Warm Up 11/6

$5^2 \cdot \sqrt{\pi}$

$5^{(2\pi)}$

Let $f(x) = 5^x$. Evaluate the following.

1. $f(4)$

$= 5^4 = \boxed{625}$

2. $f(-2^4)$

$5^{-16} = \boxed{\frac{1}{5^{16}}}$

3. $[f(-2)]^3$

$(5^{-2})^3 = \left(\frac{1}{25}\right)^3 = \boxed{\frac{1}{25^3}}$

4. $f\left(\frac{3}{2}\right)$

$5^{3/2} \approx \boxed{11.18}$

5. $f(-\sqrt{3})$

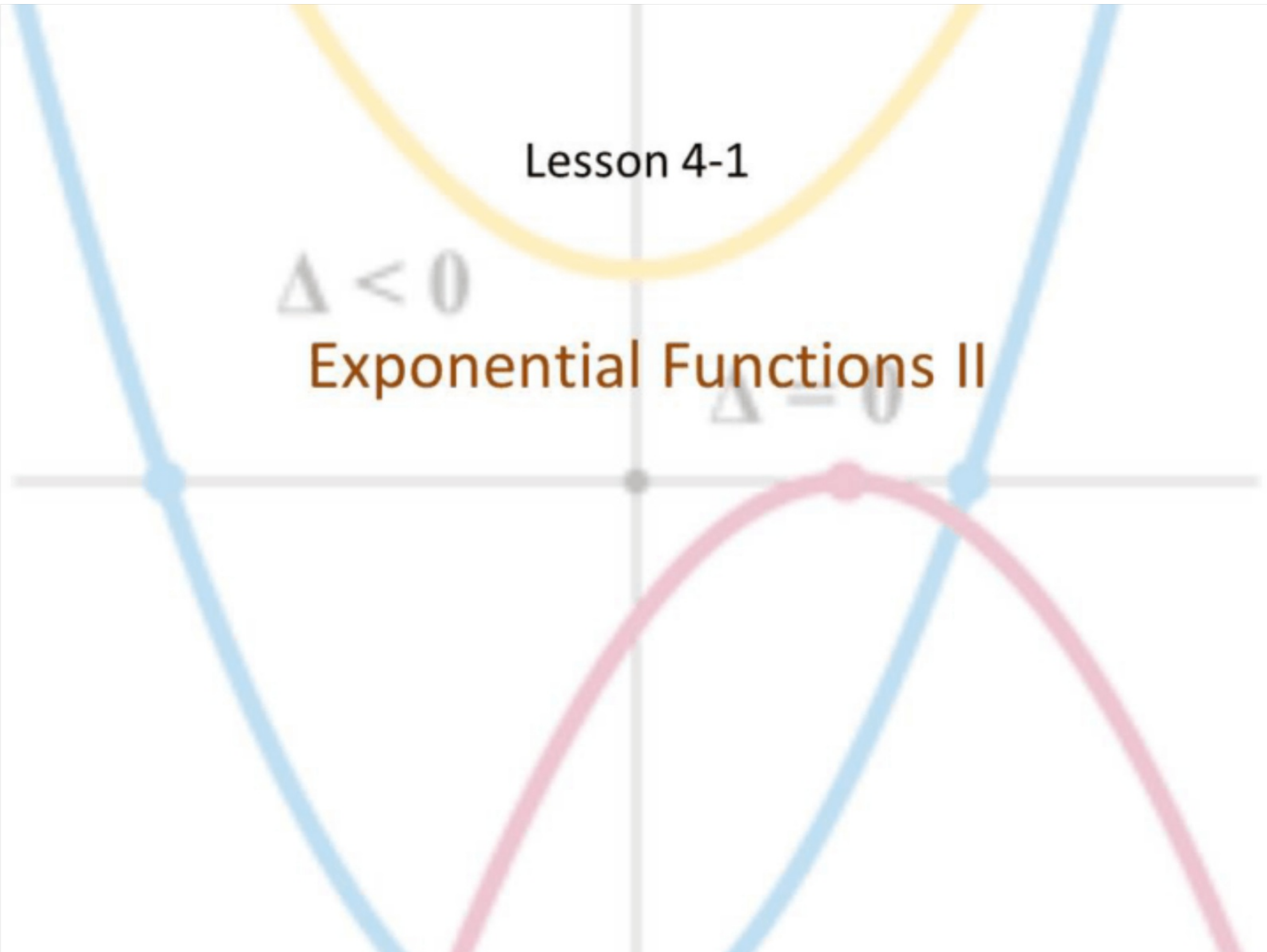
$5^{-\sqrt{3}} \approx \boxed{0.062}$

6. $f(2\pi)$

$5^{2\pi} \approx \boxed{24646.}$

Lesson 4-1

Exponential Functions II



Objective

Students will…

- ~~Be able to identify the end behavior of exponential functions.~~
- Be able to derive the exponential function of whose graph is given.

Exponential Functions

In our previous chapter, we studied polynomial and rational functions. Yet another important and practical function group is the exponential function.

The **exponential function** with **base** a is defined for all real numbers by

$$f(x) = a^x, \text{ where } a > 0 \text{ and } a \neq 1.$$

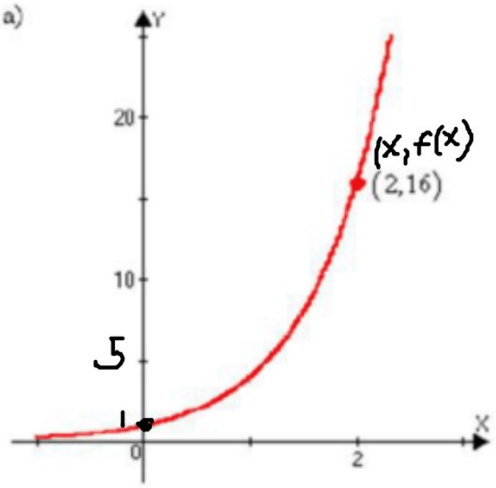
Also, note that here our **exponent** is the variable, instead of the **base**.

$y = (x-h)^2 + k$

Deriving Exponential Functions

We can find the equation of the functions from the given graphs. The idea is to use the exponential definition, $f(x) = a^x + k$

Ex. a)



$k = 0$

$\sqrt{16} = \pm\sqrt{a^2}$

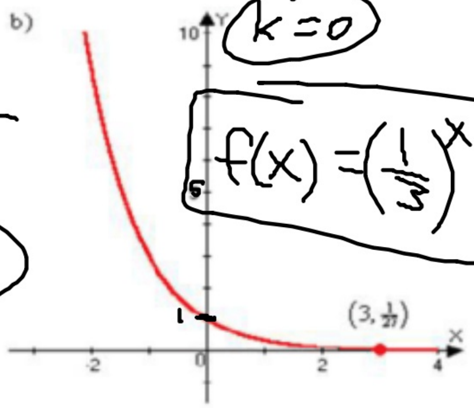
$\pm 4 = a$

$\boxed{f(x) = 4^x}$

Examples

Find the exponential function $f(x) = a^x + k$ whose graph is given.

1.



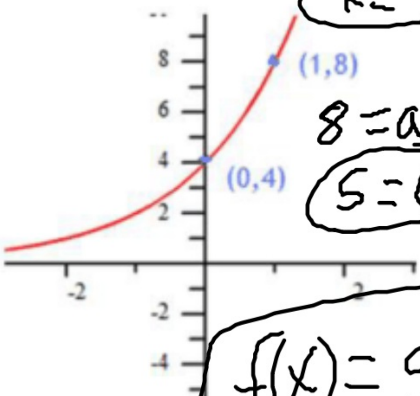
$k = 0$

$\sqrt[3]{\frac{1}{27}} = \sqrt[3]{a^3}$

$\frac{1}{3} = a$

$\boxed{f(x) = \left(\frac{1}{3}\right)^x}$

2.



$k = 3$

$8 = a^1 + 3$

$5 = a$

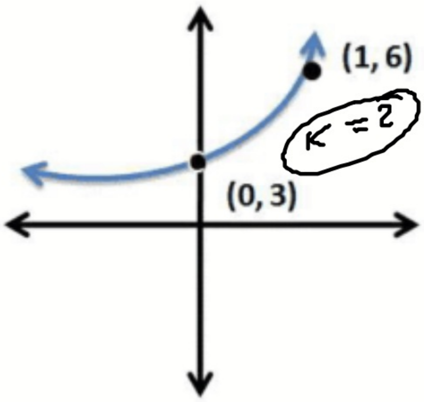
$\boxed{f(x) = 5^x + 3}$

Examples

Find the exponential function $f(x) = a^x + k$ whose graph is given.

$\boxed{f(x) = 4^x + 2}$

3.



$6 = a^1 + 2$

$4 = a$

The *Natural* Exponential Functions

In studying exponential functions, there is a very special number that is studied, mainly because of its use virtually on a daily basis out in the real world. It is a called the *Natural* exponential function, denoted as e

So, by definition, the ***natural* exponential function** is the exponential function

$$f(x) = e^x, \text{ where the base } e \approx 2.71828 \ldots$$

$$e = \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$$

By definition e is the value that $\left(1 + \frac{1}{n}\right)^n$ approaches as $n \to \infty$

This will be studied much more extensively in Calculus. For this course, our focus is simply using this strange number via a calculator ☺

Examples

Evaluate each expression correct to five decimal places.

1. e^3 2. $2e^{-0.53}$ 3. $e^{4.8}$

$\approx \boxed{20.08554}$ $\approx \boxed{1.17721}$ $\approx \boxed{121.51042}$

Homework 11/6

TB pg. 336-337 #15-24, 39, 40