^5 - \frac{2}{x^3} - 2\pi$

$$f'(x) = 20x^4 + \frac{6}{x^4}$$

3. $f(x) = \frac{x^3 - 2\sqrt{x}}{x^2}$

$$f'(x) = 1 + \frac{3}{x^2\sqrt{x}}$$

4. $f(x) = \tan^2(3x)$

$$f'(x) = 6\tan(3x)\sec^2(3x)$$

5. $f(x) = \frac{\cot x}{2x-3}$

$$f'(x) = \frac{3\csc^2 x - 2x\csc^2 x - 2\cot x}{(2x-3)^2}$$

6. $f(x) = \sqrt{x}\ (x^3 - x^{-1})$

$$f'(x) = \frac{7x^2}{2}\sqrt{x} + \frac{1}{2x\sqrt{x}}$$

7. $f(x) = (x^2 + 1)(\arctan(x))$

$$f'(x) = 2x\arctan(x) + 1$$

8. $f(x) = \cot(2x - e)$

$f'(x) = -2\csc^2(2x - e)$

9. $f(x) = \arcsin(x^3)$

$f'(x) = \dfrac{3x^2}{\sqrt{1 - x^6}}$

10. $f(x) = \sin^3(\sqrt{x})$

$f'(x) = \dfrac{3\sin^2\sqrt{x}\cos\sqrt{x}}{2\sqrt{x}}$

11. $f(x) = (3x^4 - 5)^{56}$

$f'(x) = 672x^3\left(3x^4 - 5\right)^{55}$

12. $f(x) = e^{(\cos 2x)}$

$f'(x) = 2\sin 2x e^{\cos(2x)}$

Find dy/dx by implicit differentiation:

13. $x^2 - \sqrt{y} = 3$

$y' = 4x\sqrt{y}$

14. $xy = 2x^2y$

$y' = \dfrac{4xy - y}{x - 2x^2}$

15. $\sin^3(y^3) = 5x$

$\dfrac{5}{9y^2\sin^2\left(y^3\right)\cos\left(y^3\right)}$