1. [2] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F.

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

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

    T   F   Profit is equal to price minus revenue.

    T   F   If the graph of f' is increasing at $x = 1$, then $f''(1) > 0$.
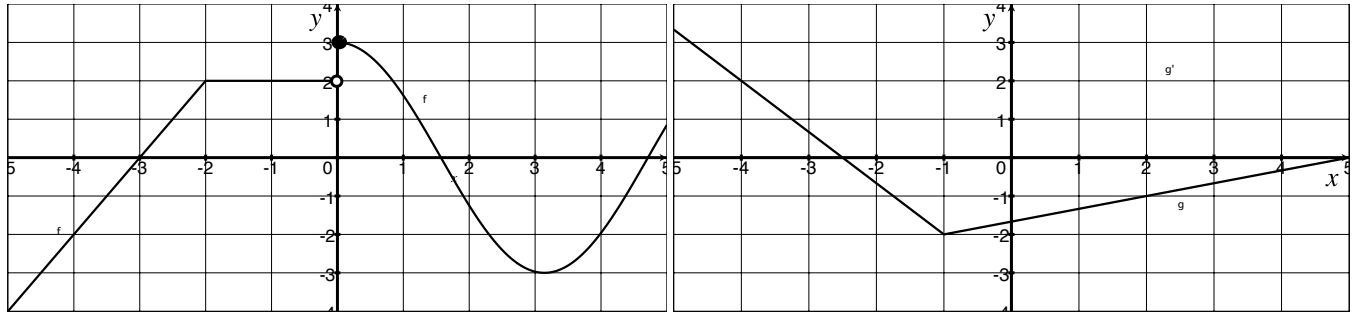
Show your work for the following problems. The correct answer with no supporting work will receive NO credit (this includes multiple choice questions).

2. [5] Draw a possible graph of $f(x) = y$ given the following information:

    (a) $f'(x) > 0$ on $1 < x < 3$

    (b) $f'(x) < 0$ when $x < 1$ and $x > 3$

    (c) $f''(x) < 0$ on $1 < x < 3$

    (d) $f'(x) = 0$ at $x = 0$ and $x = 3$
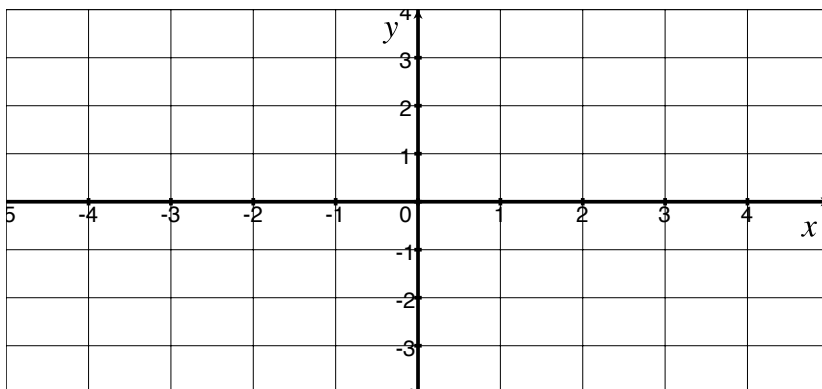
3. Let f be the function whose graph is below.

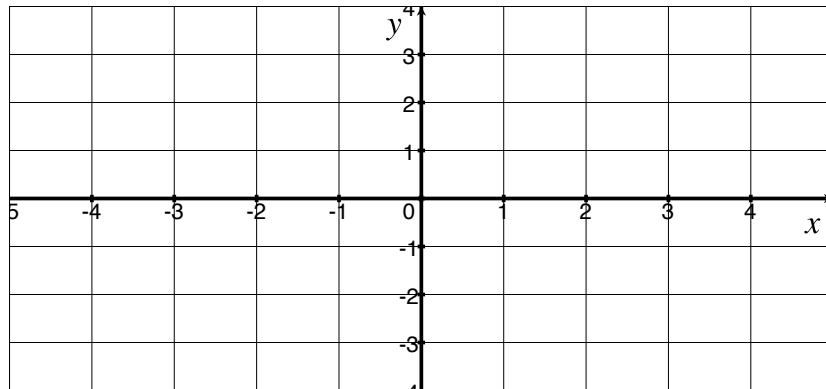
(a) [10] Find the following (if they exist):

$g(-4)$ $\qquad\qquad\qquad\qquad$ $g'(-4)$

$(g \circ f)(-4)$ $\qquad\qquad\qquad$ $\left(\frac{f}{g}\right)'(-4)$

(b) [3] *Sketch* the graph of g'.

4. The demand curve for a product is given by $q = 300 - 3p$, where p is the price of the product and q is the quantity consumers will buy at that price.

   (a) [2] Write the revenue as a function of price.

   (b) [3] Find the marginal revenue when the price is \$10, and interpret your answer in terms of revenue.

   (c) [4] If the marginal cost of making the product is \$20, and the business has the ability to set the price (by controlling q), what should the business set the price to so as to maximize profit?

5. [4] Let $f(x) = x^2$ and $g(x) = x^2 + 3$. What can you say about the slopes of the tangent lines to the two graphs at point $x = 1$? $x = a$, where a is any value? Justify your comments.

6. [12] For each rule of f given below, find $f'(x)$.

$$f(x) = 5 \cdot 3^x + \ln x$$

$$e^{5-2x}$$

$$f(x) = \frac{3x^7 - x}{\sqrt{x}}$$

$$f(x) = (\sqrt{3x^4 - x})e^{5-2x}$$

7. [5] Find the equation of the tangent line to the graph of $y = 2x^3 - 5x^2 + 3x - 5$ at $x = 1$.