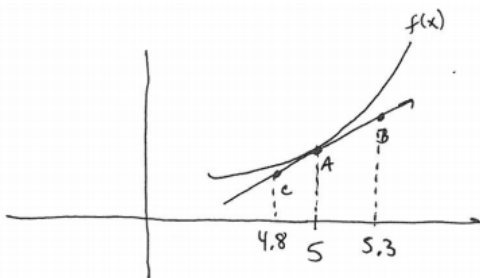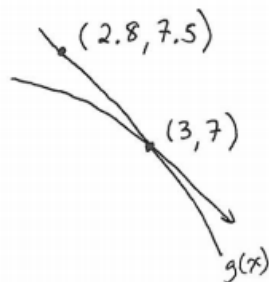It can be helpful from time to time to sketch a graph or picture to strengthen our understanding of concepts and ideas. Use the following sketches to answer problems below.

1. A sketch of the function $f(x)$ is given below:

   If $f(5) = 12$ and $f'(5) = 2$, then find the coordinates of $A, B,$ and C.

2. A sketch of the function $g(x)$ is given below:

   If possible, find each of the following. Write "Not enough information" where appropriate.

   (a) $g(3) =$
   (b) $g(2.8) =$
   (c) $g^{-1}(7) =$
   (d) $g'(3) =$
   (e) $g'(2.8) =$

3. The president announces that the national deficit is increasing, but at a decreasing rate. Interpret this statement in terms of a function and its derivatives.

4. Sketch the graph of a function that satisfies all of the given conditions.

   - $f'(1) = f'(-1) = 0$
   - $f'(x) < 0$ if $|x| < 1$
   - $f'(x) > 0$ if $1 < |x| < 2$
   - $f'(x) = -1$ if $|x| > 2$
   - $f''(x) < 0$ if $-2 < x < 0$
   - inflection point $(0, 1)$

5. Suppose $f'(x) = xe^{-x^2}$

   (a) On what interval is f increasing? On what interval is f decreasing?

   (b) Does f have a maximum value? Minimum value?

6. On what interval is the function $f(x) = x^3 - 4x^2 + 5x$ concave upward?

7. The equation $y'' + y' - 2y = x^2$ is called a **differential equation** because it involves an unknown function y and its derivatives y' and y''. Find constants A, B, and C such that the function $y = Ax^2 + Bx + C$ satisfies this equation. (Differential equations will be studied in detail in Calculus 2).

8. Suppose the curve $y = x^4 + ax^3 + bx^2 + cx + d$ has a tangent line when $x = 0$ with equation $y = 2x + 1$ and a tangent line when $x = 1$ with equation $y = 2 - 3x$. Find the values of a, b, c, and d.

Optional Challenge Problems

Find a possible formula for each function in the derivative matching card activity from last week (see the "Activities" page of the course website).