1. Differentiate $y = \dfrac{x^3}{\tan(x)}$.
2. Differentiate $e^{\sin(e^x)}$.
3. Find an equation of the line tangent to the curve
$$\ln(x+y) + 4x^3 = 4 + \ln(2)$$
at the point $(x, y) = (1, 1)$.
4. Find $\frac{dy}{dx}$ if $1 + x^2\cos(y^2) = y^3 + e^x$.
5. Differentiate $y = \sinh(\cosh(x))$.
6. Show that the equation $e^{-x} = x^3$ has exactly one solution.
7. Find a formula for the nth derivative of $\ln(x)$.
8. Find all critical numbers of $f(x) = 2x^{1/3}(3 + x^{4/3})$.
9. The half-life of silver-108 is 418 years. Find an exact expression for the number of years it takes for a 120mg sample of silver-108 to become 100mg.
10. Find $\lim\limits_{x\to 1} \dfrac{\arctan(x) - 1}{x^2 - 1}$.
11. Verify that $f(x) = 2\sqrt{x} - x$ satisfies the three hypotheses of Rolle's theorem on the interval $[0, 4]$, and find all numbers c that satisfy the conclusion of Rolle's theorem.
12. Show that $\arccos\left(\dfrac{2\sqrt{x}}{x+1}\right) = 2\arctan(\sqrt{x}) - \dfrac{\pi}{2}$ for $x \geq 1$.
13. Find all critical values of $f(x) = e^x\sin(x)$.
14. Find all intervals on which f is increasing or decreasing and all x-values of local maxima and minima of the function $f(x) = x^2e^x$.
15. Sketch $y = x^{1/x^2}$ for $x > 0$.
16. Sketch the curve $y = x^5 - 5x^4 + 5x^3$.