Section 5.3 & 5.4: Exponential Functions

Essential Question: What is exponential growth and decay?

What is continious growth?

Exponential Functions

$f(x) = ab^x$ where $a > 0$

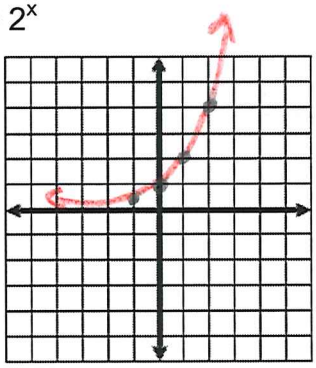
Growth if …
$b > 1$

Decay if …
$0 < b < 1$

Example 1 $y = 2^x$

$a = 1$
$b = 2$

x	y
-1	1/2
0	1
1	2
2	4

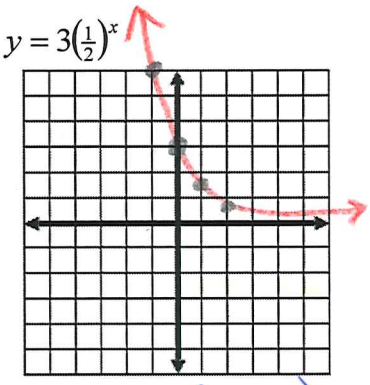


Use/Purpose: finances, bacteria growth

Example 2 $y = 3\left(\frac{1}{2}\right)^x$

$a = 3$
$b = 1/2$

x	y
-2	$3(2)^2 = 12$
-1	$3(2)^1 = 6$
0	$3(2)^0 = 3$
1	3/2
2	$3(1/4) = 3/4$



Use/Purpose: Half-life (science)

Asymptote: The line the graph never crosses, in exponential growth it is the x-axis, $y=0$

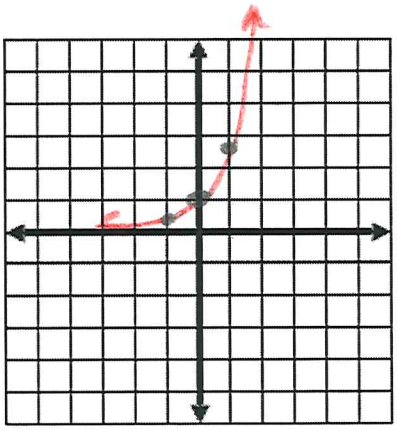
The Number *e*

e is called the Euler number after Swiss mathematician Leonard Euler (1700's)

$e \approx 2.718$

Graph $y = e^x$

x	y
-1	$e^{-1} = \frac{1}{e}$
0	$e^0 = 1$
1	$e^1 \approx 2.718$



Use/Purpose:
finances (CD's, bonds)

Biology (continuous growth)

Compound Interest *Continuously*

$A = Pe^{rt}$

A = final amount
P = initial amount
r = rate (apr) as a decimal
t = time (years)

Example

Jack and Diane are going to start a CollegeSure CD (certificate of deposit) at their bank for their newborn daughter. The particular CD they opened pays a continuous rate of 6.5% and requires a minimum deposit of $2500.

→ initial amount

not growth continuous = Pert

→ .065

If Jack and Diane's daughter begins college at the age of 18, how much money will she have earned from the CD when she goes to college?

$A = 2500 \cdot e^{(.065)(18)}$

$A =$ $8054.98

Section 5.3/5.4 Summary:

① Exponential Growth $f(x) = a \cdot b^x$ where $b > 1$

$f(x)$ increases as x increases

② Exponential Decay $f(x) = a \cdot b^x$ where $0 < b < 1$

$f(x)$ decreases as x increases

③ Compound Continuous Growth $A = Pe^{rt}$

(look for "continuously")

A = final amount

P = initial amount

e = constant ≈ 2.718

r = rate as a decimal

t = time in years