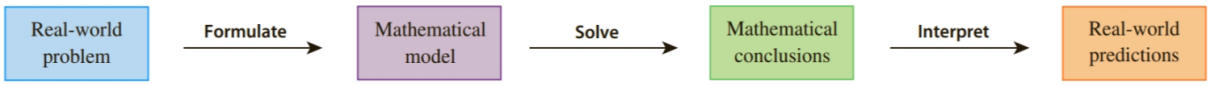
Please remind me to hit "record."

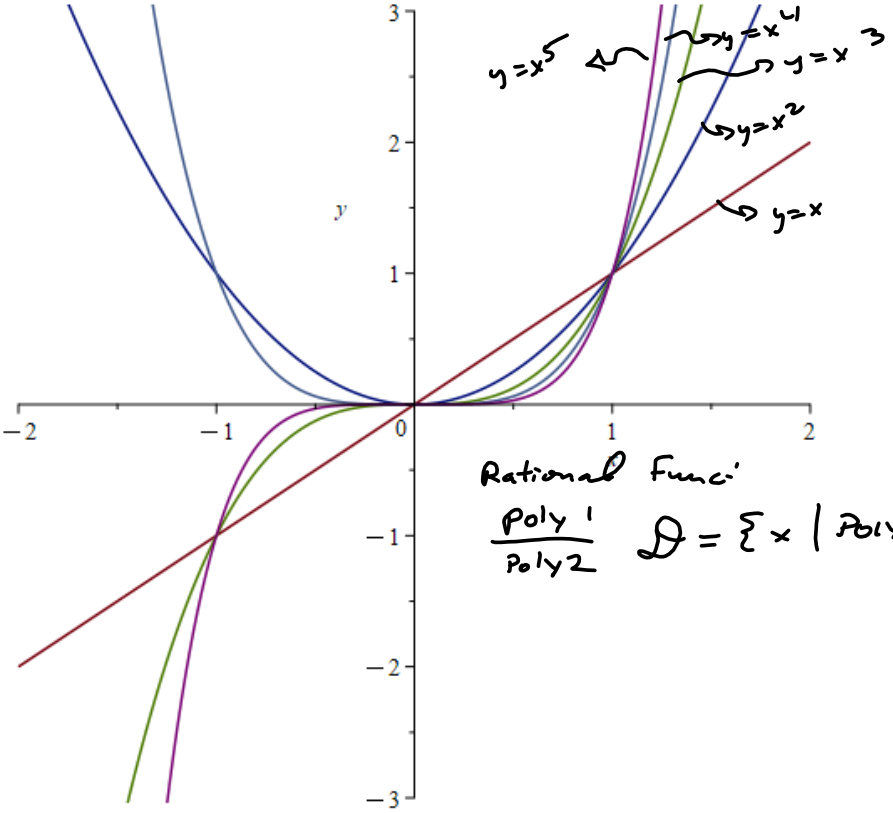
1.2 - Library of Functions, Math Models, More Domain,

1.3 - Graphing Techniques using Transformations of Basic functions.



"Inasmuch as our model relates to reality, we are not sure. Inasmuch as we are sure, our model doesn't relate to reality."

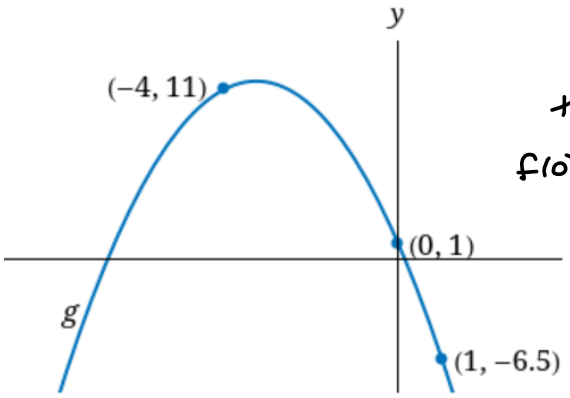
Power Funcs : x, x^2, x^3, x^4, x^5 all together



Rational Funci

$\frac{\text{Poly 1}}{\text{Poly 2}}$ $D = \{x \mid \text{Poly 2} \neq 0\}$

Find the Quadratic Function fitting this graph.



If it's quadratic $f(x)$,

then $f(x) = ax^2 + bx + c$

$f(0) = c = 1$

$f(x) = ax^2 + bx + 1$

$f(-4) = 11$:

$(-4)^2 a + (-4)b + 1 = 11$

$16a - 4b + 1 = 11$

$16a - 4b = 10$

$f(1) = -6.5$

$a + b + 1 = -6.5$

$a + b = -7.5$

$10a + 10b = -75$

$\begin{bmatrix} 16 & -4 & 10 \\ 1 & 1 & -7.5 \end{bmatrix} \sim \begin{bmatrix} 1 & 1 & -7.5 \\ 16 & -4 & 10 \end{bmatrix}$

GAUSSIAN ELIMINATION

$10a + 10b = -75$

~~$16a - 4b = 10$~~

$8a - 2b = 5$

$-8E1 + 10E2$

$-8E1 \quad -80a - 80b = -600$

$10E2 \quad 80a - 20b = 50$

$-100b = -550$

$b = 5.50$

$10a + 10(5.5) = -75$

$10a + 55 = -75$

$10a = -130$

$a = -13$

$f(x) = -13x^2 + 5.5x + 1$

```
with(LinearAlgebra) :
A := ⟨⟨1, 16⟩|⟨1, −4⟩|⟨−7.5, 10⟩⟩
```

$$A := \begin{bmatrix} 1 & 1 & -7.5 \\ 16 & -4 & 10 \end{bmatrix}$$

```
ReducedRowEchelonForm(A)
```

$$\begin{bmatrix} 1. & 0. & -1. \\ 0. & 1. & -6.50000000000000 \end{bmatrix}$$

$1a + 0b = -1$
$0a + 1b = -6.5$ $\Rightarrow$ $a = -1$, $b = -6.5$

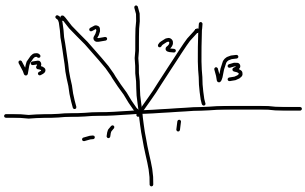
Find the domain of

$$R(x) = \frac{x^2+\cos(x)}{2\sin(x)-\sqrt{3}}$$

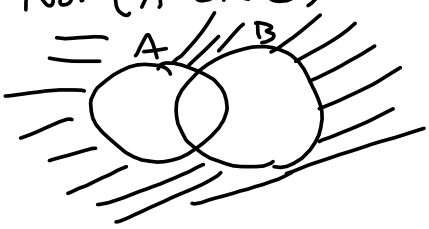
Need: $2\sin(x)-\sqrt{3} \neq 0$

$\Rightarrow 2\sin(x) \neq \sqrt{3}$

$\sin(x) \neq \frac{\sqrt{3}}{2}$

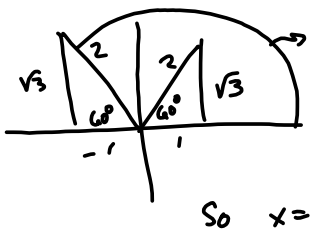


= NOT (A OR B)



NOT A AND NOT B

NOT A OR NOT B



$180°-60° = 120° = \frac{2\pi}{3}$

$60° = \frac{\pi}{3}$

= NOT (A AND B)

So $x = \frac{\pi}{3}, \frac{2\pi}{3}$ are bad in $[0, 2\pi]$

& so $x = \frac{\pi}{3}+2n\pi$, $x = \frac{2\pi}{3}+2n\pi$, $n = 0, \pm1, \pm2, \ldots$

(i.e., $n \in \mathbb{Z}$ — Integers.)

$$\mathcal{D} = \{x \mid x \neq \tfrac{\pi}{3}+2n\pi \text{ and } x \neq \tfrac{2\pi}{3}+2n\pi\}$$

$$= \{x \mid x \pm \tfrac{\pi}{3}+2n\pi \text{ OR } \tfrac{2\pi}{3}+2n\pi\}$$

WebAssign: " $x \pm$ " $\frac{\pi}{3}+2\pi, \frac{2\pi}{3}+2n\pi$

$A = \{x \mid x = \frac{\pi}{3}+2n\pi\}$

$B = \{x \mid x = \frac{2\pi}{3}+2n\pi\}$

$\mathcal{D} = \mathbb{R} \setminus (A \cup B)$ "R not A or B"

$= (\mathbb{R} \setminus A) \cap (\mathbb{R} \setminus B)$ "R not A and R not B"

Need to talk about the strict definition of increasing and decreasing.

A function f is called **increasing** on an interval I if

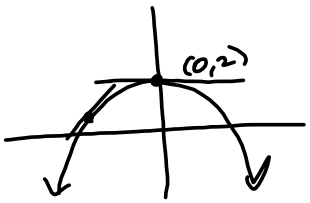
$$f(x_1) < f(x_2) \qquad \text{whenever } x_1 < x_2 \text{ in } I$$

It is called **decreasing** on I if

$$f(x_1) > f(x_2) \qquad \text{whenever } x_1 < x_2 \text{ in } I$$

This means that you include the max/min point. I said it should be an open interval. Not so, according to this.

$-x^2+2$



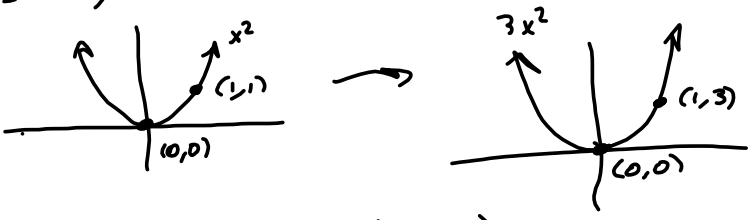
$x=0$ is in the interval of increase & the interval of decrease.

Increasing:
$I = (-\infty, 0]$
Decreasing:
$I_2 = [0, \infty)$

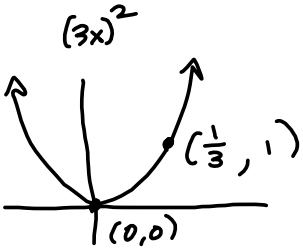
f(x) : Transformations :

$af(x)$: $(x,y) \longmapsto (x, ay)$

$f(x) = x^2$, $3x^2 = 3f(x)$

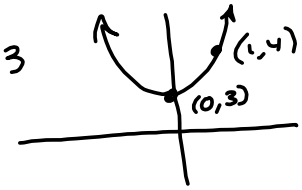


$f(bx)$: $(x,y) \longmapsto (\frac{1}{b}x, y)$

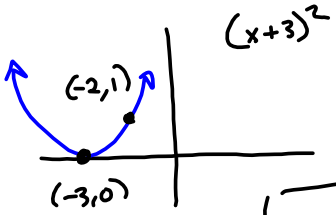


$f(x)+c$: $(x,y) \longmapsto (x, y+c)$

x^2+3



$f(x+d)$: $(x,y) \longmapsto (x-d, y)$



$af(b(x+d))+c$
Put it all together