

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 $\sqrt{4+x} = 2 + \sqrt{x}$

T F $\log(y) = \frac{1}{y}y'$

T F $\frac{d}{dt}(s^2) = 2s$

T F $\frac{d}{dx}(2^x) = x2^{x-1}$

T F $\frac{d}{dx}(\log_2(x)) = \frac{1}{x \ln 2}$

T F If f is a continuous function, f' exists.

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

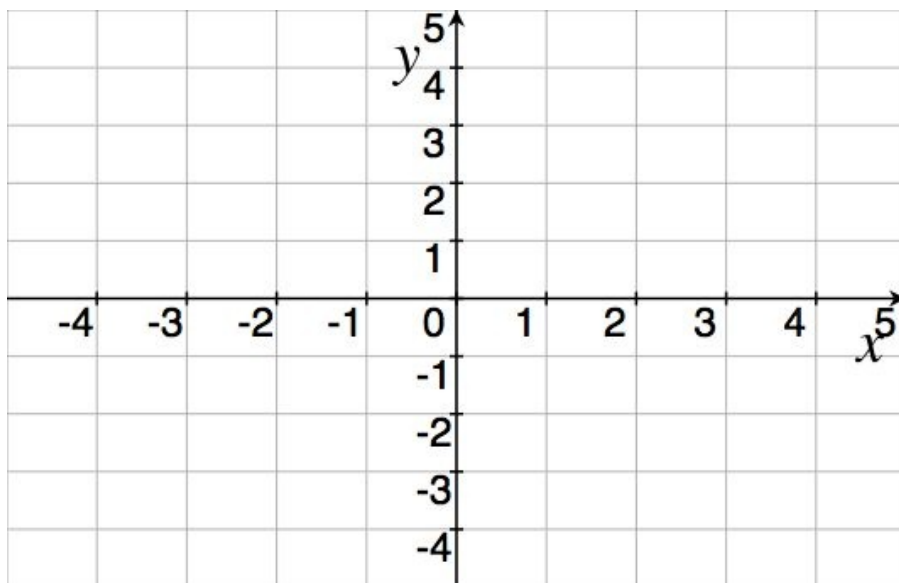
2. [5] Sketch the graph of an example function f that satisfies the following conditions:

(a) f is not differentiable when $x = -3$

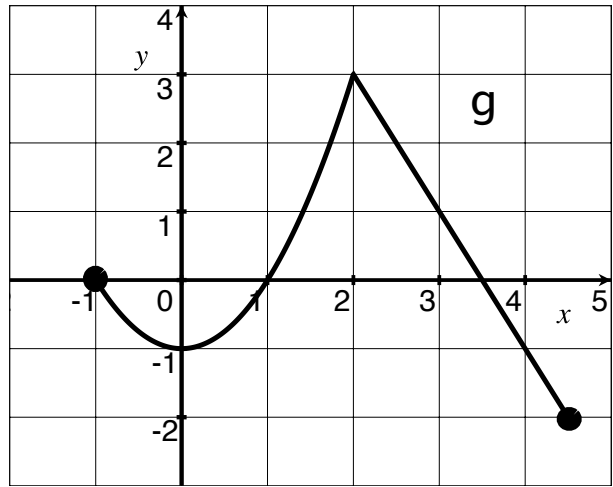
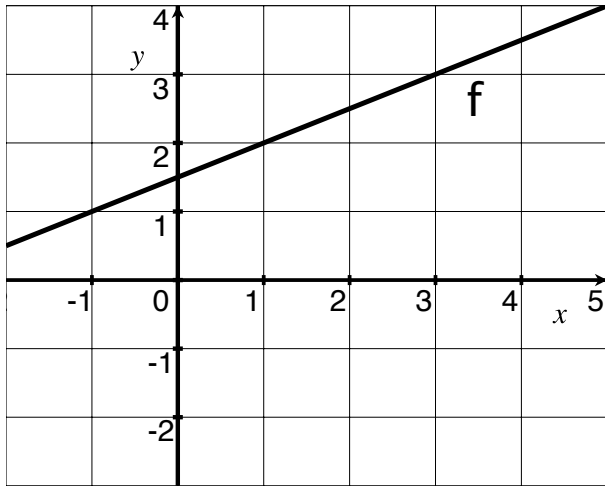
(b) f is continuous when $x = -3$

(c) $f(1) = 2$

(d) $f'(1) = -\frac{1}{2}$



3. [10] Let the graph of f and g be those shown below.



Estimate the following (if they exist):

$$(f - 4g)'(3)$$

$$(g + f)'(2)$$

$$(f \circ g)'(1)$$

$$(f \cdot g)'(3)$$

4. [14] Find the derivatives of the following and do *not* simplify.

$$y = \sin(x) \cos(x)$$

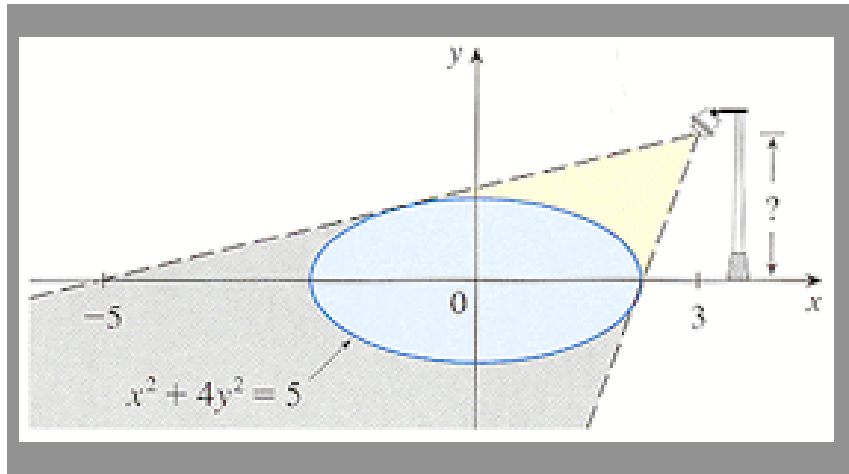
$$y = \sin(\cos(x))$$

$$y = \frac{x\sqrt{x^4 + 2}}{(4x - 3)^7}$$

$$y = (\sqrt{x})^x$$

5. [10] (§3.6 #69) The figure below shows a lamp located three units to the right of the y -axis and a shadow created by the elliptical region $x^2 + 4y^2 \leq 5$. The point $(-5, 0)$ is on the edge of the shadow.

- (a) [2] Find $\frac{dy}{dx}$ of the ellipse.



- (b) [3] Denote the point that is both on the ellipse and the top dashed line by (c, d) . Notice that the slope of the top dashed line is thus $\frac{d - 0}{c - (-5)}$. Use this information and what you found in part (a) to find the value of c .
- (c) [5] Find the equation of the top dashed line and then find out the height of the lamp.

6. (§3.9 #21) [5] Ryan and Stella were being chased by a pack of zombies. At point P they decided to split up and Stella ran south at 12 ft/s. Ryan waited for ten seconds to try to draw most of the zombies towards him and then started to run east at 15 ft/s. One minute later the two of them are still alive and running in their respective directions. At what rate are Ryan and Stella moving apart at this instant?