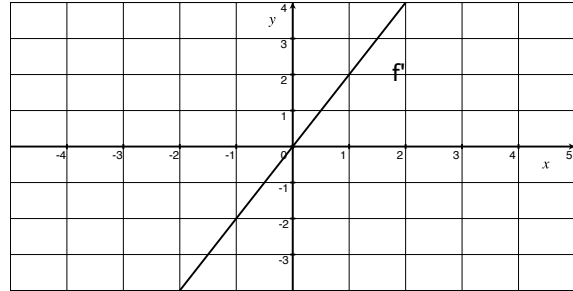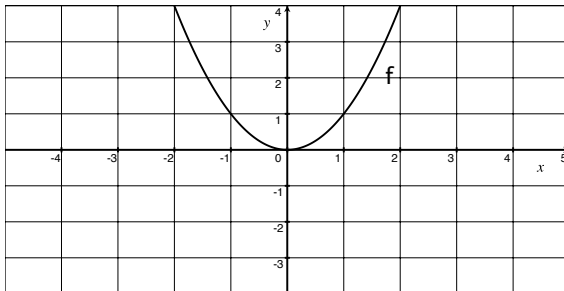# 2nd Derivatives

Get into groups of two or three people and work on the following problems.

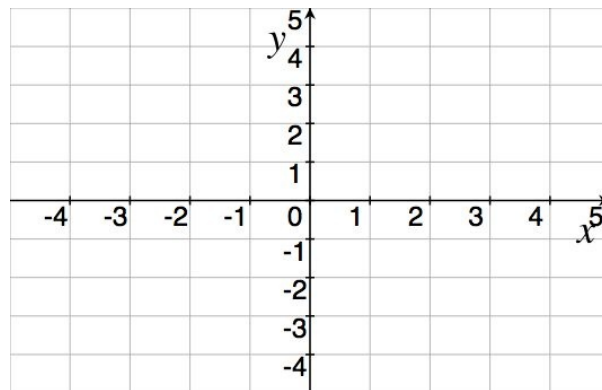1. Let $f(x) = x^2$. Below is the graph of f and f'.

Since f' is again a function we can take the derivative of f'. We call this new function f'' and say "f double prime".

   (a) Use the above graphs to fill in the chart below and then sketch f''.

x	$f''(x)$
-2	
-1	
$\frac{-1}{2}$	
0	
2	
$\frac{3}{2}$	

   (b) What interval is $f''(x) > 0$?

   (c) If $f'' > 0$ on an interval, is f' increasing or decreasing?

1

2. Concavity is defined on page 17. The words are worth reading but the pictures are better. Draw 3 curves that are concave up and verify your answers with the definition on page 17.

3. Is the function f in 1. concave up?

   There is a connection between concavity and the sign of the second derivative and the example in 1. is the best way to remember it:

   $f'' > 0$ on an interval means that graph of f is concave up.

   Verify the above claim is consistent with your work in 3.

4. Graph a function g that is concave down on some interval. Note, you will need to take *two* derivatives of the function whose graph your draw so don't make it too crazy.
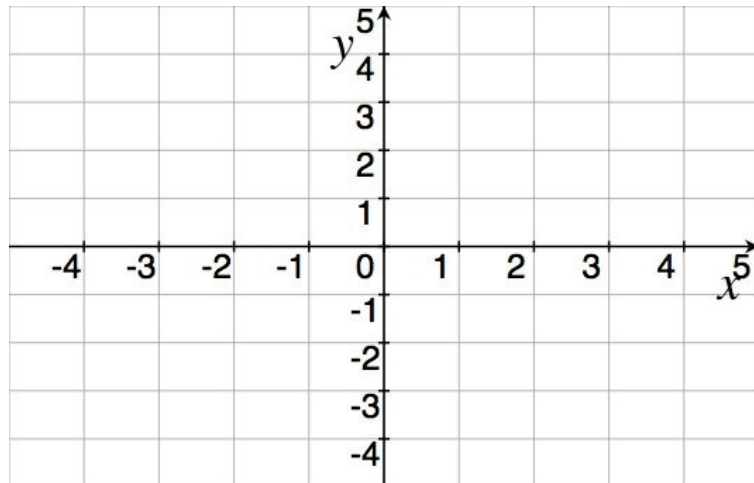
   (a) Sketch the curve of g'.

   (b) Sketch the curve of g''. What is the sign of f'' on the interval that g is concave down?

   Verify your conclusion by reading the box on page 119.