1. Let $S(x)$ =sine of x radians (the usual $sin(x)$ function we've been using). Let $G(x)$ = sine of x **degrees**. Similarly, let $C(x)$ =cosine of x radians, and let $H(x)$=cosine of x degrees.

   (a) Are S and G the same function? For what values of x is $S(x) = G(x)$? What about $C(x)$ and $H(x)$?

   (b) Express $G(x)$ and $H(x)$ in terms of $S(x)$ and $C(x)$.

   (c) What is $\frac{dG}{dx}$? What is $\frac{dH}{dx}$? (Hint: Use part a) and the chain rule.)

   (d) Express $\frac{dG}{dx}$ and $\frac{dH}{dx}$ in terms of $G(x)$ and $H(x)$. (No mention of sin or S or cos or C allowed.)

   (e) Is it still true that $(G(x))^2 + (H(x))^2 = 1$?

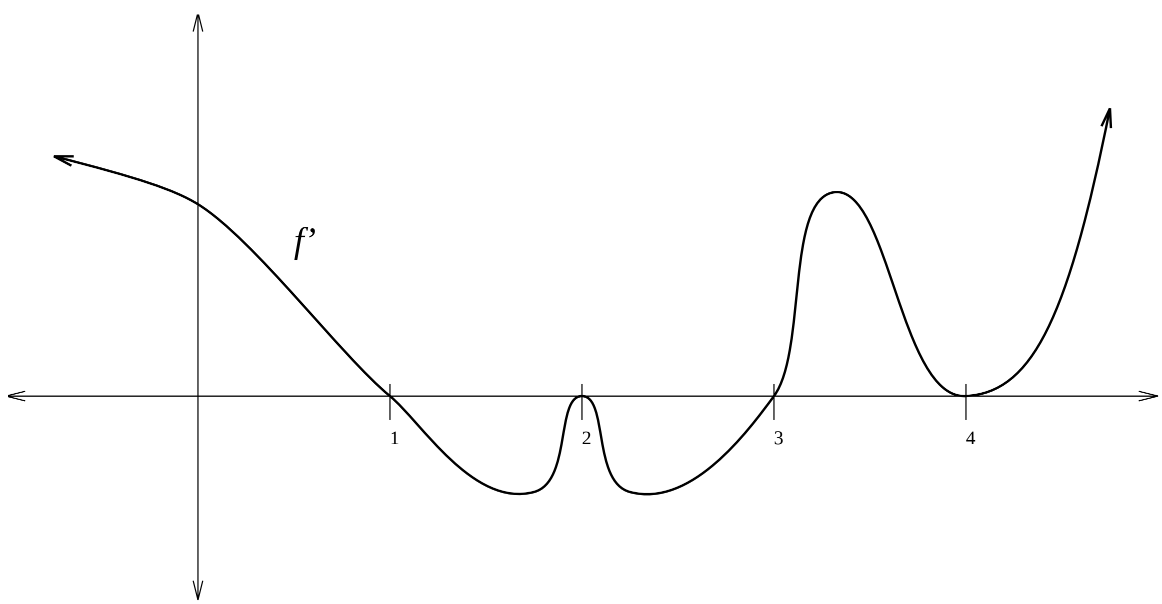
   (f) Why don't we use the unit of degrees in calculus?

2. The graph given below represents the graph of f', that is, the derivative of a function f.

   (a) Where (on which intervals) is the original function f increasing?

   (b) Where is f increasing most rapidly?

   (c) Sketch the graph of f''.



3. As a certain epidemic spreads through a population, the percentage p of infected individuals at time t (in days) satisfies the equation (called a *differential equation*)

$$\frac{dp}{dt} = 4p - 0.06p^2 \quad 0 \leq p \leq 100$$

   (a) How fast is the epidemic spreading when $p = 10\%$ and when $p = 70\%$?

   (b) For which p is the epidemic neither spreading nor diminishing?

   (c) Plot dp/dt as a function of p.

(d) What is the maximum possible rate of increase and for which p does this occur?

4. Consider the equation $x^2 + y^2 = 1$.

   (a) Sketch the graph.

   (b) Can you represent that graph as the graph of a single function? Why or why not?

   (c) Temporarily pretend $y = f(x)$ is a function of x. Rewrite the equation with $f(x)$ in the place of y. Differentiate the equation term by term, remembering to use the chain rule when needed. This gives you a new equation.

   (d) Solve that new equation algebraically for $f'(x)$ (your answer can have an $f(x)$ in it).

   (e) Write your formula for f' in terms of x and y. What does it represent on the graph? What would be a better notation to use here instead of f'?