

## § 1.4 - Exponential Functions, part I

- In this video, we will:
  - Quickly Review familiar functions
  - Define exponential functions
  - List the Laws of Exponents
  - Solve Exponential Equations

Types of Functions we will encounter in Calc I:

① Linear -  $y = mx + b$   
Quadratic -  $y = ax^2 + bx + c$   
Cubic -  $y = ax^3 + bx^2 + cx + d$   
⋮

} Polynomials

② Rational Functions : Ex:  $\frac{x^2 + x - 2}{x^2 - x - 3}$

③ Trig Functions:  $\sin(x)$   $\tan(x)$   $\csc(x)$   
 $\cos(x)$   $\sec(x)$   $\cot(x)$

④ Exponential + Logarithmic Functions

An exponential function has the form:

$$f(x) = a^x, \text{ where } a \text{ is a positive constant}$$

OR  $g(x) = b \cdot a^x$ ,  $a > 0$ ,  $b$  is any number

Examples:  $f(x) = 2^x$ ,  $f(5) = 2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

$$g(t) = 3^t, g(-2) = 3^{-2} = \frac{1}{3^2} = \frac{1}{9}$$

$$h(x) = 10^x, h(0) = 10^0 = 1$$

$$s(t) = 9^t, s(1.5) = s(3/2) = 9^{3/2} = \sqrt[3]{9^3} = \sqrt[3]{729} = 9$$

$$a(t) = 16^t, a(7/4) = 16^{7/4} = (16^{1/4})^7 = (2)^7 = 128$$

$$k(x) = 5 \cdot 8^x, k(-2/3) = 5 \cdot 8^{-2/3} = 5 \cdot \frac{1}{8^{2/3}} = 5 \cdot \frac{1}{2^2} = 5 \cdot \frac{1}{4} = \frac{5}{4}$$

Question: How do we calculate  $3^{\sqrt{2}}$ ?

How does a calculator calculate  $3^{\sqrt{2}}$ ?

How does a calculator calculate anything?



$$\frac{a^x}{a^y} = a^x \cdot a^{-y} = \underline{a^{x-y}}$$

Not  $a^{x^y} \neq (a^x)^y$   $(4^3)^2 = 4^6$   
 vs  $4^{3^2} = 4^9$

$$2x^2 = \underline{(2x)^2}$$

of Exponents to Simplify:

$$3x-1 = x+8 \Rightarrow 2x=9 \Rightarrow x=9/2$$