Definition
A differentiable function $f(x)$ is *concave up* on an interval (a, b):

and *concave down* on (a, b) when:

1. How can we test the concavity (up or down) of a function $f(x)$ that is twice differentiable?

2. (a) Consider the function $f(x) = x^3 + 3x^2 - 1$. On what intervals is the function concave up, respectively concave down?

   Definition
   A point $(a, f(a))$ on a function is an *inflection point* if

(b) Compute the inflection points for the following functions:

ii. $f(x) = x^3$

iii. $f(x) = \sqrt[3]{x}$

iv. $f(x) = x^4$

(c) Look at the four functions of part 2. For each function, compute the value of the second derivative at the inflection point. What can we conclude from this?

3. We now have all we need to sketch functions (or to check that the graph given by a graphing software is correct). List the pieces of information one needs to do a "good" sketch ?

   1.

   2.

   3.

   4.

   5.

   6.

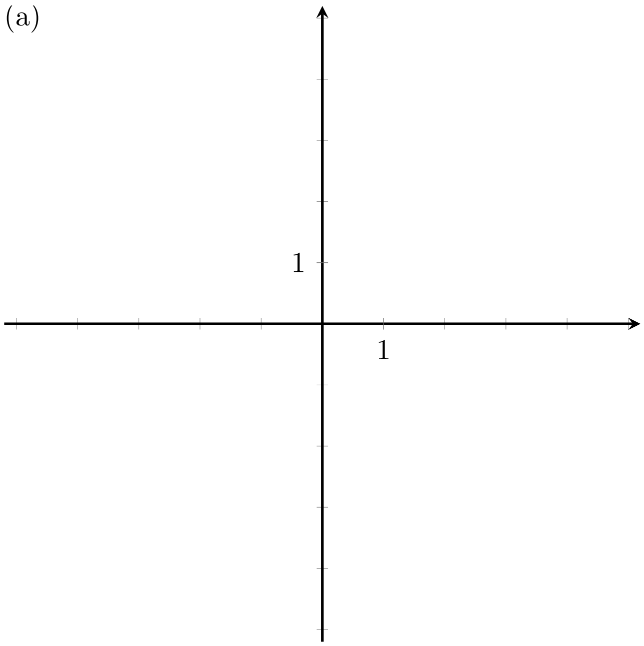
4. Using the procedure described above, sketch the following functions on the following page:

   (a) $f(x) = x\sqrt{9 - x^2}$

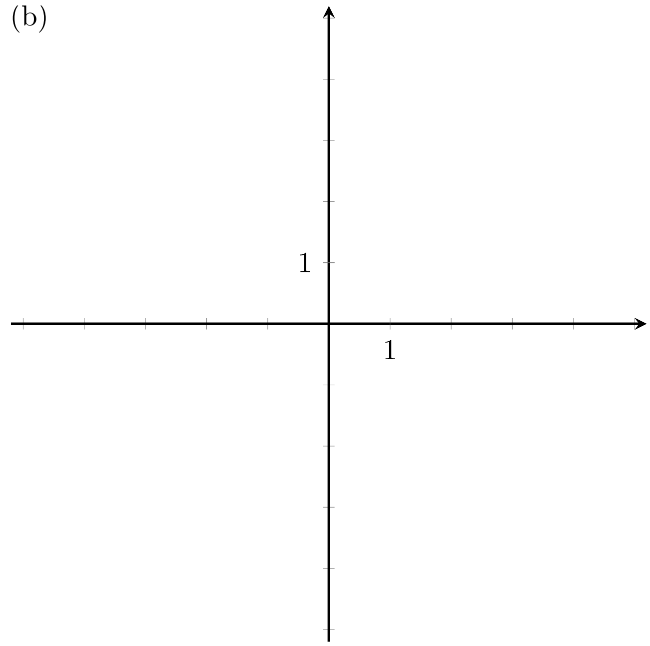
   (b) $f(x) = \dfrac{x^2 - 3}{x^2 - 4}$

   (c) $f(x) = \sqrt{|x|}$

(a)



(b)



(c)