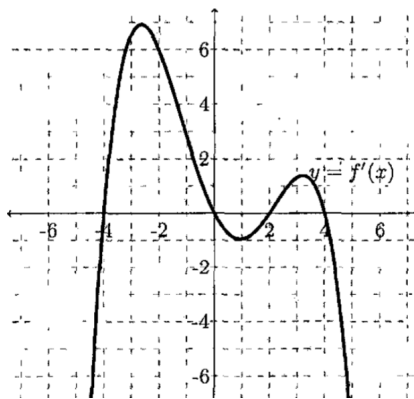

IN-CLASS ACTIVITY : HIGHER DERIVATIVES

1. Draw a graph of a function f satisfying all of the following properties :
 - i) $f(x)$ is defined in the interval $[-3, 3]$;
 - ii) $f'(x) > 0$ if $x > 2$;
 - iii) $f'(x) < 0$ if $-1 < x < 2$;
 - iv) $f''(x) < 0$ for every x .
2. For the following functions determine the intervals where $f(x)$ is increasing or decreasing and the intervals where $f(x)$ is concave up or concave down.
 - (a) $f(x) = x^2 - 6x$
 - (b) $f(x) = x^3 - 6x^2$
 - (c) $f(x) = x^4 + x^3$
 - (d) $f(x) = \frac{\sqrt{x}}{4} + \frac{1}{x}$
3. A particle is moving along a line and its position at time $t \geq 0$ is given by $s(t) = 3t^4 - 10t^3 + 9t^2 + 5$.
 - i) Find the times at which the particle is at rest;
 - ii) Find the intervals of times where the particle is accelerating (i.e. the velocity is positive and increasing).
4. The graph of the derivative of a function $f(x)$ is given below.



- i) At what intervals is $f(x)$ increasing?
- ii) Is $f''(0) > 0$?
- iii) Find at least one point x_0 where $f'(x_0) = 0$ and $f''(x_0) > 0$.
- iv) Find at least one point x_0 where $f''(x_0) = 0$.