

1. [6] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F. Let f be a function and x and y be positive numbers.

T F $\frac{9}{\sqrt{x}} = 9x^{\frac{1}{2}}$.

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

T F If f is continuous and $\lim_{x \rightarrow -2} f(x) = 5.2$, then $f(-2) = 5.2$.

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

T F The parabola is the graph of a differentiable function.

T F $\frac{d}{dx}(e^x) = xe^{x-1}$

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

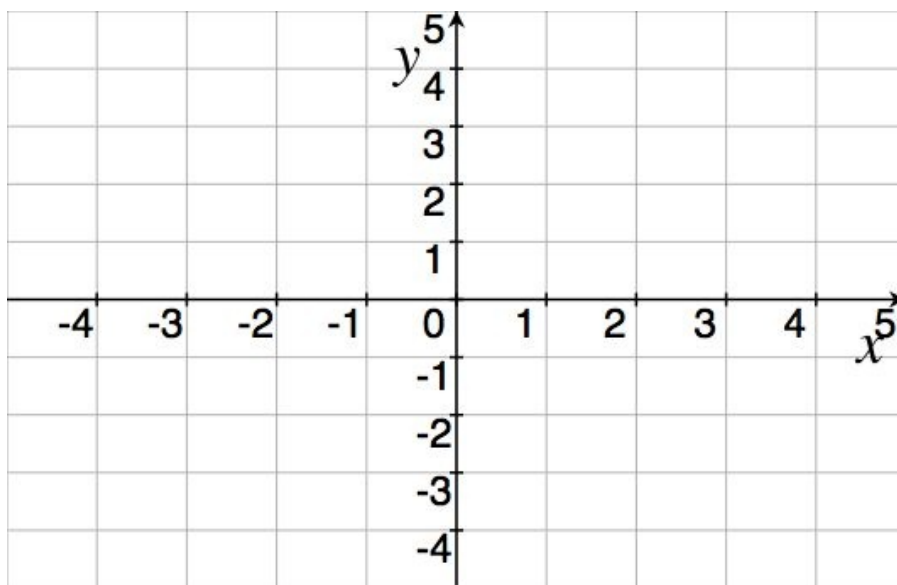
2. [5] (Quiz 2 #1) Sketch the graph of an example function f that satisfies the following:

(a) f is *not* continuous at $x = 0$

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

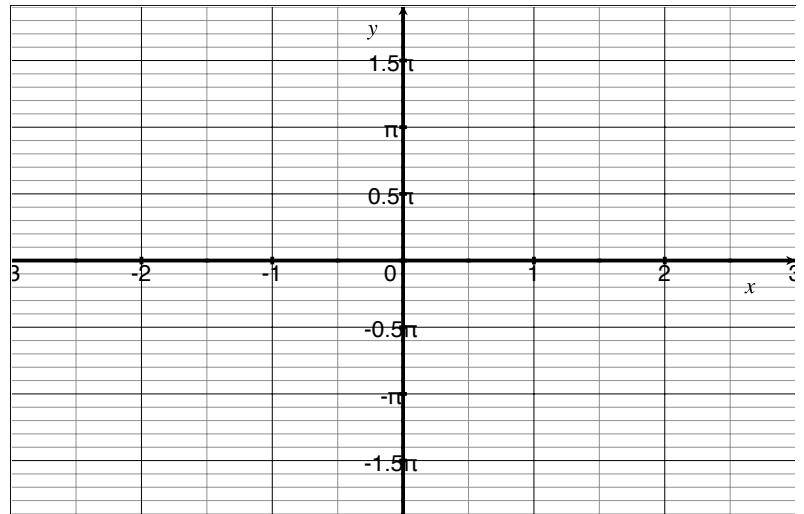
(c) $f(-3) = -2$

(d) $f'(-3) > 0$



3. Let

$$g(x) = \begin{cases} \pi x + \frac{\pi}{2} & \text{if } x < 0 \\ \pi & \text{if } x = 0 \\ 2 \arctan(x) & \text{if } 0 \leq x \end{cases}$$



(a) [3] (Quiz1 #1) *Carefully* graph g below.

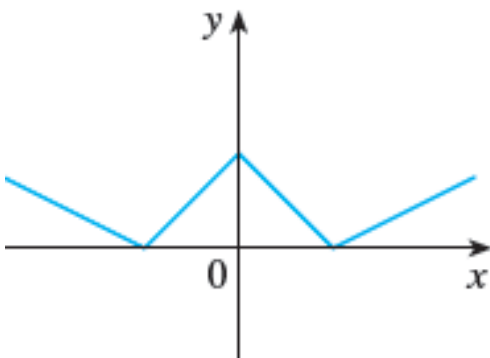
(b) [1] (§2.2 #5) Estimate $\lim_{x \rightarrow 0^-} g(x)$

(c) [2] (§2.6 #4) Estimate $\lim_{x \rightarrow \infty} g(x)$

(d) [2] (WebHW5 #6) Estimate $g'(-1)$

(e) [2] (§2.3 #2) Estimate $\lim_{x \rightarrow -2} \left[\frac{2}{3}g(x) + 2 \right]$

4. [4] (WebHW6 #4) Consider the function m graphed on the left. Sketch m' .



5. [12] (§2.3 #2, WebW4 #10, Day 2 extra practice, & PracticeExam #4) Find the limit or explain why it does not exist.

$$\lim_{x \rightarrow -1} (x^3 - 2x + 3)$$

$$\lim_{x \rightarrow \infty} \frac{7x - 2}{1 + 2x}$$

$$\lim_{h \rightarrow 0} \frac{(2 + h)^{-1} - 2^{-1}}{h}$$

$$\lim_{x \rightarrow 0} \frac{1}{x^2} \sin x$$

6. (Day 6 extra practice) Let $f(x) = 1 + 2e^x - 3x$.

(a) [5] Find the equation for the line tangent to the graph of f , when $x = 0$.

(b) [3] At what point of f is the tangent line parallel to $3x - y = 5$?

7. [5] Choose *ONE* of the following. Clearly identify which of the two you are answering and what work you want to be considered for credit.

No, doing both questions will not earn you extra credit.

- (a) (§2.6 #63) Under certain assumptions the velocity $v(t)$ of a falling raindrop at time t is:

$$v(t) = v^*(1 - e^{\frac{-gt}{v^*}})$$

where g is the acceleration due to gravity (9.8 m/s^2), and v^* is a constant.

- i. [3] Find $\lim_{t \rightarrow \infty} v(t)$.
 - ii. [2] Interpret the answer given in (i) as a scientist and explain what v^* is in everyday language.
- (b) [5] (Story Wks #6) The shuttle Discovery launched the Hubble Space Telescope April 24th 1990.

The shuttle's distance traveled from liftoff ($t = 0$) to jettisoning the rocket boosters ($t = 126\text{s}$) was well modeled by the function:

$$0.0003255t^4 - 0.03009667t^3 + 11.805t^2 - 3.083t$$

- i. [2] Find a function that describes the velocity of the shuttle.
- ii. [1] Find a function that describes the acceleration of the shuttle.
- iii. [2] Outline the steps you would do to identify the maximum acceleration obtained by the shuttle in the first 126 seconds. You do *not* need to complete these steps, just outline them clearly!