Do Now (2/24 & 2/25)

Take out your 6.1 notes and Exponential Function Flipbook from last class. In your own words, summarize the process of how you would find the graph of a given exponential function.

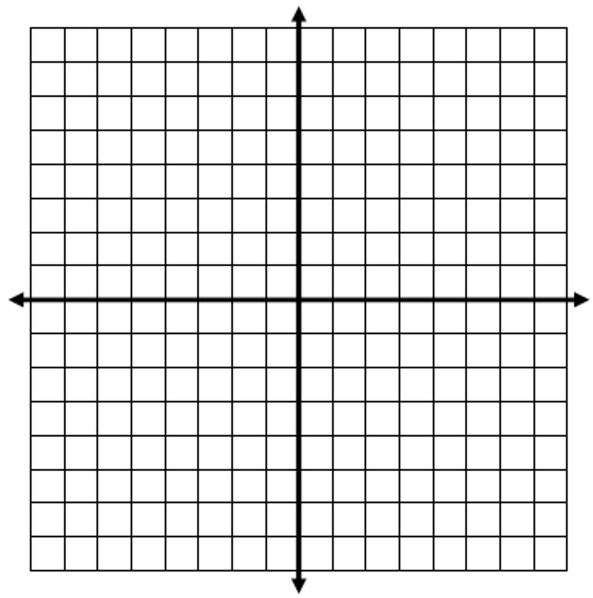
A

$$f(x) = \left(\frac{1}{2}\right)^{x-3} + 1$$

DOMAIN

RANGE

Y-INTERCEPT



ASYMPTOTE

END BEHAVIOR

$$f(x) = \left(\frac{1}{2}\right)^{x-3} + 1$$

x	$y=\left(\frac{1}{2}\right)^{x}$	x + 3	y + 1
-2	$\left(\frac{1}{2}\right)^{-2} = 2^2 = 4$	$-2+3=1$	$4+1=5$
-1	$\left(\frac{1}{2}\right)^{-1} = 2^1 = 2$	$-1+3=2$	$2+1=3$
0	$\left(\frac{1}{2}\right)^{0} = 1$	$0+3=3$	$1+1=2$
1	$\left(\frac{1}{2}\right)^{1} = \frac{1}{2}$	$1+3=4$	$\frac{1}{2}+1=\frac{3}{2}$
2	$\left(\frac{1}{2}\right)^{2} = \frac{1}{4}$	$2+3=5$	$\frac{1}{4}+1=\frac{5}{4}$

A

$$f(x) = \left(\frac{1}{2}\right)^{x-3} + 1$$

DOMAIN

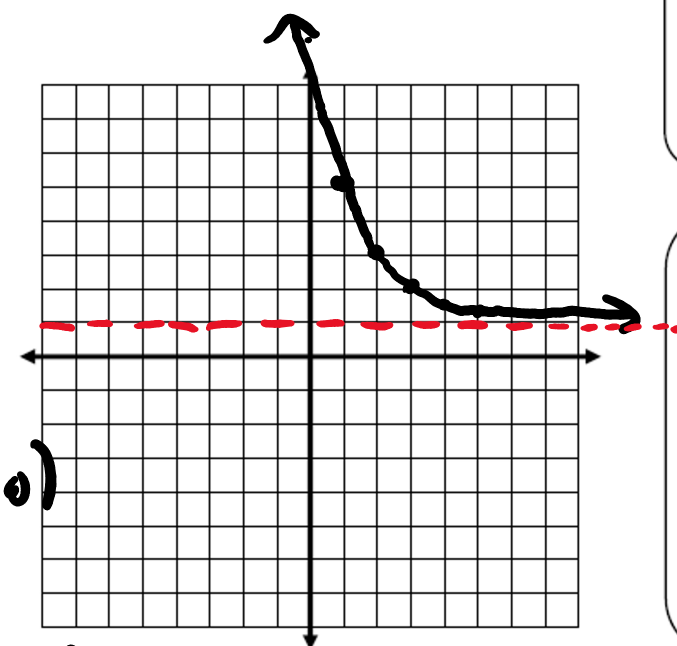
$(-\infty, \infty)$

RANGE

$(1, \infty)$

Y-INTERCEPT (x=0)

$y = 9$



ASYMPTOTE

$y = 1$

END BEHAVIOR

As $x \to -\infty$, $y \to \infty$

As $x \to \infty$, $y \to 1$

$$\left(\tfrac{1}{2}\right)^{0-3} + 1 = \left(\tfrac{1}{2}\right)^{-3} + 1 = \tfrac{2}{1}^{3} + 1 = 9$$

- Get whiteboards ready
- Get calculators ready
- Get 6.2 Notes ready
- Exponential Projects Handout

Essential Question: How can you develop exponential models to represent and interpret situations?

Learning Goal:

- Write exponential models in different ways to solve problems

Standard(s):
MAFS.912.A-SSE.1.1b-Interpret complicated expressions by viewing one or more of their parts as a single entity…

To write an exponential equation in word problems, use the form

$$y = (initial\ amount)(rate)^t$$

$y = a \cdot b^x$

- Rate is either:
  - 1 + % if ___growth___ 5% ↑, 1+0.05
    1.05
  - 1 - % if ___decay___ 5% ↓ 1 − 0.95
  - Double: ___2___
  - Triple: _____
  - Quadruple: ____
  - Half: _____
  - Third: ______

Example 1

Memory loss after learning a concept can be modeled by an exponential function. Suppose the amount of concepts you can retrieve from memory is halved after every 6 hours of inactivity or absence of training/practice. Mr. Soto is learning Chinese. If he learned 50 Chinese characters from a math class, how much can be retrieved after 24 hours if he is not practicing, reviewing notes, etc.

你能行的

$$y = 50 \cdot \left(\frac{1}{2}\right)^{t/6}$$

Example 1

Memory loss after learning a concept can be modeled by an exponential function. Suppose the amount of concepts you can retrieve from memory is halved after every 6 hours of inactivity or absence of training/practice. If a student learned 50 concepts from a math class, how much can be retrieved after 24 hours if the student is not practicing problems outside of class, reviewing notes, etc.

If t represents hours, then

$$y = 50 \cdot \left(\frac{1}{2}\right)^{\frac{t}{6}}$$

$$y = 50 \cdot \left(\frac{1}{2}\right)^{\frac{24}{6}} = 50 \cdot \left(\frac{1}{2}\right)^{4} = 3.125 \approx 3 \text{ ideas/concepts}$$

Example 2

The median household income in the US increased by an average of 0.5% each month between 1979 and 1999. If the median household income was $37,060 in 1979, (a) write an equation for the median household income for t months. (b) What was the median household income after 5 years?

a

+

60 mths

t

0.005

$$y = 37{,}060 \cdot (1.005)^t$$

Example 2

The median household income in the US increased by an average of 0.5% each month between 1979 and 1999. If the median household income was $37,060 in 1979, write an equation for the median household income for t months.

$(1+r)$

$(a)\ y = 37{,}060 \cdot (1.005)^t$

$(b)\ y = 37{,}060 \cdot (1.005)^{60} = \$49{,}988.39$

$37{,}060(1.005)^{(5\cdot 12)}$

Try It!

Your family bought a house 10 years ago. Since that time, the value of the real estate in your neighborhood has decline 3% per year. If you initially paid \$179,000 for their house, write an equation to model the value of your house after t years. How much would you house be worth today?

$$y = 179{,}000(0.97)^{t} \quad t = 10$$

$$1 - 0.03$$

\$131,998

Compound Interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Compound Interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

A = amount at the end
P = Principle (initial amount)
r = rate of interest (annually)
n = #of times compounded per year
t = #of years

Compound Interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

n

Annual: 1

Semiannually: 2

Quarterly: 4

Monthly: 12

Weekly: 52

Biweekly: 26

Daily: 365

Compound Interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Annual: n = 1

Semiannually: n = 2

Quarterly: n = 4

Monthly: n = 12

Weekly: n = 52

Biweekly: n = 26

Daily: n = 365

Example 3

Karen has $1000 that she invests into a bank account that pays 3.5% interest compounded quarterly. (a) How much money does Karen have at the end of 5 years? (b) How much interest is this?

P $n = 4$ r = 0.035 t

Example 3

Karen has $1000 that she invests into a bank account that pays 3.5% interest compounded quarterly. (a) How much money does Karen have at the end of 5 years? (b) How much interest is this?

$(a)\ A = 1000\left(1 + \frac{0.035}{4}\right)^{(4)(5)}$ =$1190.34

$(b)\ 1190.34 - 1000 = \$190.34$ interest

Try It!

Karen decided to use her credit card to pay $1000 to repair her laptop hard drive. Her Discover Card charges 20% interest compounded daily. How much will she owe after 5 years?

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$= 1000\left(1 + \frac{0.20}{365}\right)^{\wedge}(365 \cdot 5)$$

$$= \$2,717.54$$

$$\sim \$1190$$

Try It!

Karen decided to use her credit card to pay $1000 to repair her laptop hard drive. Her Discover Card charges 20% interest compounded daily. How much will she owe after 5 years?

$$y = 1000\left(1 + \frac{0.20}{365}\right)^{365*5} = \$2717.54$$

*Not counting any monthly fees charged if no payments are made, etc.

Example 4

Karen has $1000 that she invests into a bank account that pays 3.5% interest. She wants to find different plans with different compounding periods. How much will she have after 5 years if interest is compounded daily? Every hour? Every minute? Every second?

$n = \underline{365 \cdot 24 \cdot 60 \cdot 60}$

Example 4

Karen has $1000 that she invests into a bank account that pays 3.5% interest. She wants to find different plans with different compounding periods. How much will she have after 5 years if interest is compounded daily? Every hour? Every minute? Every second?

Compounding Periods	A $=P\left(1+\frac{r}{n}\right)^{nt}$ $1190
Daily (n = 365)	$A= 1000\left(1+\frac{0.035}{365}\right)^{(365)(5)} = \$1191.23622$
Every hour (n = 8760)	$A= 1000\left(1+\frac{0.035}{8760}\right)^{(8760)(5)} = \$1191.245759$
Every minute (n = 525,600)	$A= 1000\left(1+\frac{0.035}{525600}\right)^{(525600)(5)} = \$1191.244447$
Every second (31,536,000)	$A= 1000\left(1+\frac{0.035}{31536000}\right)^{(31536000)(5)} = \$1191.24621$
Infinitely?	?

↳ Continuous

365*24=8,760 8760*60=525600 525600*60=31536000

- To do infinite compounding periods means to compound continuously!

$A = Pe^{rt}$

Euler's

Natural base

- To do infinite compounding periods means to compound continuously!

$A = Pe^{rt}$

e is an irrational number => e = 2.7182818284590452….

- It is called the natural base (or Euler's number)

Example 5

Karen has $1000 that she invests into a bank account that pays 3.5% interest. How much will she have in the bank account after 5 years if interest is compounded continuously?

$A = Pe^{rt}$ ⇒ 1000 e^(0.035 × 5)

Example 5

Karen has $1000 that she invests into a bank account that pays 3.5% interest. How much will she have in the bank account after 5 years if interest is compounded continuously?

$$A = Pe^{rt} = 1000e^{0.035*5} = \$1191.24622$$

Example 5

Karen has $1000 that she invests into a bank account that pays 3.5% interest. How much will she have in the bank account after 5 years if interest is compounded continuously?

Compounding Periods	$A = P\left(1+\frac{r}{n}\right)^{nt}$
Daily (n = 365)	$A = 1000\left(1+\frac{0.035}{365}\right)^{(365)(5)} = \$1191.23622$
Every hour (n = 8760)	$A = 1000\left(1+\frac{0.035}{8760}\right)^{(8760)(5)} = \$1191.245759$
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Every second (31,536,000)	$A = 1000\left(1+\frac{0.035}{31536000}\right)^{(31536000)(5)} = \$1191.24621$
Infinitely?	$A = 1000e^{0.035*5} = \$1191.24622$

Ti30XIIs Calculator

$$Example)\ 3000\left(1+\frac{0.3}{2}\right)^{(2)(5)}$$

Calculator: 3000 (1 + 0.3 ÷ 2) ^ (2 x 5)

Example) $3000e^{(0.5)(8)}$

Calculator: $3000 \quad 2nd \quad LN \quad 0.5 \ x \ 8 \ )$

To Do

- Work on Exponential Models Project OR
- Exponential Models Worksheet (Extra Practice)

Monday, February 24, 2020 7:13 AM

7th : (D, Mod)

Ex ?

- Mercy :
- Jaelin
- Ilustugn
- Alex -
- Alvareeh
- Emilie
- Morgan

2nd : (D, Mod)

Ex

- Jasmine
- Kai
- Ramme
- Alex
- Emma
- Elijah
- Zoe
- Gray
- Nate (online)
- Jan
- Melia