1. Find y'' for the function $f(x) = (1 + x^2)\tan x$.
2. Find the n-th derivative of the function $f(x) = \dfrac{1}{1+x}$.
3. Find the 46-th derivative of the function $\cos\left(\dfrac{x}{3}\right)$.
4. Find $\dfrac{d^2y}{dx^2}$ if $\sqrt{x} + \sqrt{y} = 8$.
5. If $\mathbf{r}(t) =< t^3, t^2 >$ represents the position of a particle at time t, find the angle between the velocity and the acceleration vector at time $t = 1$.
6. Consider the curve $x = t^2 - 10t - 3$, $y = 5t^2 + t$.
   (a) Find the equation of the tangent line at the point (8,4).
   (b) At what point(s) is the tangent line to the graph parallel to the line $7x + 2y = 19$.
7. Find the point(s) on the curve $x = 1 - 2\cos t$, $y = 2 + 3\sin t$ where the tangent is horizontal or vertical.
8. A balloon is rising at a constant speed of 5 ft/s. A boy is cycling along a straight road at a speed of 15 ft/s. When he passes under the balloon it is 45 ft above him. How fast is the distance between the boy and the balloon increasing 3 s later?
9. A kite 100 ft above the ground moves horizontally at a speed of 8 ft/s. At what rate is the angle between the spring and the horizontal decreasing when 200 ft of string have been let out?
10. A trough is 10 ft long and its ends have the shape of isosceles triangles that are 3 ft across the top and have a height of 1 ft. If the trough is filled with water at a rate of 12 ft^3/min, how fast is the water level rising when the water is 6 inches deep?
11. A paper cup has the shape of a cone with height 10 cm and radius 3 cm (at the top). If the water is poured into the cup at a rate of 2 cm^3/s, how fast is the water level rising when the water is 5 cm deep?