

Name:

1. [7] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F. Let  $f$  be a function.

T F  $(x + y)^{-2} = \sqrt{x + y}$

T F  $\lim_{x \rightarrow a} f(x) = f(\lim_{x \rightarrow a} x)$

T F If  $f'(r)$  exists, then  $\lim_{x \rightarrow r} f(x) = f(r)$ .

T F The absolute value function is a differentiable function.

T F If  $f$  is continuous,  $f(0) = -5$ , and  $f(4) = 8$ , then  $-5 \leq f(2) \leq 8$

T F If  $\lim_{x \rightarrow a} g(x) = 0$ , then  $\lim_{x \rightarrow a} \frac{f(x)}{g(x)}$  does not exist.

T F  $\lim_{x \rightarrow -1} (x^3 + 5x) = -6$

Show your work for the following problems. The correct answer with no supporting work will receive NO credit (this includes multiple choice questions).

2. [2] (§2.7 #20) If the tangent line to  $y = f(x)$  at  $(4, 3)$  passes through the point  $(0, 2)$  find the following.

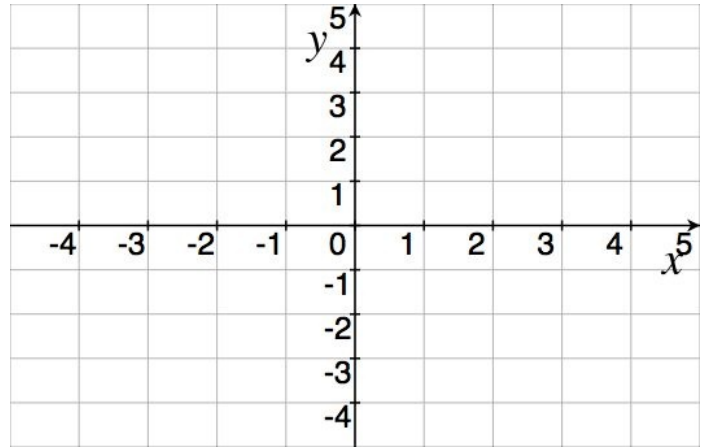
(a)  $f(4)$

(b)  $f'(4)$

3. Let  $f$  be a piece-wise defined function defined by  $f(x) = \begin{cases} 3^x & \text{if } x \leq 0, \\ \sin(\pi x) & \text{if } 0 < x < 3, \end{cases}$

(a) [2] (Quiz1 #1) Graph  $f$  on the axes provided.

(b) [1] (§2.2 #12) Determine the values of  $c$  for which  $\lim_{x \rightarrow c} f(x)$  exists.



(c) [3] (WebHW3 #11) Evaluate the following (if they exist!)

$$\lim_{x \rightarrow 3^-} f(x)$$

$$f(0)$$

$$\lim_{x \rightarrow 0^+} f(x)$$

4. [4] Find the limit if it exists, or explain why it does not exist.

(InfLimitsWks #1)

$$\lim_{x \rightarrow \infty} \frac{x-2}{x^2-1}$$

(PracticeExam #4)

$$\lim_{x \rightarrow 5^+} \ln(x-5)$$

5. [4] Find the limit if it exists, or explain why it does not exist.

(§2.5 #36)

$$\lim_{x \rightarrow \frac{\pi}{2}} \sin(x + \cos(x))$$

(§2.3 Lecture)

$$\lim_{x \rightarrow 0} x^2 \sin \frac{\pi}{x}$$

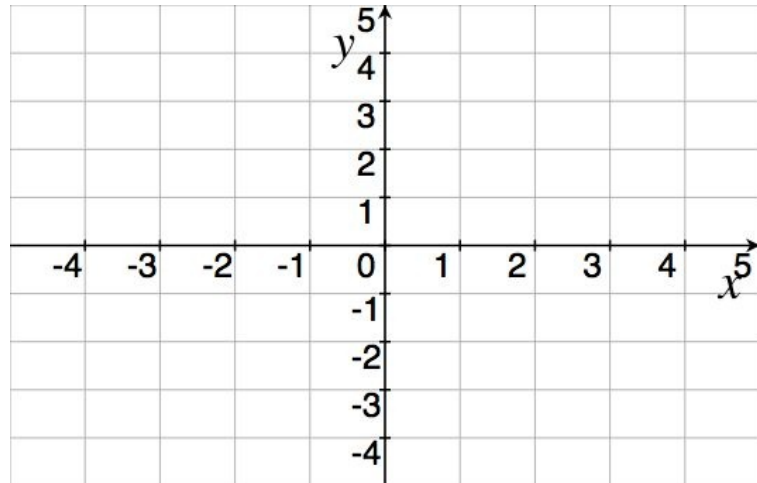
6. [5] (ContWks #6) Sketch a graph of a function  $\alpha$  that satisfies *all* of the following:

(a)  $\alpha(2) = 2$

(b)  $\lim_{x \rightarrow 2} \alpha(x) = -3$

(c)  $\lim_{x \rightarrow \infty} \alpha(x) = -3$

(d)  $\alpha$  is continuous for  $-4 \leq x \leq 1$



7. [3] Write the algebraic rule or the function  $\alpha$  you created in the problem above.

8. Consider the graph of the piece-wise defined function  $g$  to answer the following questions

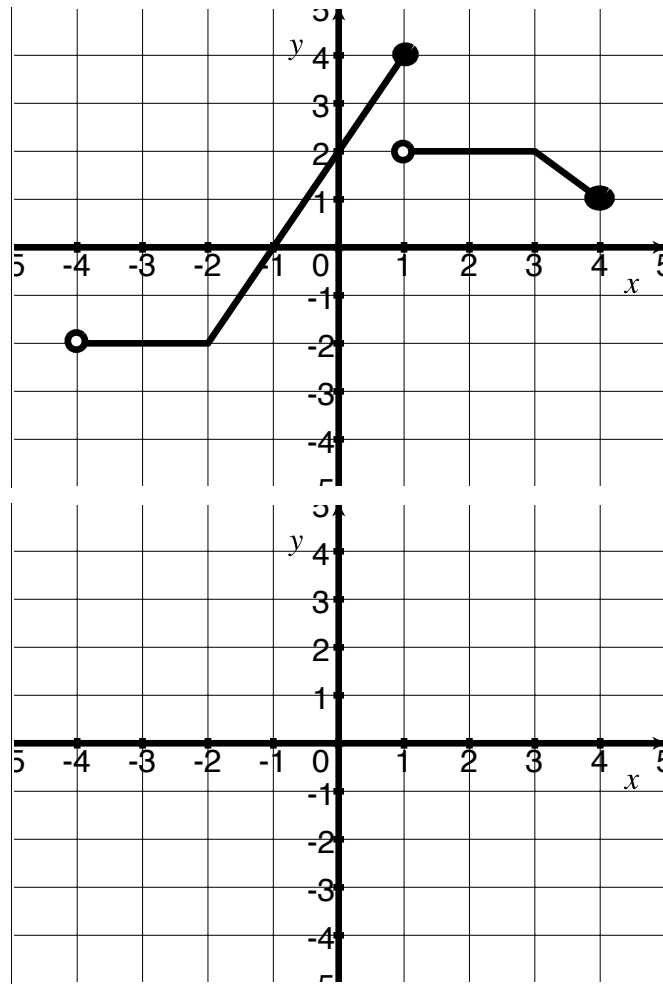
(a) [1] (WebHW2 #1)  
 $g(1)$

(b) [1] (WebHW2 #1)  
 $\lim_{x \rightarrow 3} g(x)$

(c) [1] (Quiz2 #3)  
 $g'(3)$

(d) [2] (Quiz2 #3)  
 $\frac{d}{dx}g|_{x=0}$

(e) [4] (WebHW5 #6)  
 Draw a graph of  $g'(x)$



9. (WebHW5 #3) [5] Let  $f(x) = 4x - x^2$ . Find the equation for the line tangent to the graph of  $f$ , when  $x = 1$ .

10. If a rock is thrown upward on the planet Mars with a velocity of 8m/s, its height (in meters) after  $t$  seconds is given by  $H(t) = 8t - 2t^2$ .
- (a) [2] Find a function that describes the instantaneous velocity of the ball after  $t$  seconds.
  - (b) [2] When does the ball reach its highest point?
  - (c) [1] When does the rock hit the surface?