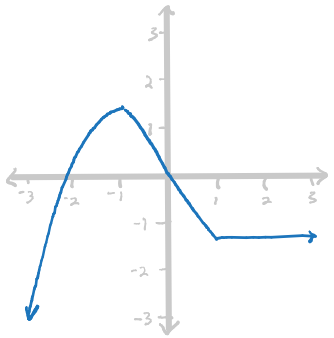
Section 1.3

Def A function is **increasing** on an open interval (a,b) if $f(x_1) < f(x_2)$ whenever $a < x_1 < x_2 < b$. A function is **decreasing** on an open interval (a,b) if $f(x_1) > f(x_2)$ whenever $a < x_1 < x_2 < b$. A function is **constant** on an open interval if $f(x_1) = f(x_2)$ whenever $a < x_1 < x_2 < b$.

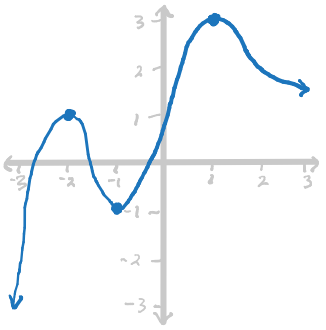
Ex 1 The function to the right is increasing on $(-\infty, -1)$, decreasing on $(-1, 1)$, and constant on $(1, \infty)$.



Def A function value $f(a)$ is a **relative maximum** of f if there exists an open interval containing a such that $f(a) > f(x)$ for all $x \neq a$ in the open interval.

2) A function value $f(b)$ is a **relative minimum** of f if there exists an open interval containing b such that $f(b) < f(x)$ for all $x \neq b$ in the open interval.

Ex 2 The function in the graph to the right has relative maxima at -2 and 1, and the relative maxima are $f(-2) = 1$ and $f(1) = 3$, respectively. The function has a relative minimum at -1, and the relative minimum is $f(-1) = -1$.



Def A function is **even** if $f(-x) = f(x)$ for all x in the domain. A function is **odd** if $f(-x) = -f(x)$ for all x in the domain.

Ex 3 $f(x) = x^4 - 2$ is even because $f(-x) = (-x)^4 - 2 = x^4 - 2 = f(x)$.

$g(x) = 2x\sqrt{x^2-1}$ is odd because $g(-x) = 2(-x)\sqrt{(-x)^2-1} = -2x\sqrt{x^2-1} = -g(x)$.

The next definition will be important soon (and again in Calculus), but for now feels a bit unmotivated.

Def The expression $\dfrac{f(x+h)-f(x)}{h}$ for $h \neq 0$ is called the

difference quotient of the function f.

Ex 4 Given $f(x) = 3x^2 + x$, the difference quotient for $h \neq 0$ is

$$\frac{f(x+h)-f(x)}{h} = \frac{3(x+h)^2+(x+h)-(3x^2+x)}{h} = \frac{3(x^2+2hx+h^2)+x+h-3x^2-x}{h}$$

$$= \frac{3x^2+6hx+3h^2+x+h-3x^2-x}{h}$$

$$= \frac{3h^2+6hx+h}{h}$$

$$= 3h + 6x + 1$$

Section 1.4

Def The **slope** of a line between two points (x_1, y_1) and (x_2, y_2) is $m = \dfrac{y_2 - y_1}{x_2 - x_1}$. The slope is a ratio, "rise over run," and

and is a measure of the steepness of a line.

Note: When $x_1 = x_2$ and $y_1 \neq y_2$, the line is vertical and the slope is **undefined**. In this case the line is not a function.