

**Name:**

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

1.) Using the definition of the derivative, compute  $f'(x)$  given  $f(x) = 4x^2 - 3$ .

2.) Draw a function  $f(x)$  that satisfies the following properties. Also specify what each item tells about the function  $f(x)$  in words.

(a)  $f(1) = 3$

(b)  $f'(1) = 0$

(c)  $f'(x) > 0$  for all  $x$

(d)  $f''(x) < 0$  for  $x < 0$

(e)  $f''(x) > 0$  for  $x > 0$

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

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

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

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

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

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

Name: \_\_\_\_\_

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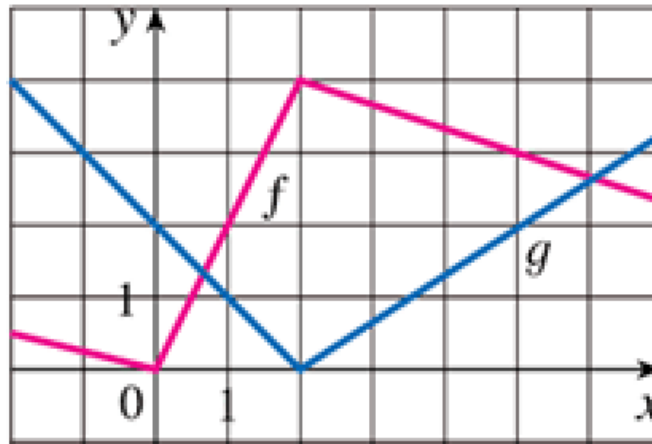
5.) Given  $y^2 + 2xy = 2x^2$ , calculate  $\frac{dy}{dx}$ .

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

Name: \_\_\_\_\_

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

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



Name: \_\_\_\_\_

- 9.) 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?

Name: \_\_\_\_\_

10.) Using the derivatives of  $\sin(x)$  and  $\cos(x)$ , prove that

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

Can you also do it without relying on the derivatives of  $\sin(x)$  and  $\cos(x)$ ?

11.) Prove that the derivative of  $\ln(x)$  is  $\frac{1}{x}$ .