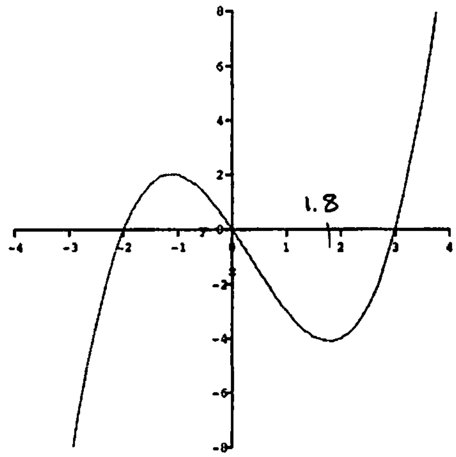
1. The graph of $f'(x)$ shown at the right.
   This is *not* the graph of $f(x)$!



Plot of y = f '(x)

   (a) Where does f have critical points?

$f'(x) = 0$ at $x = -2$, $x = 0$, $x = 3$

   (b) On which intervals is f increasing? decreasing?

$f' > 0$ $\quad f' < 0$

f increasing $(-2, 0) \cup (3, \infty)$

f decreasing $(-\infty, -2) \cup (0, 3)$

   (c) Where does f achieve local maxima? local minima?

Local min: $x = -2$, $x = 3$ since f changes from decreasing to increasing

Local max: $x = 0$ since f changes from increasing to decreasing

   (d) Where is f concave up? concave down?

f' increasing $\quad f'$ decreasing

f concave up: $(-\infty, -1) \cup (1.8, \infty)$ note $x = -1$, $x = 1.8$ are approximations

f concave down: $(-1, 1.8)$

   (e) Where does f have inflection points?

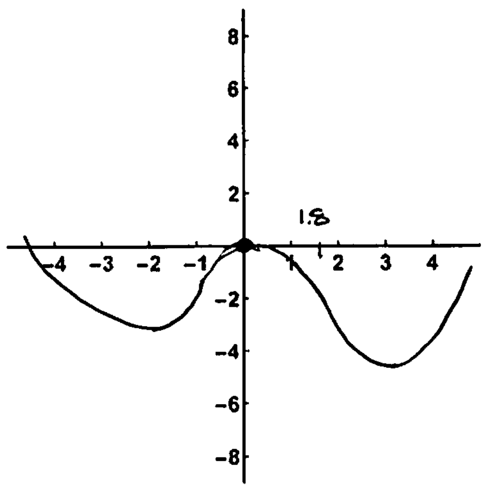
f changes concavity at

$x = -1$, $x = 1.8$

   (f) Suppose that $f(0) = 0$. Sketch a graph of f.

dec	inc	inc	dec	dec	inc
con up	con up	con dwn	con dwn	con up	con up

-2	-1	0	1.8	3
Min	Inf Pt	Max	Inf Pt	Min



   (g) How does the graph change if $f(0) = 3$?

It would be shifted up by 3

2. The graph of $f''(x)$ shown at the right. This is *not* the graph of $f(x)$ or $f'(x)$!

(a) Where is f concave up? concave down?

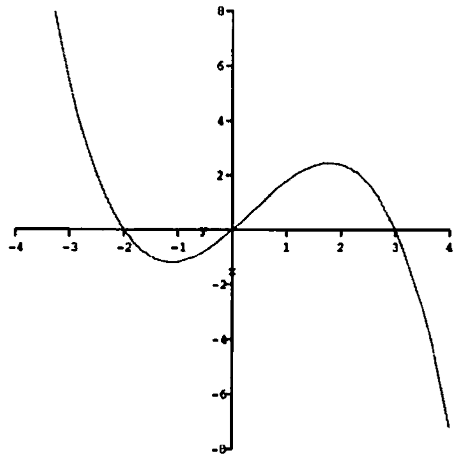
$f'' > 0$ $\quad$ $f'' < 0$

f concave up: $(-\infty, -2) \cup (0, 3)$

f concave down: $(-2, 0) \cup (3, \infty)$

(b) Where does f have inflection points?

f changes concavity at
$x = -2$, $x = 0$, $x = 3$



Plot of y = f ''(x)

(c) Suppose that $f'(-1) = 0$ and $f'(1) = 0$.
If possible, classify $x = -1$ and $x = 1$ as local maxima or local minima of f.

At $x=-1$, f is concave down, $x=-1$ is local max

At $x=1$, f is concave up, $x=1$ is a local min

(d) Suppose that $f'(0) = 0$. Is f increasing or decreasing at $x = 1$? at $x = -1$?

$f'' > 0$ on $(0,1)$ $\Rightarrow$ f' increasing on $(0,1)$
$\Rightarrow$ $f'(1) > f'(0) = 0$ $\Rightarrow$ f increasing at $x=1$

$f'' < 0$ on $(-1,0)$ $\Rightarrow$ f' decreasing on $(-1,0)$
$\Rightarrow$ $f'(-1) > f'(0) = 0$
$\Rightarrow$ f increasing at $x=-1$

(e) Suppose that $f'(-1) = -2$ and $f(-1) = 2$. Could $f(0) = 3$?
Hint: Can you determine if f is increasing or decreasing on $[-1, 0]$?

$f'' < 0$ on $(-1,0)$ $\Rightarrow$ f' decreasing on $(-1,0)$
$\Rightarrow$ f' negative on $(-1,0)$ since $f'(-1) = -2$
$\Rightarrow$ f decreasing on $(-1,0)$
$\Rightarrow$ $f(0) < f(-1) = 2$
$\Rightarrow$ $f(0)$ could not be 3