1. $y=\frac{1}{2}x^4+x^3-6x^2-18x+36$

a) $y'=2x^3+3x^2-12x-18$ $(\sqrt{6},\ )$

$-54+27+36-18$

$0=2x^3+3x^2-12x-18$ $(-\sqrt{6},\ )$

$0=x^2(2x+3)-6(2x+3)$ $(-3/2,\ )$

$0=(x^2-6)(2x+3)$

$x^2-6=0$ $\quad$ $2x+3=0$

$x=\pm\sqrt{6}$ $\quad$ $x=-3/2$

$=\pm 2.4$ $\quad$ $x=-1.5$

y': $-$ | $+$ | $-$ | $+$ at -2.4, -1.5, 2.4 (test values -3, -2, 0, 3)

min (at -2.4), max (at -1.5), min (at 2.4)

increasing: $x\in(-\sqrt{6},-3/2)$ & $(\sqrt{6},\infty)$

b) $y''=6x^2+6x-12$ $(-2,\ )$

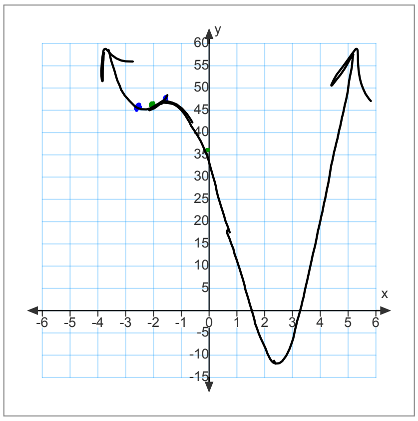
$0=6(x^2+x-2)$ $(1,\ )$

$0=6(x+2)(x-1)$

$x=-2$ $\quad$ $x=1$

y'': $+$ up | $-$ down | $+$ up at -2, 1 (test values -3, 0, 2)

down: $x\in(-2,1)$



2. Where is $y = \sqrt[3]{x}(x-4)$ decreasing?

$y = x^{1/3}(x-4)$

$y' = \frac{1}{3}x^{-2/3}(x-4) + x^{1/3}(1)$

$\frac{1}{3}x^{-2/3}$ $\qquad$ $\frac{1}{3}x^{-2/3}$

$1 \div 1/3$

$1 \times 3/1$

3

$y' = \frac{1}{3}x^{-2/3}\left[x-4+3x^{1}\right]$

$0 = \frac{4x-4}{3x^{2/3}} \rightarrow \frac{4(x-1)}{3x^{2/3}}$ $\rightarrow x=1$, $\searrow x=0$

decreasing: $x \in (-\infty, 1)$

$x \neq 0$