Name:

1. Below are the graphs of three functions and their derivatives, but they are all scrambled up. Identify each of the pairs of function/its derivative (and say which is the function and which is the derivative).

2. Compute the derivatives of the following functions:

(a) $f(x) = x^2 \cos(x)$

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

(b) $f(x) = \ln(x + \sqrt{1 - x^2})$

$$\boxed{f'(x) = \frac{1}{x + \sqrt{1 - x^2}}\left(1 - \frac{1}{2}(1 - x^2)^{-1/2}(-2x)\right)}.$$

(c) $f(x) = \dfrac{1 - x}{1 + x}$.

$$\boxed{-\frac{2}{(1 + x)^2}}.$$

3. Use the limit definition of the derivative (i.e., $\lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$) to compute the following derivatives:

(a) $f(x) = x^3$

$$\lim_{h\to 0} \frac{(x+h)^3 - x^3}{h} = \lim_{h\to 0} \frac{x^3 + 3x^2 h + 3xh^2 + h^3 - x^3}{h} = \lim_{h\to 0} 3x^2 + 3xh^2 + h^3 = 3x^2.$$

(b) $f(x) = \frac{1}{x}$.

$$\lim_{h\to 0} \frac{\frac{1}{x+h} - \frac{1}{x}}{h} = \lim_{h\to 0} \frac{\frac{x}{x(x+h)} - \frac{x+h}{x(x+h)}}{h} = \lim_{h\to 0} \frac{-1}{x(x+h)} = -\frac{1}{x^2}.$$

4. The equation of an ellipse centered at the origin is given by

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

where a and b are constants. In terms of x and y, write down the slope of the tangent line to a point (x, y) on the ellipse.

$$\frac{2x}{a^2} + \frac{2yy'}{b^2} = 0$$

$$\boxed{y' = -\frac{b^2 x}{a^2 y}}.$$

5. What is the equation of the line tangent to the graph of $y = x^2$ at the point $(2, 4)$?

Slope is going to be 4 and the equation of a line with slope 4 passing through $(2, 4)$ is $\boxed{y - 4 = 4(x - 2)}$.