Directions: Complete all question and **show all applicable work.** Partial credit will be given. All questions are equally weighted.

1.) Calculate the derivative for each of the following.

(a) $2x^3 + 3x^2 + 5x + 23$

(b) $e^x \sin(x)$

2.) Calculate the derivative for each of the following.

(a) $\frac{1}{3}\ln(x^3)$

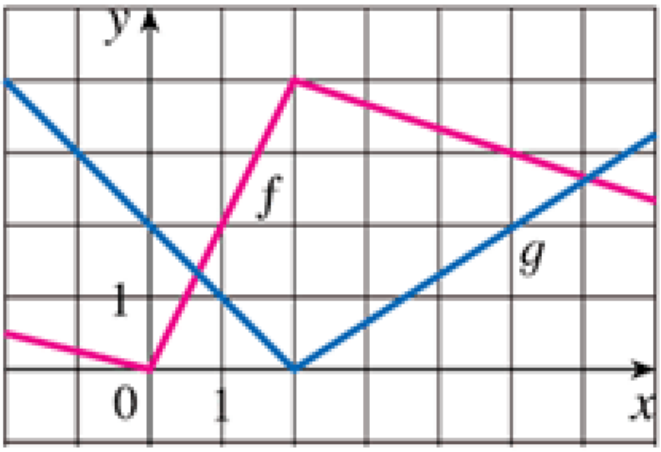
(b) $\arcsin(\sqrt{1-x^2})$

3.) Given $y^2 + 2xy = 2x^2$, calculate $\frac{dy}{dx}$.

4.) Find a linear approximation to $f(x) = e^x$ at $x = 0$.

5.) Compute: $\sin\left(\arctan\left(\frac{3}{4}\right)\right)$

6.) Using the graph below, let $F(x) = f(g(x))$, find $F'(1)$.



7.) A ball is thrown straight up into the air with its height given by $h = -4.9t^2 + 20t + 3$.

(a) Find the velocity of the ball for any time t.

(b) Find the acceleration of ball for any time t.

(c) When does the ball reach its peak height?

(d) What is the peak height?

8.) BONUS (5pts): Using the derivatives of $\sin(x)$ and $\cos(x)$, prove that

$$\frac{d}{dx}\tan(x) = \sec^2(x).$$