Aim: What is Euler's (Leonhard Euler) Number, e, and what is some of its applications? (Chapter 7.2)

Do Now: Use your calculator to graph $y=2^x$, $y=2^{(x-3)}$, $y=2^{(x+3)}$, $y=3(2^x)$, $y=\frac{1}{3}(2)^x$ Describe what type of effect each graph has on the parent function $y=2^x$?

I- Transformation of the Exponential Parent Function

1) **Essential Understanding** The factor a in $y = ab^x$ can stretch or compress, and possibly reflect the graph of the parent function $y = b^x$.

2) How does the graph of $y = -0.5 \cdot 5^x$ compare to the graph of the parent function?

3) **Write the parent function of each function. Describes its transformation**

1. $y = 5 \cdot 3^x$ **2.** $y = 7^{(x-3)}$ **3.** $y = 6^{(x-2)} + 9$

II- Types of Transformations

1) take note

Concept Summary **Families of Exponential Functions**

Parent function	$y = b^x$
Stretch $(\lvert a\rvert > 1)$ Compression (Shrink) $(0 < \lvert a\rvert < 1)$ Reflection $(a < 0)$ in x-axis	$y = ab^x$
Translations (horizontal by h; vertical by k)	$y = b^{(x-h)} + k$
All transformations combined	$y = ab^{(x-h)} + k$

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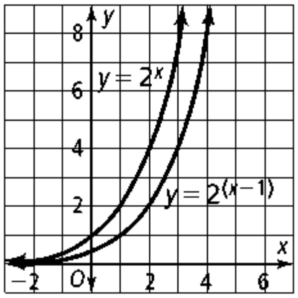
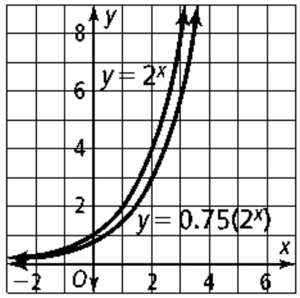
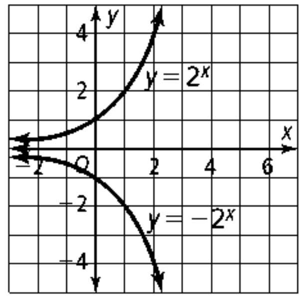
2) **Identify each function as a compression, a reflection, or a translation of the parent function.**







3) **Physics** The best temperature to brew coffee is between 195°F and 205°F. Coffee is cool enough to drink at 185°F. The table shows temperature readings from a sample cup of coffee. How long does it take for a cup of coffee to be cool enough to drink? Use an exponential model.

Time (min)	Temp (°F)
0	203
5	177
10	153
15	137
20	121
25	111
30	104

Step 1
Plot the data to determine if an exponential model is realistic.

Step 2
The graphing calculator exponential model assumes the asymptote is $y = 0$. Since room temperature is about 68°F, subtract 68 from each temperature value. Calculate the third list by letting **L3 = L2 − 68.**

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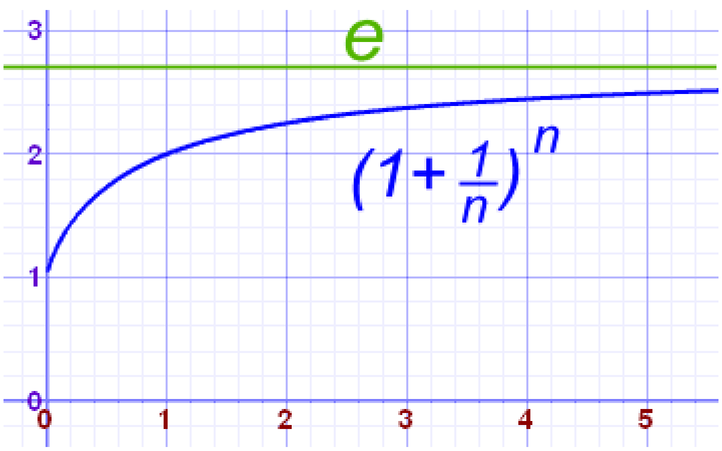
III – Euler's Number

1) **Natural base exponential functions** are exponential functions with base e. These functions are useful for describing continuous growth or decay. Exponential functions with base e have the same properties as other exponential functions.

2) There are many ways of calculating the value of ***e***, but none of them ever give an exact answer, because ***e*** is irrational (not the ratio of two integers).

But it **is** known to over 1 trillion digits of accuracy!

For example, the value of $(1 + 1/n)^n$ approaches ***e*** as n gets bigger and bigger:



n	$(1 + 1/n)^n$
1	2.00000
2	2.25000
5	2.48832
10	2.59374
100	2.70481
1,000	2.71692
10,000	2.71815
100,000	2.71827

3) **Use the graph of $y = e^x$ to evaluate each expression to four decimal places.**

a. e^3 **b.** $e^{0.5}$ **c.** e^{-4}

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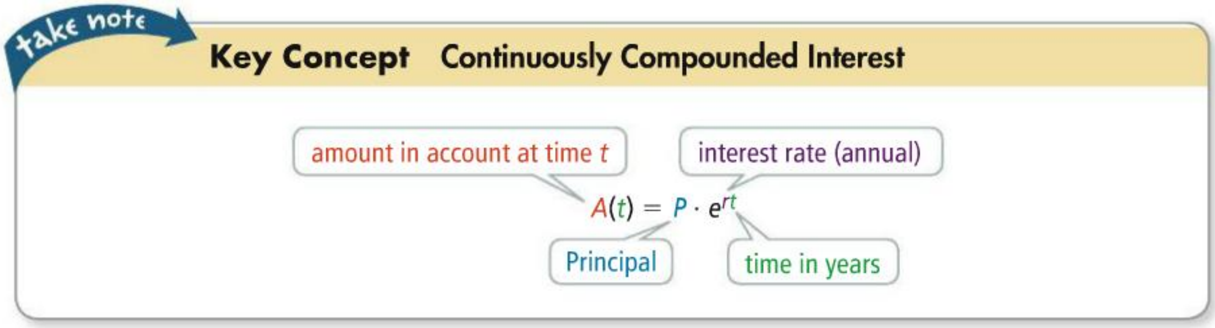
4)



5) **Find the amount in a continuously compounded account for the given conditions.**

a. principal: $300

annual interest rate: 5%

time: 4 yr

$A(t) = P \cdot e^{rt}$

$A(t) = \$300 \cdot e^{(0.05)(4)}$

$A(4) =$

b. principal: $650

annual interest rate: 6.5%

time: 20 yr

$A(t) = P \cdot e^{rt}$

$A(t) =$