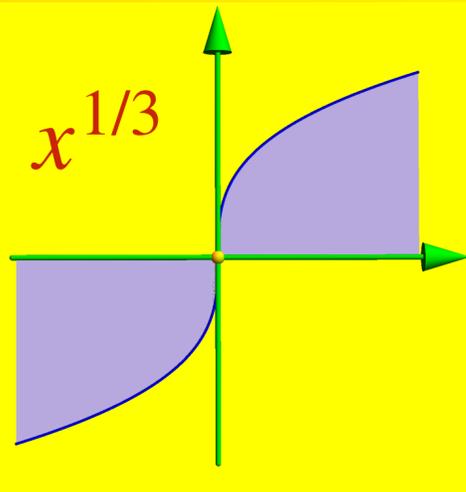
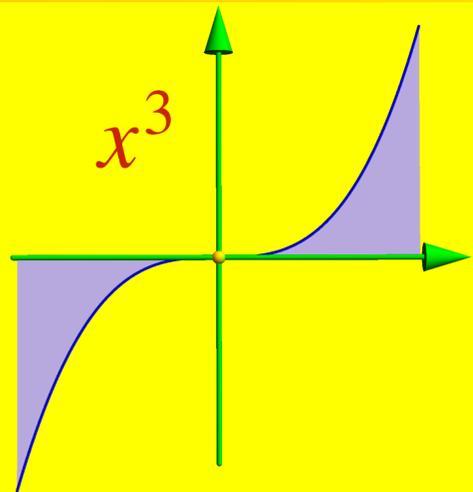


2

Functions

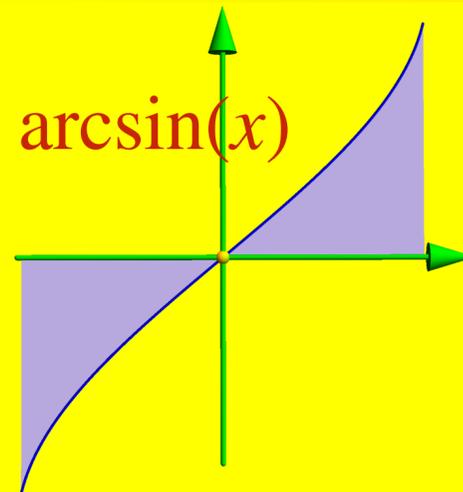
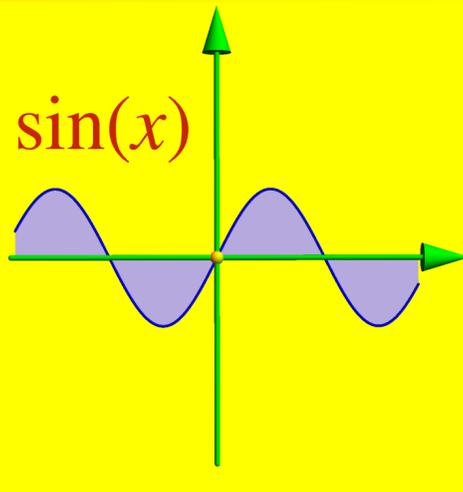
Power functions

$1, x, x^2, x^3, 1/x, 1/x^2$



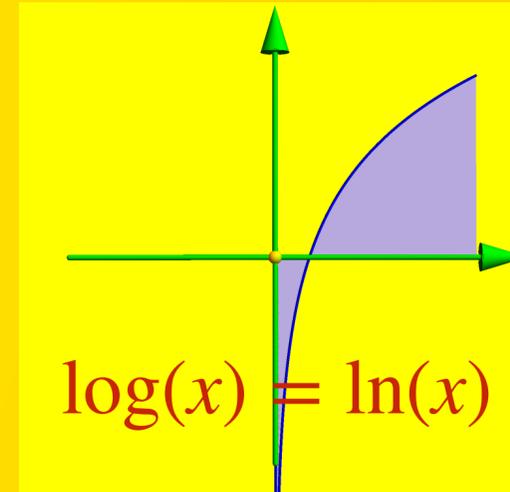
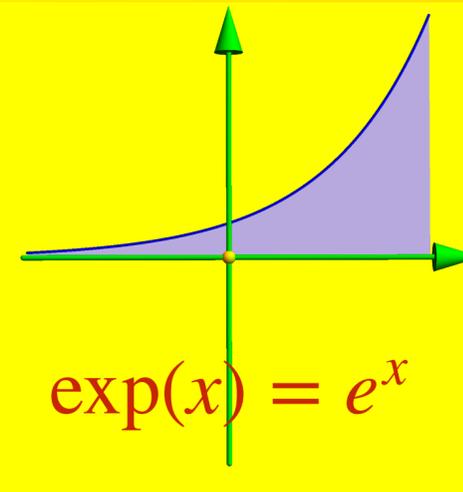
Trig Functions

$\sin(x), \cos(x), \tan(x), \cot(x)$



Exponential functions

$2^x, e^x, (1+h)^{x/h}$



Roots

$\sqrt{x}, x^{1/3}$

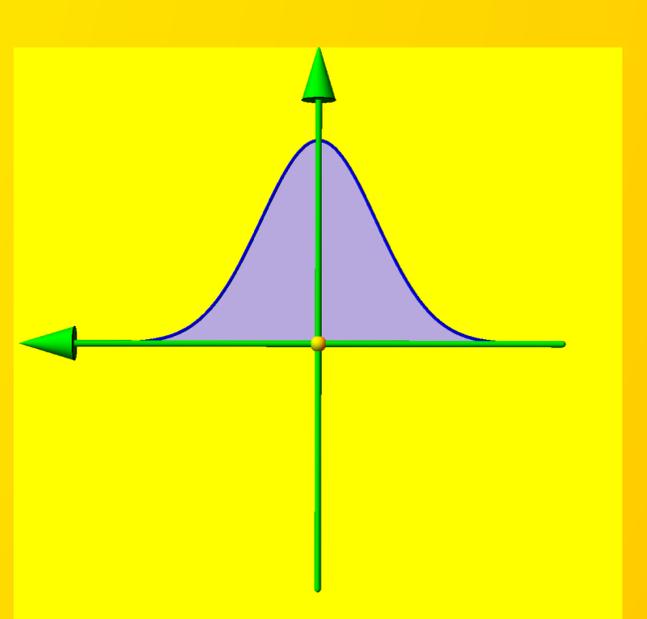
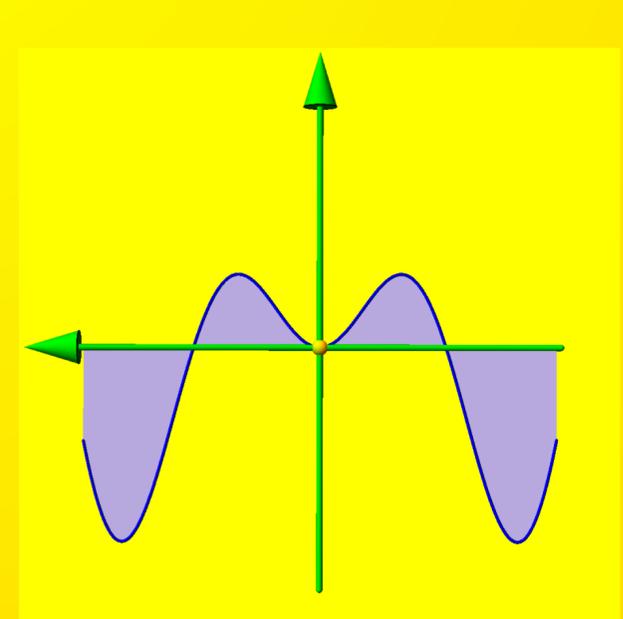
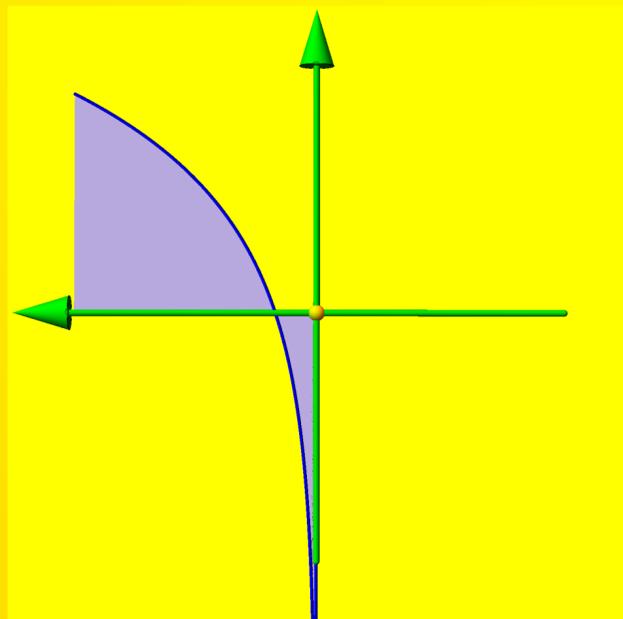
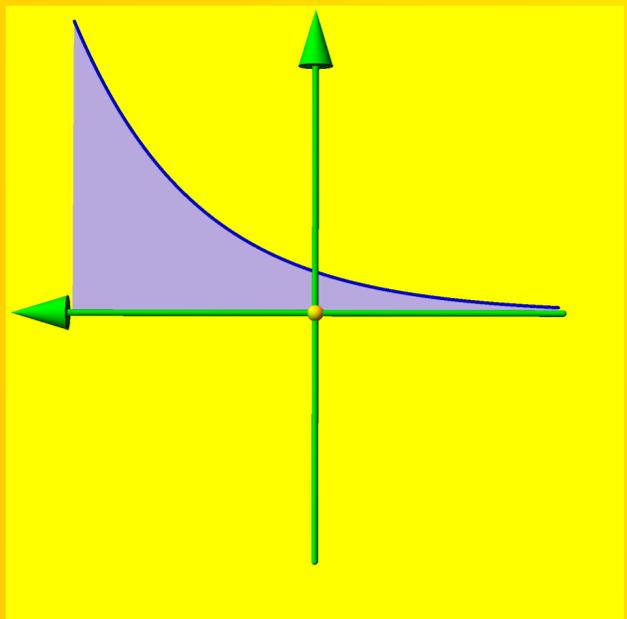
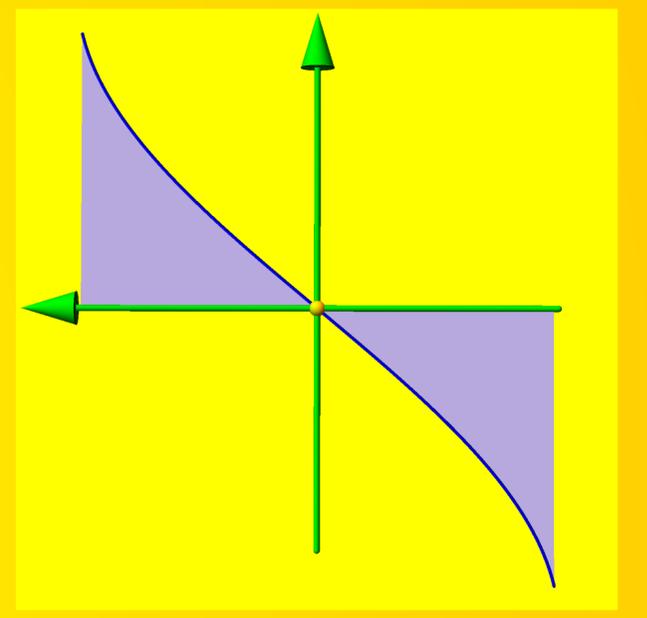
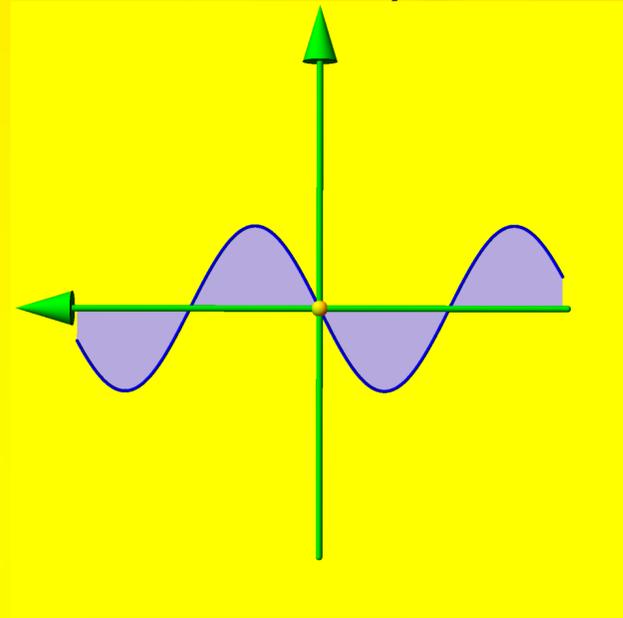
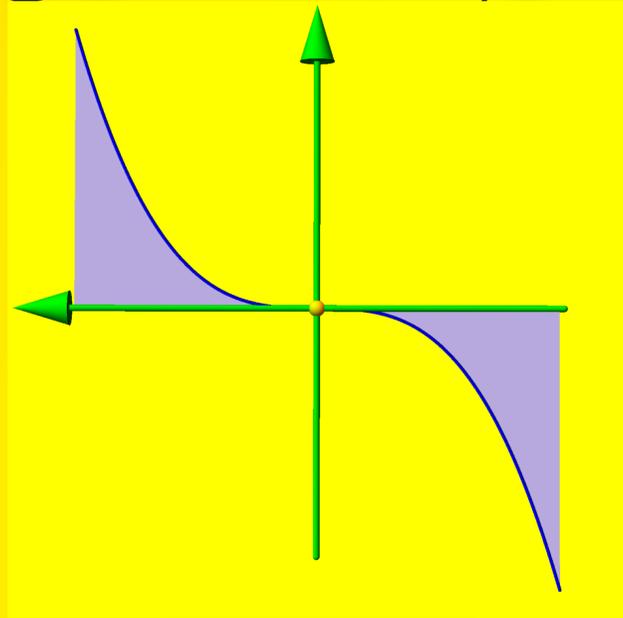
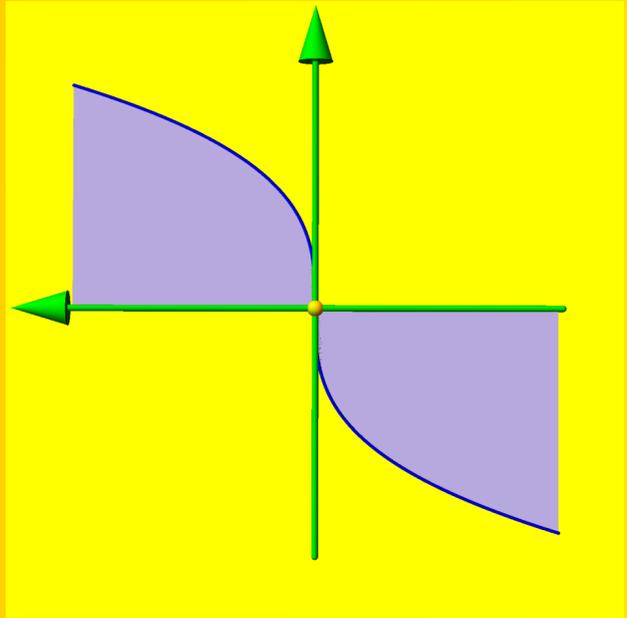
Inverse Trig

$\arcsin(x), \arccos(x), \arctan(x)$

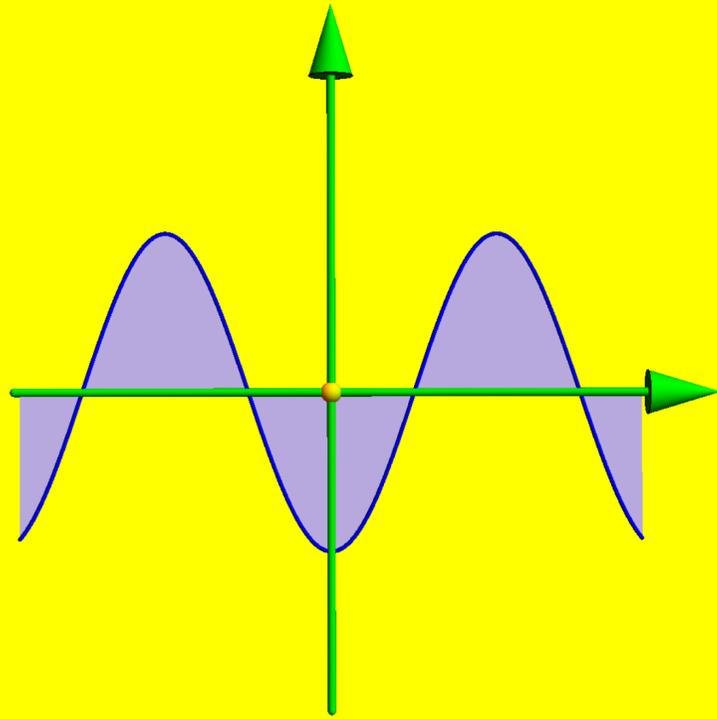
Log

$\log(x) = \ln(x)$

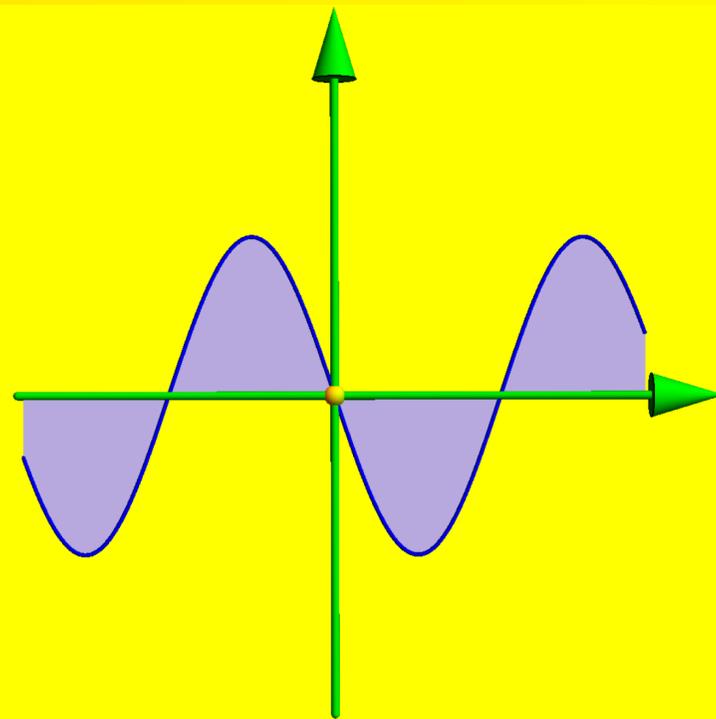
What is your favorite function?



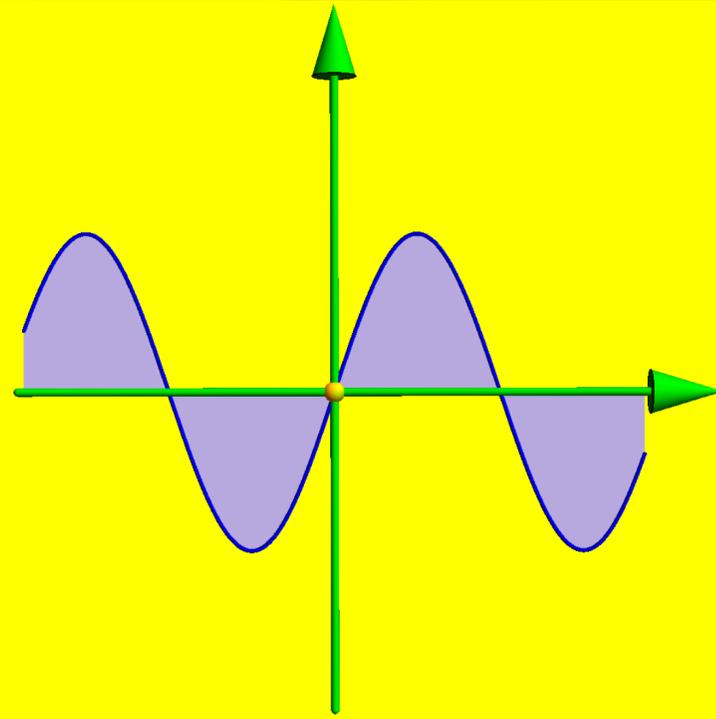
Which one is the sin function?



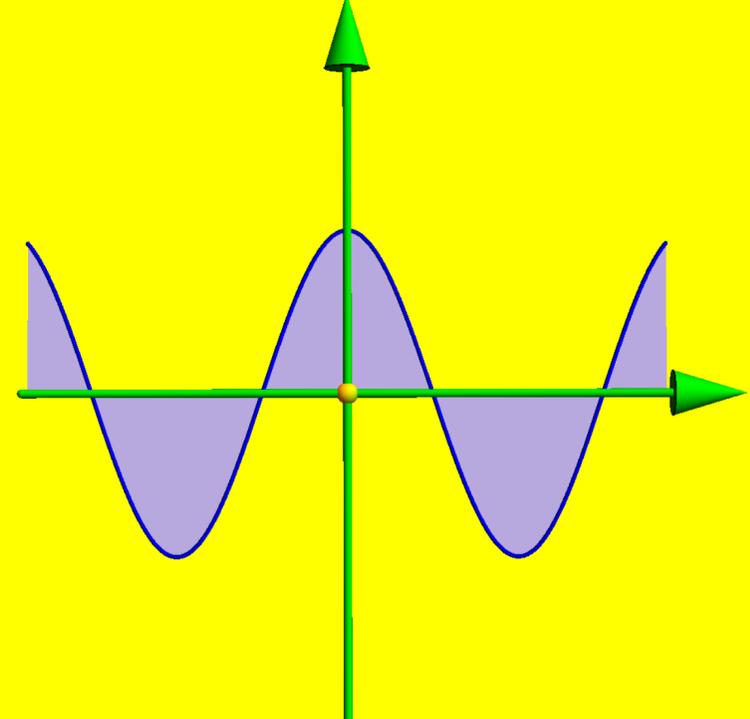
A



B



C



D

Project groups

INTRODUCTION TO CALCULUS

MATH 1A

Data project 1: Primes

1.1. Define the **prime function** $f(x)$ as the function on positive integers which gives the x 'th prime. So,

$$f(1) = 2, f(2) = 3, f(3) = 5, f(4) = 7.$$

By definition, the prime function is **monotone** in the sense that $f(x+1) > f(x)$ and more generally $f(y) > f(x)$ if $y > x$. To start this project, .

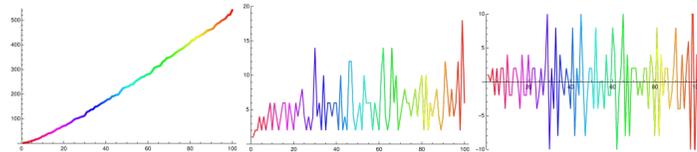


FIGURE 1. Prime function $f(x)$, velocity $f'(x) = f(x+1) - f(x)$ and acceleration $f''(x) = f(x+2) - 2f(x+1) + f(x)$.

1.2. Define the **derivative**

$$f'(x) = f(x+1) - f(x).$$

This measures the increase or decrease between x and $x+1$ and is also known as **rate of change**. For any positive integer h , the expression

$$\frac{f(x+h) - f(x)}{h}$$

is called the **average rate of change** from x to $x+h$. The name average is justified because

$$\frac{f(x+h) - f(x)}{h} = \frac{f'(x) + f'(x+1) + \dots + f'(x+h-1)}{h}$$

is the average between all the rate of changes. Question 2:

.

1.3. A point x for which $f'(x) = 2$ is called a **prime twin**. A big conjecture is that there are infinitely many prime twins. The problem appears too difficult for current mathematics to be solved; but we can find small prime twins, especially with a computer. Third question: .

▶ [Cubeoctahedron Group](#)

▶ [Disphenoid Group](#)

▶ [Dodecahedron Group](#)

▶ [Echidnahedron Group](#)

▶ [Icosahedron Group](#)

▶ [Icosidodecahedron Group](#)

▶ [Octahedron Group](#)

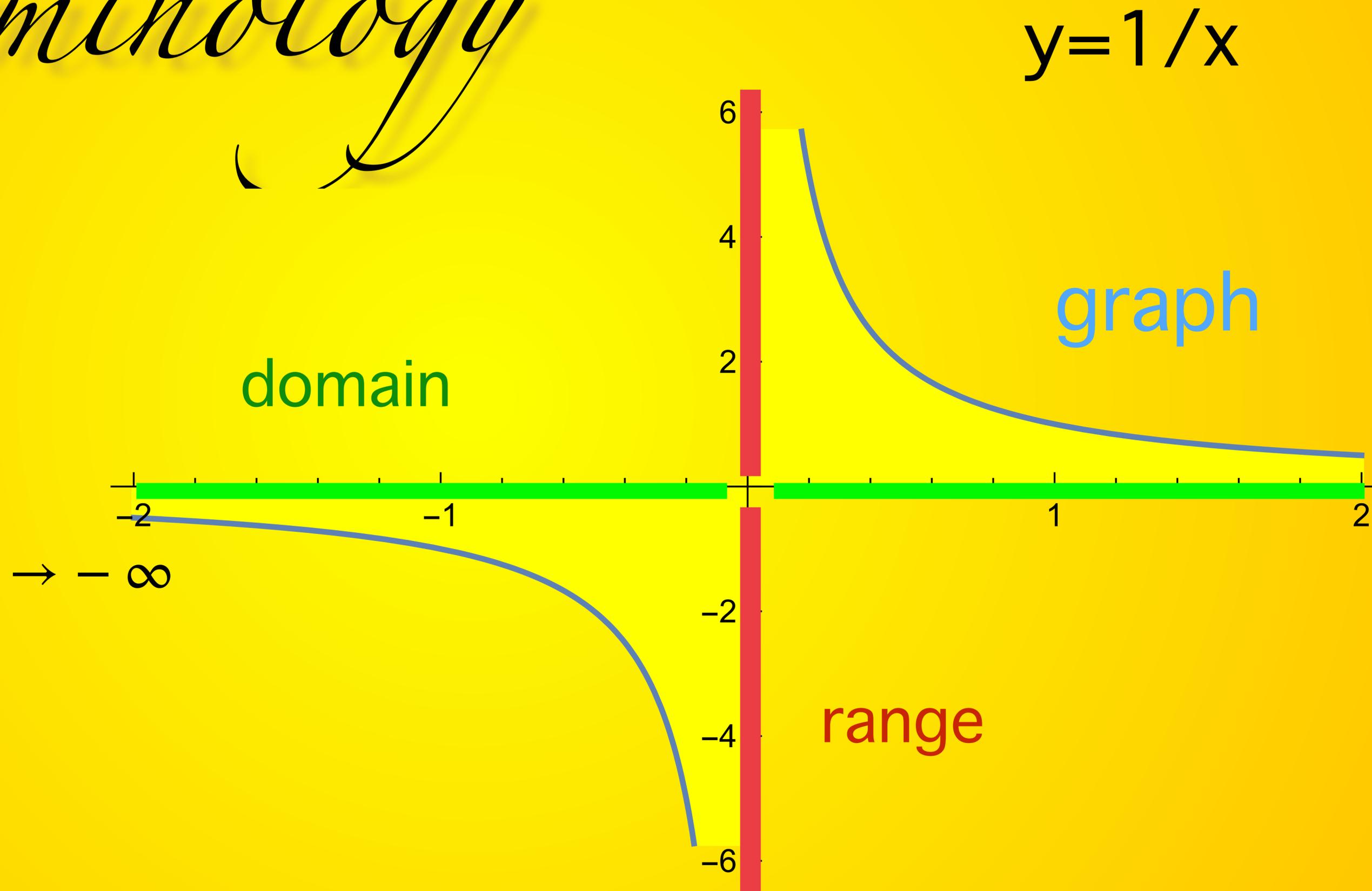
▶ [Sphenocorona Group](#)

▶ [Tetrakisshexahedron Group](#)

▶ [Trapezohedron Group](#)

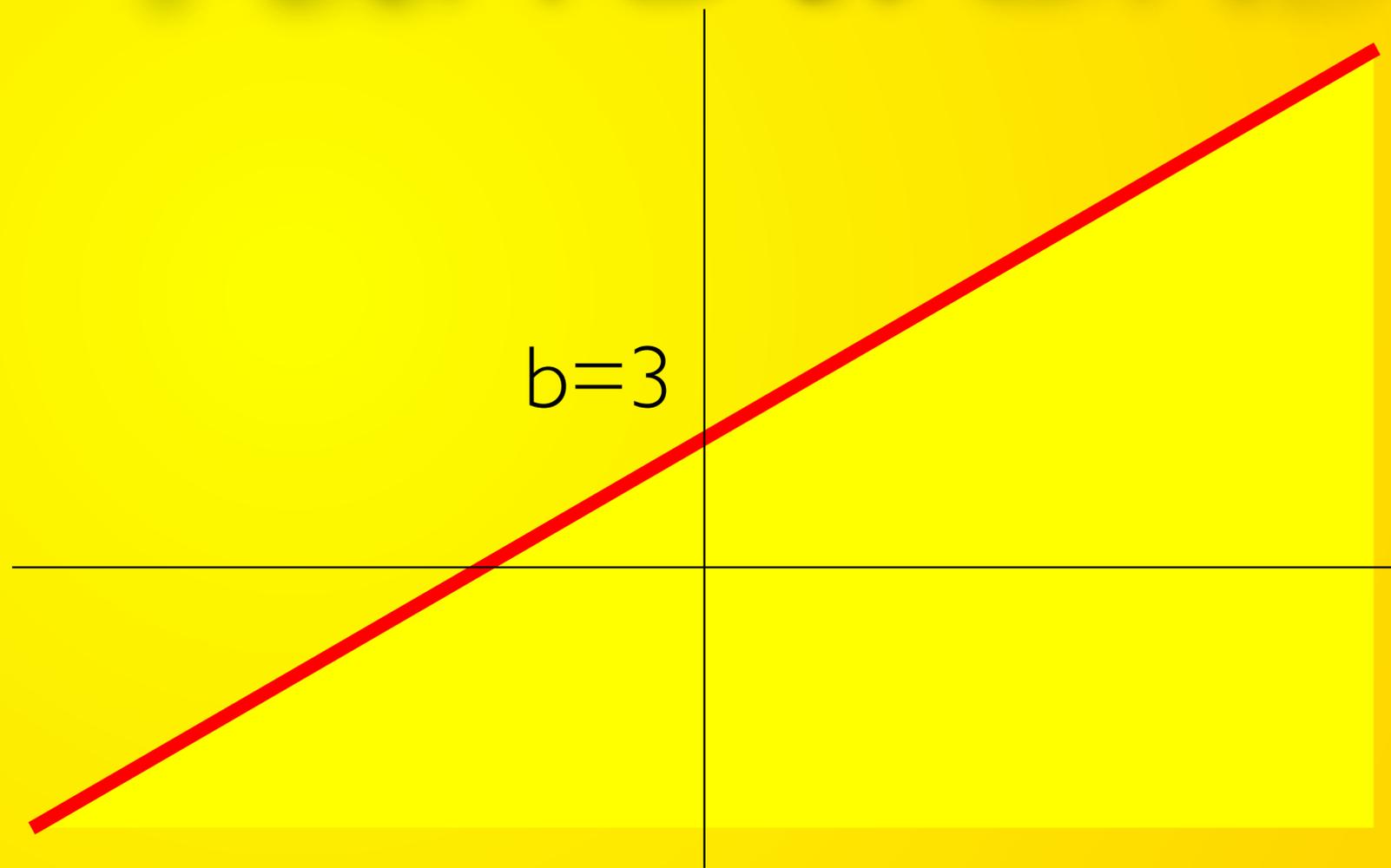
Project 1 on prime numbers

Terminology



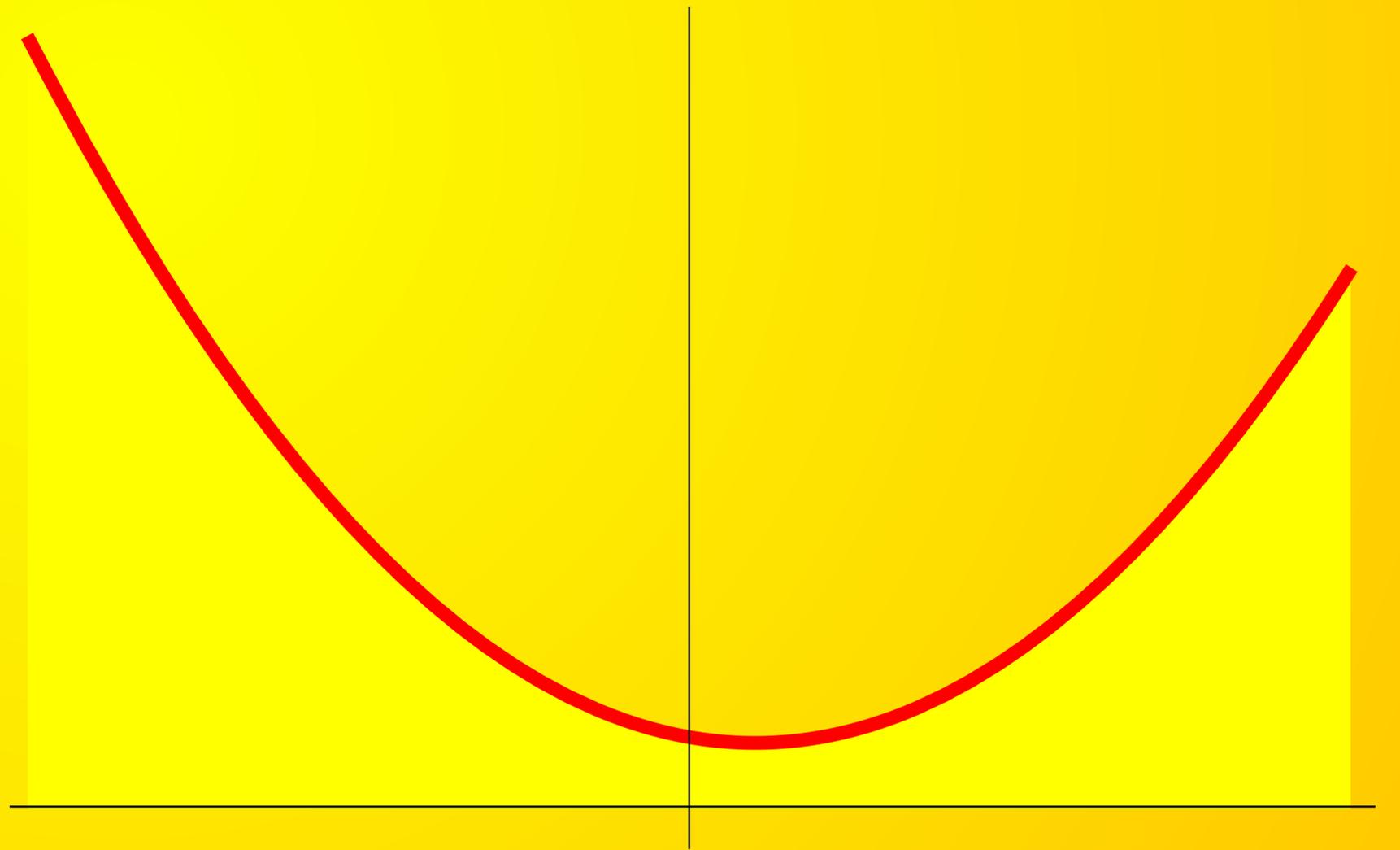
LINEAR FUNCTIONS

$$f(x) = x + 3$$



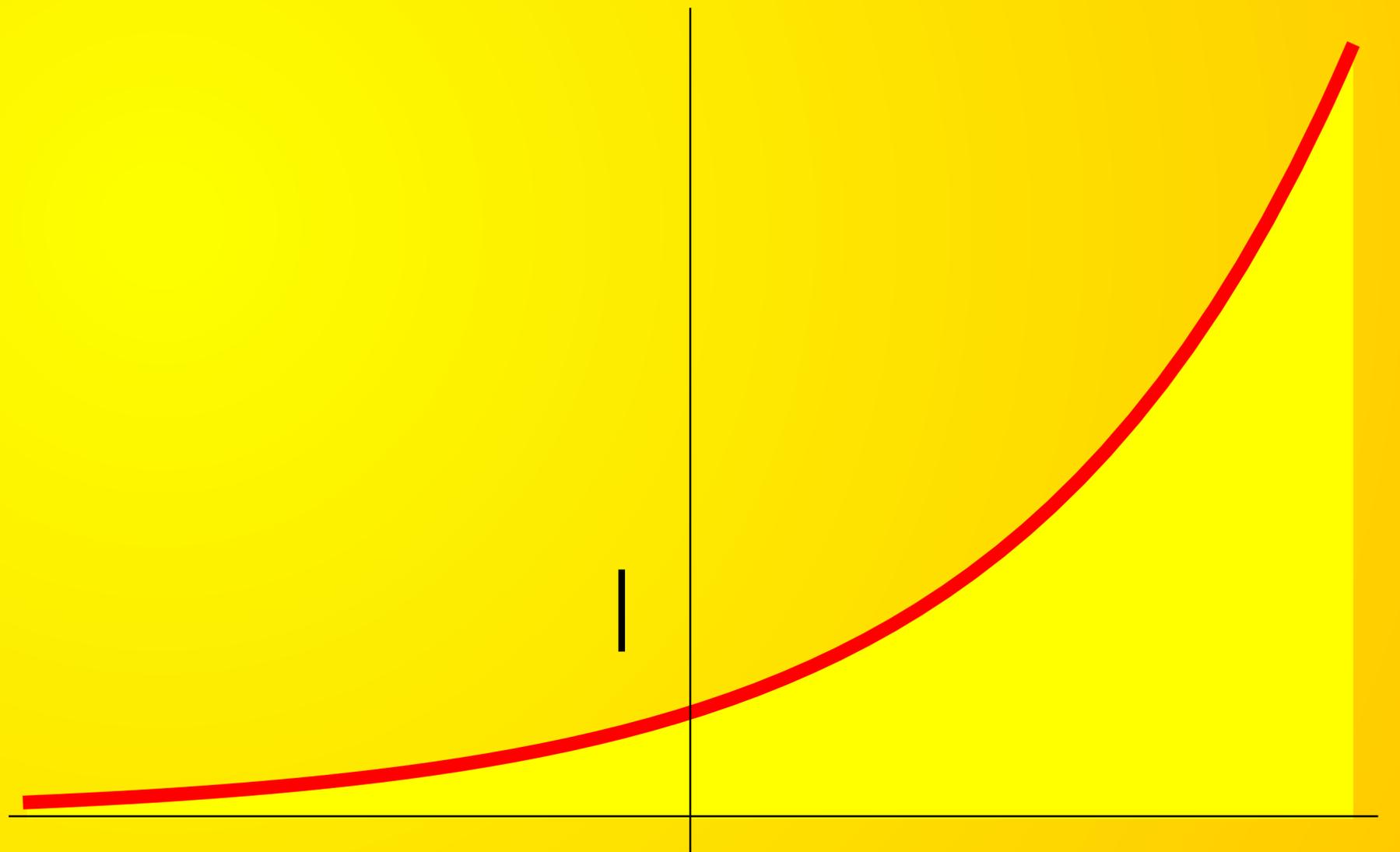
POLYNOMIAL FUNCTIONS

$$f(x) = x^2 - x + 3$$



EXPONENTIAL FUNCTIONS

$$f(x) = e^x = \exp(x)$$



PROBLEMS

Plot

a)

$$f(x) = e^{-x}$$

d)

$$f(x) = 1/\cos(x)$$

b)

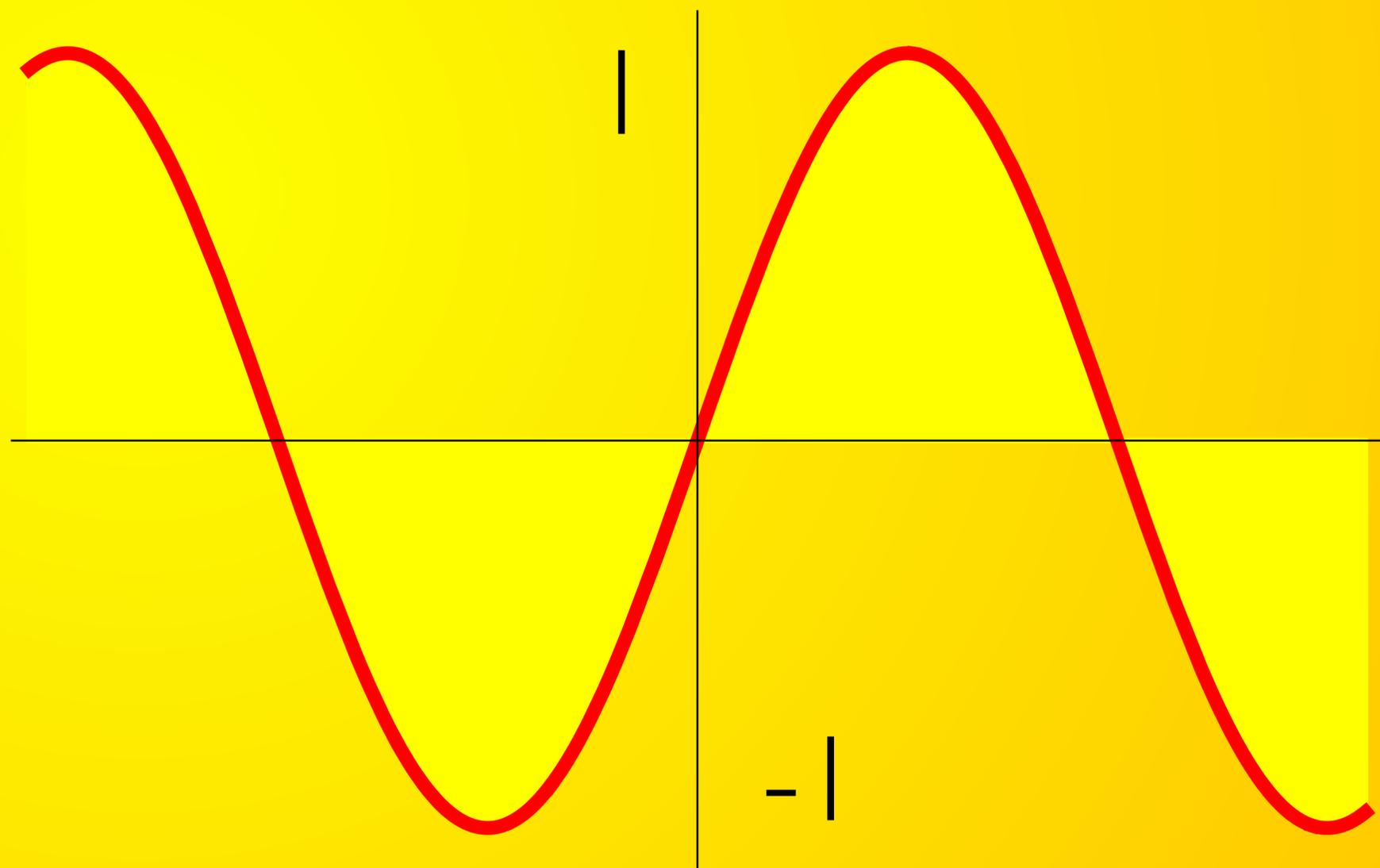
$$f(x) = \frac{1}{1-x}$$

e)

$$f(x) = \log|x+2|$$

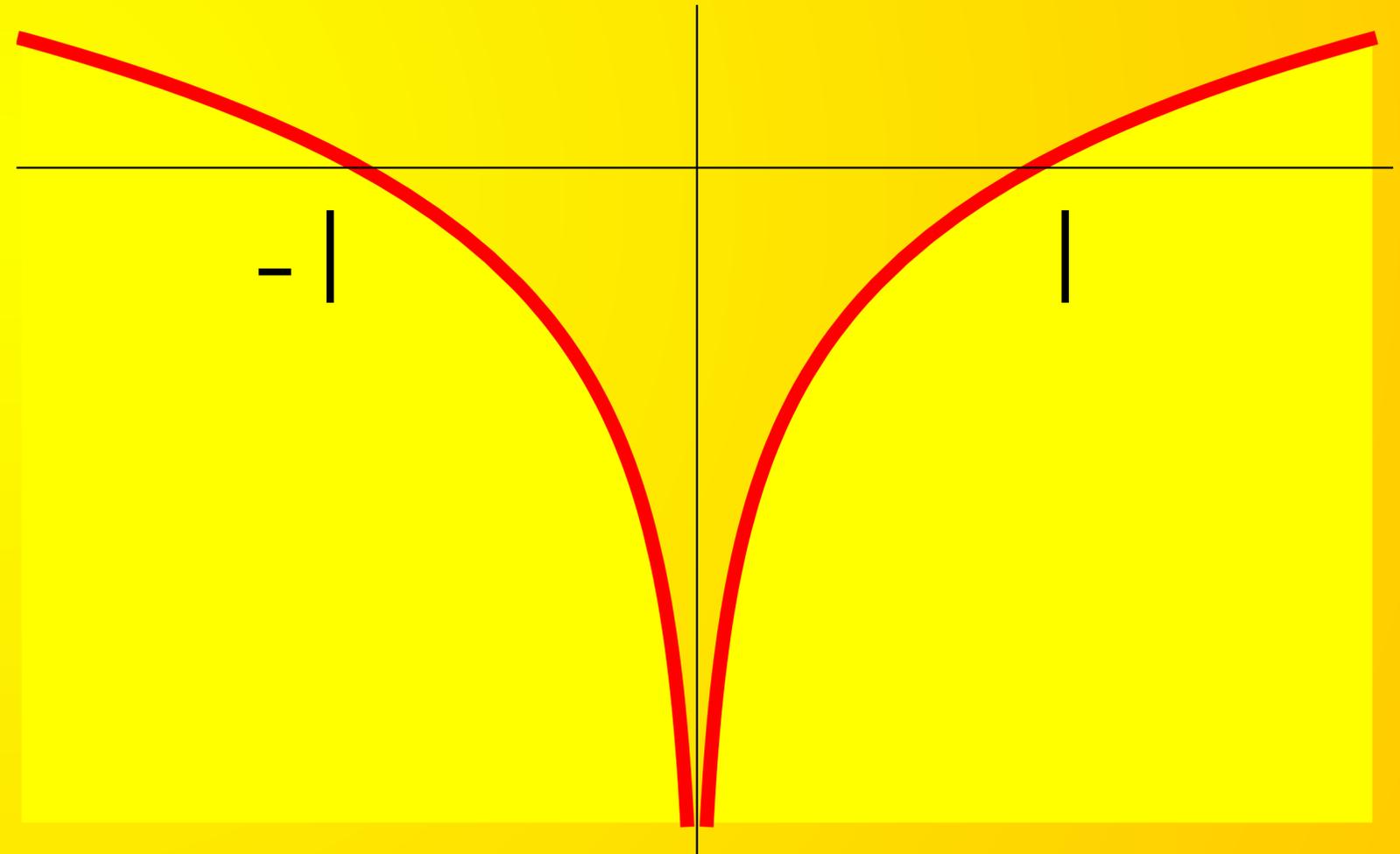
TRIG FUNCTIONS

$$f(x) = \sin(x)$$



LOG FUNCTION

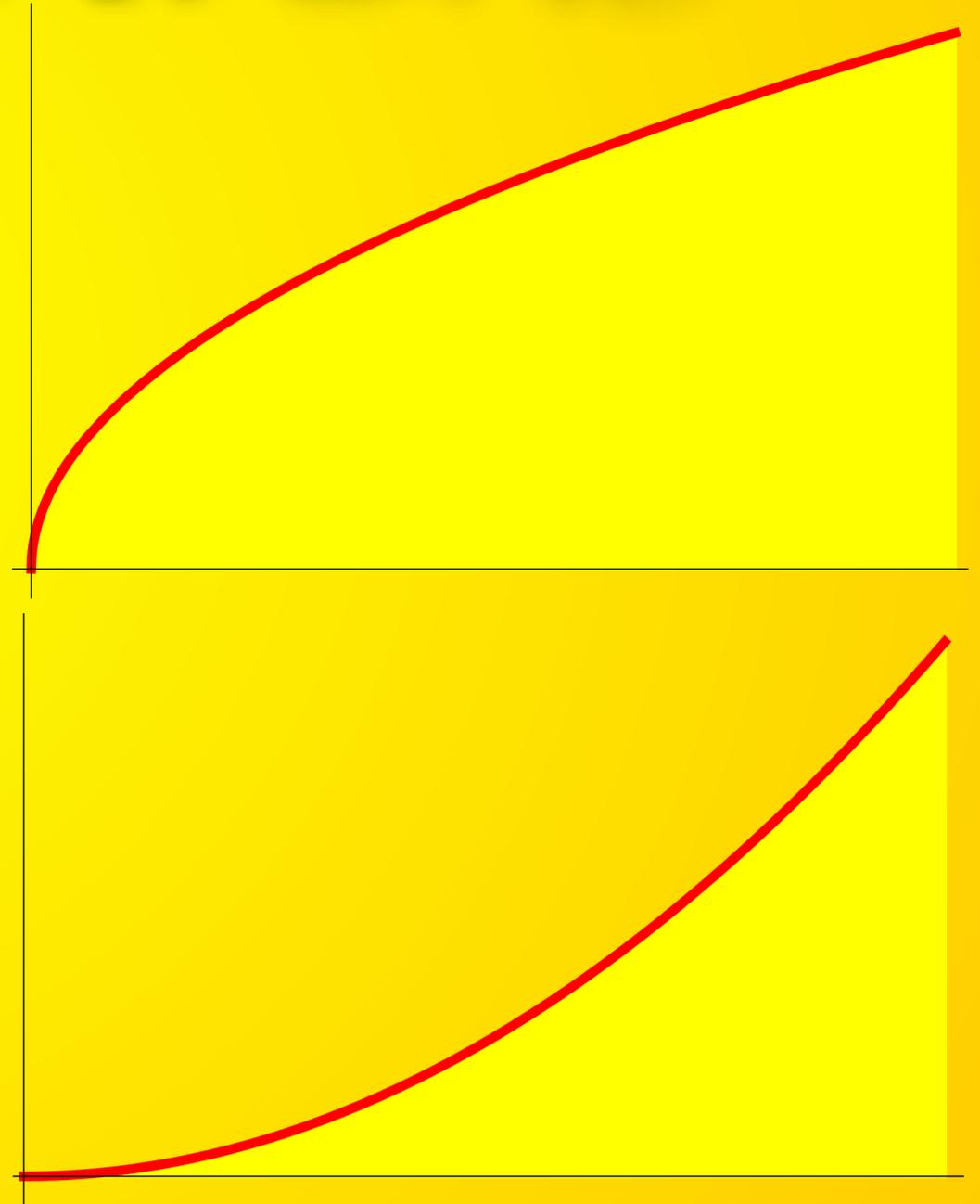
$$f(x) = \ln |x| = \log |x|$$



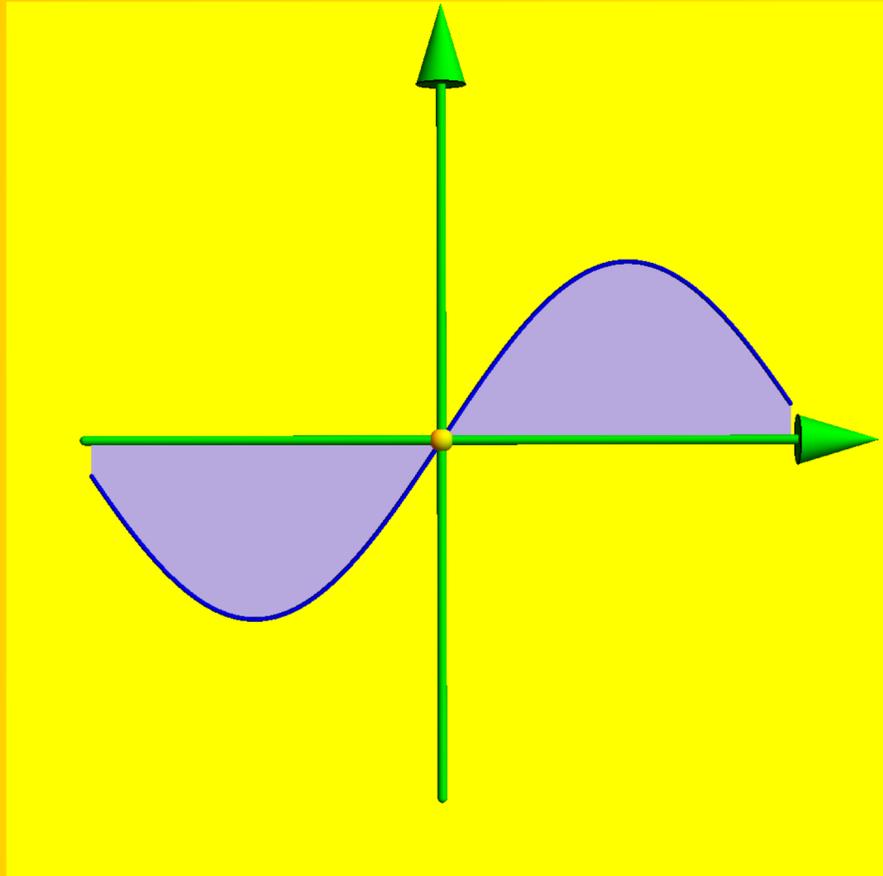
INVERSE FUNCTIONS

$$y = x^2$$

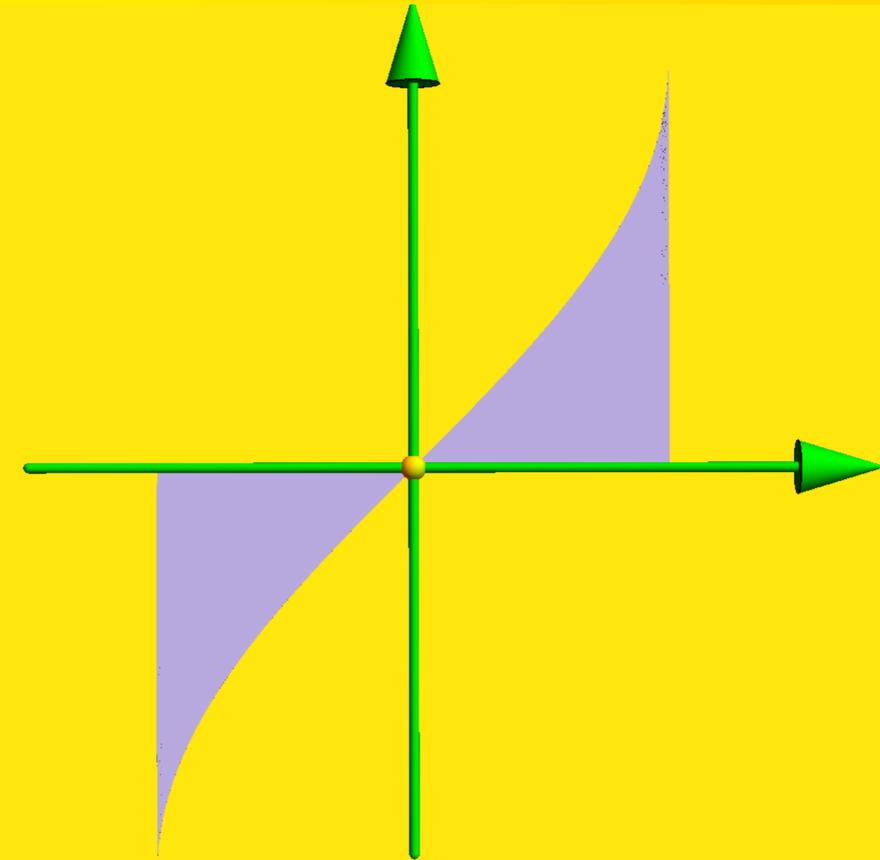
$$y = \sqrt{x}$$



INVERSE FUNCTIONS



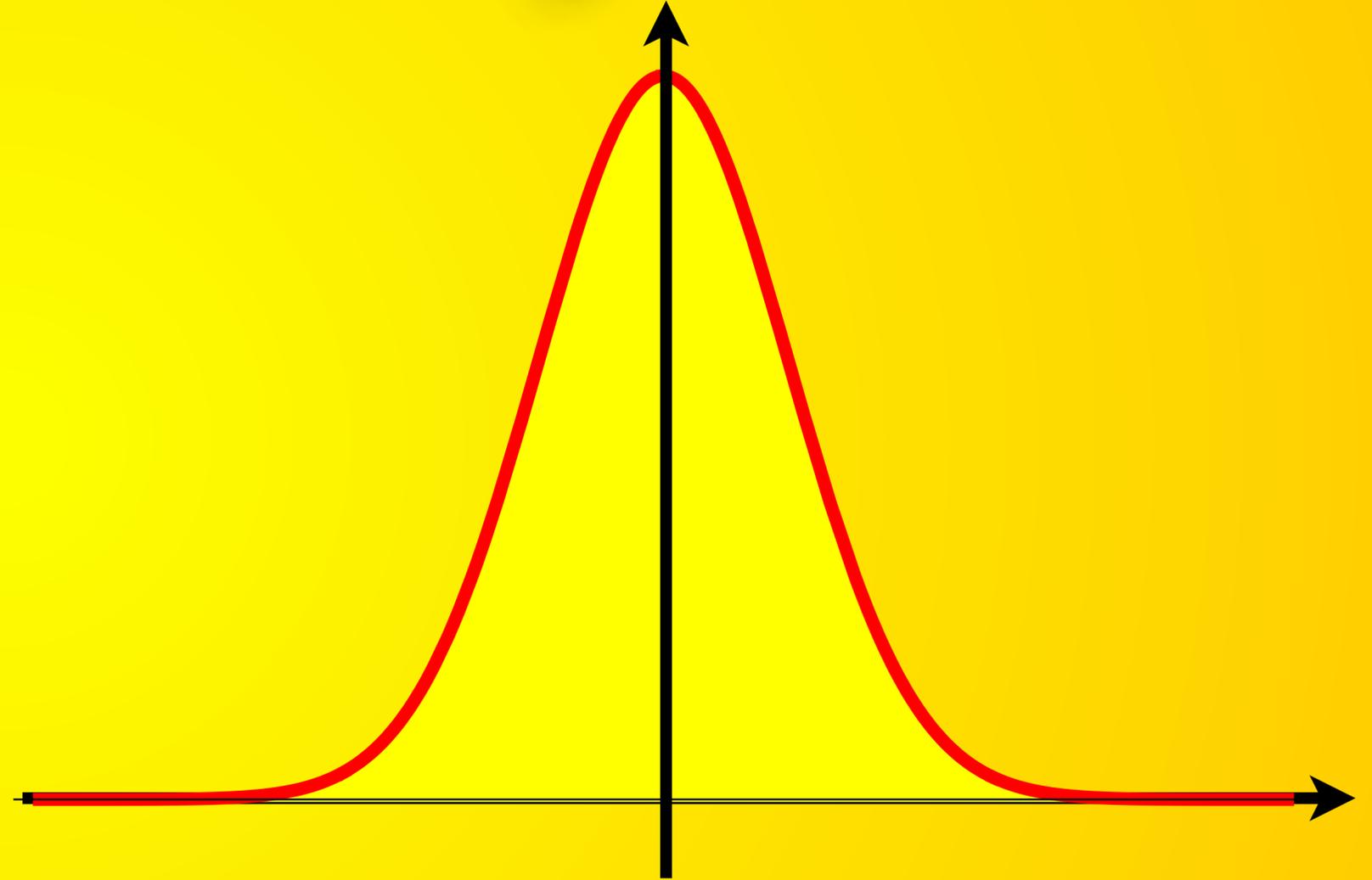
$$y = \sin(x)$$



$$y = \arcsin(x)$$

COMPOSING

$$f(x) = e^{-x^2}$$



BELL CURVE

Functions

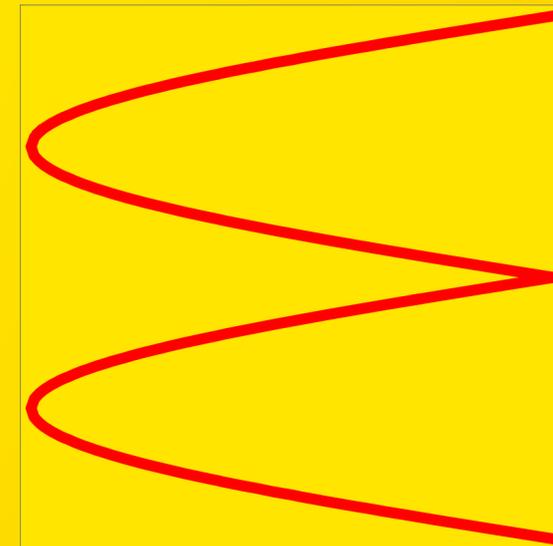
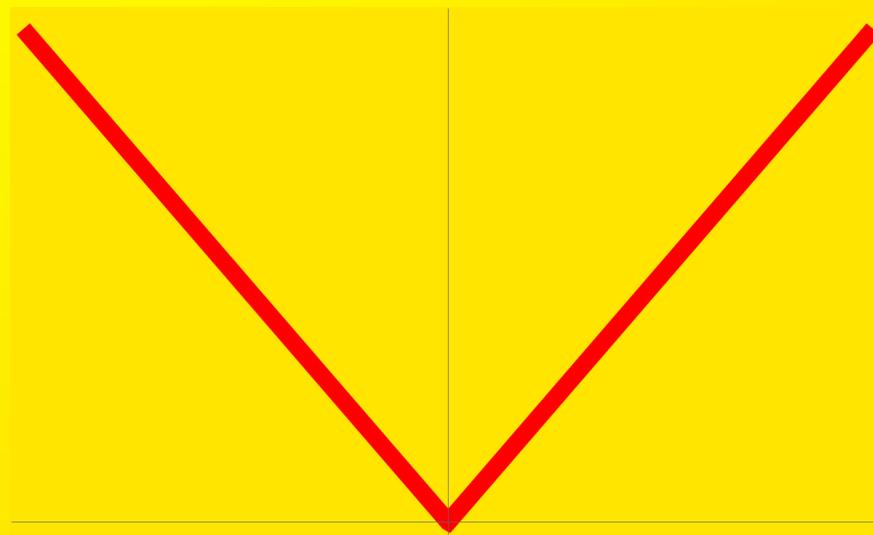
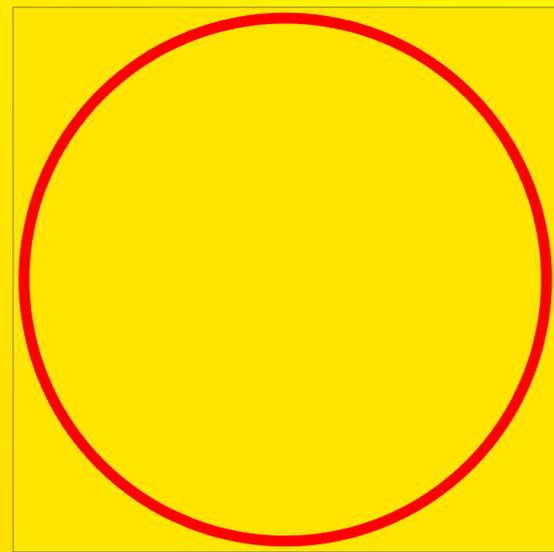
All you need is

$$y = 1/x$$

$$x^2 + y^2 = 1$$

$$y = |x|$$

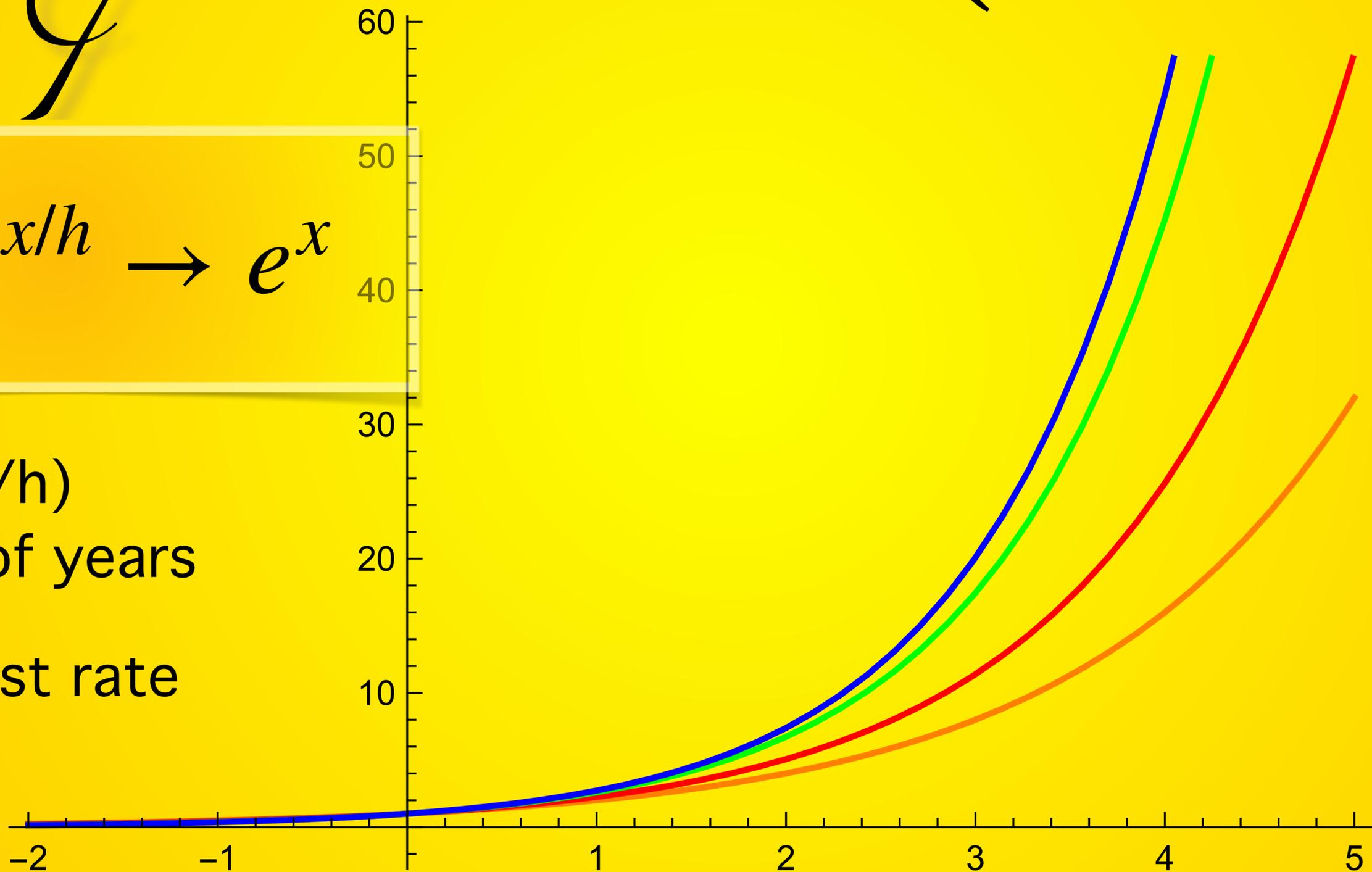
$$x = -|\sin(y)|$$



Exponential $(1+h)^{x/h}$

$$(1+h)^{x/h} \rightarrow e^x$$

$n=(x/h)$
number of years
 h : interest rate



- $(1+1)^x$
- $(1+\frac{1}{2})^{2x}$
- $(1+\frac{1}{10})^{10x}$
- $\exp(x)$

Compound Interest



Technology

We want to plot:

$$x \exp\left(-\frac{1}{x^2}\right)$$

Use at least 2 online tools

JAM BOARD

Plot

a)

$$f(x) = xe^{-x^2}$$

d)

$$f(x) = \cot(x)$$

b)

$$f(x) = \sin(x^2)$$

e)

$$f(x) = 1/|\log(x)|$$

JAM BOARD

Plot

a)

$$f(x) = \sin(1/x)$$

d)

$$f(x) = |x - |x||$$

b)

$$f(x) = \cos(e^x)$$

e)

$$f(x) = \log(\exp(x))$$

The end