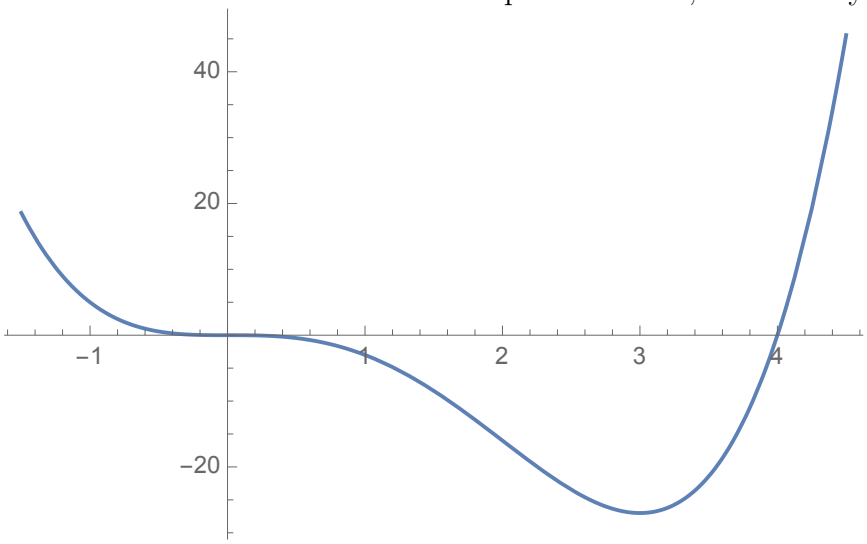
MATH 30, 4/7-8/2020: WORKSHEET ON FIRST AND SECOND DERIV.S

(1) Discuss the graph of $f(x) = x^4 - 4x^3$ with respect to concavity, points of inflection, and local maxima and minima. You can use the picture below, but check your answers using calculus.



(2) Sketch the graph of a function satisfying the following conditions:
$f'(0) = f'(2) = f'(4) = 0$,
$f'(x) > 0$ if $x < 0$ or $2 < x < 4$,
$f'(x) < 0$ if $0 < x < 2$ or $x > 4$,
$f''(x) > 0$ if $1 < x < 3$,
$f''(x) < 0$ if $x < 1$ or $x > 3$.

(3) For the following functions, find the intervals on which f is increasing or decreasing. Find the local maxima and minima of f. Find the intervals of concavity and the inflection points. Then make a rough sketch of the graph.

(a) $f(x) = 4x^3 + 3x^2 - 6x + 1$

(b) $g(x) = \sin x + \cos x$ for $0 \leq x \leq 2\pi$.

(c) $h(x) = x^4 e^{-x}$.

(d) $p(x) = 2 + 2x^2 - x^4$.

(4) Find the local maxima and minima of $f(x) = \dfrac{x^2}{x-1}$ using both the First Derivative Test ("Increasing/Decreasing") and the Second Derivative Test ("Concavity"). Which do you prefer?