Entry Task: Your company makes two household cleaners: Miracle Bathtub Cleaner and Speedex Floor Cleaner. Your daily production of both cleaners combined is limited to 2,000 gallons. Your daily sales of Miracle Bathtub Cleaner never exceed 1,200 gallons, and your daily sales of Speedex Floor Cleaner never exceed 1,400 gallons. Finally, you make $1.00 profit on each gallon of Miracle Bathtub Cleaner that you sell and $2.00 on each gallon of Speedex Floor Cleaner that you sell. Determine **the amount of each cleaner you should produce** in order to maximize profit.

STEP 1: "…amount of each cleaner…"

x =

y =

	x	y

STEP 2: Constraints and Objective?

STEP 3: Graph

STEP 4: Corners

STEP 5: Evaluate objective

(,   ) →

(,   ) →

(,   ) →

(,   ) →

(,   ) →

Closing Tues: 4.2
Closing Thurs: 5.1/5.2 and 5.3
Exam 2 is Tuesday, Nov. 22nd.
No lecture Wed, Nov. 23rd.

5.1/5.2 Exponentials & Logarithms
(Get your calculator out!)

Def'n: An <u>exponential</u> function can be written as
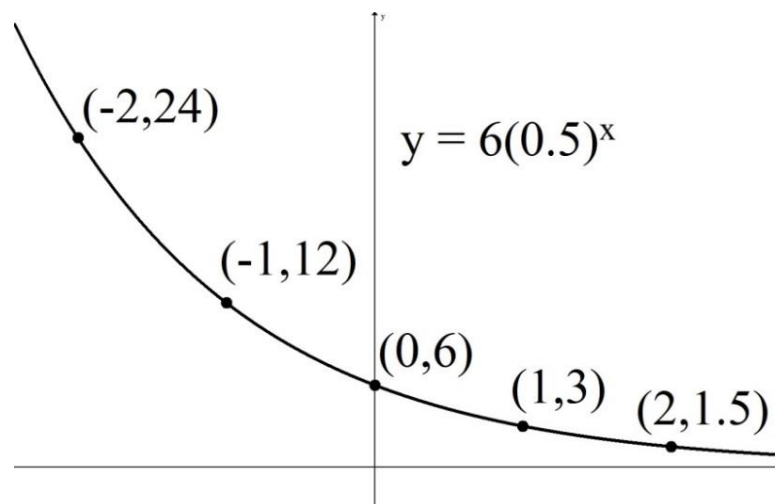
$$f(x) = A\, b^x$$

    $A = f(0)$ = the *y*-intercept

    b = the base

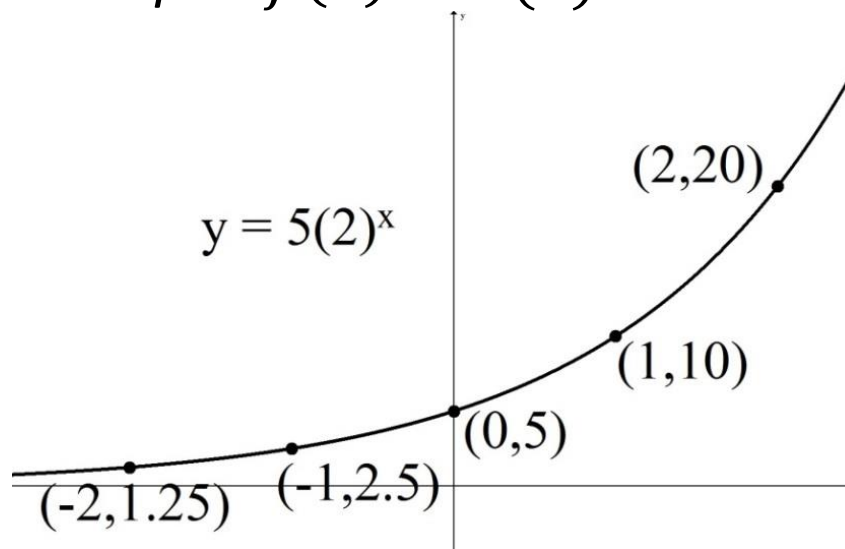The most used base in applications is
e = 2.71828182…. (Euler's constant)

For $0 < b < 1$, exponential decay
Example: $f(x) = 6(0.5)^x$

$(-2,24)$

$y = 6(0.5)^x$

$(-1,12)$

$(0,6)$

$(1,3)$ $(2,1.5)$

If $b > 1$, exponential growth
Example: $f(x) = 5(2)^x$

$(2,20)$

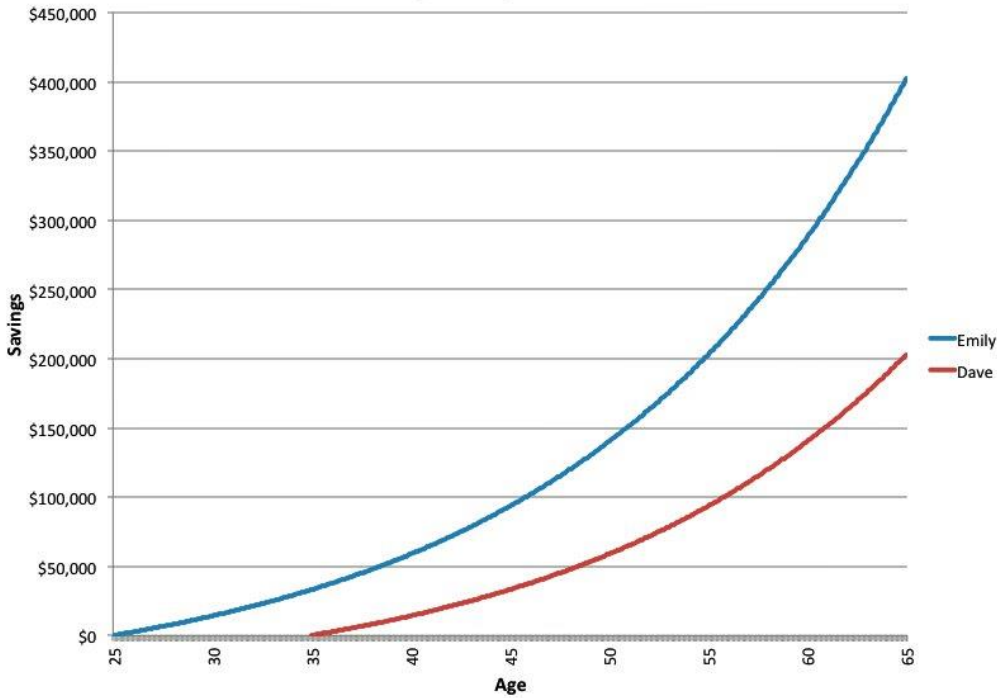$y = 5(2)^x$

$(1,10)$

$(0,5)$

$(-2,1.25)$ $(-1,2.5)$

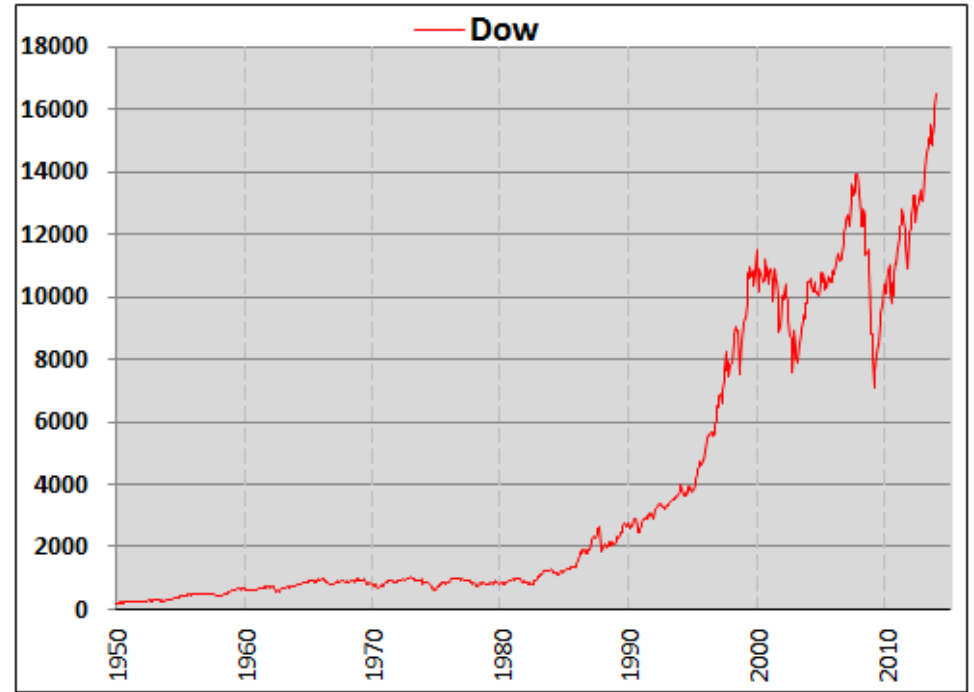# Exponential functions are everywhere you look in business!

Examples

Savings Accounts

Starting Saving at 25 vs. 35

Economic Growth

Skills Review
Power/Root/Exponent Facts

Rule	Example	Example
$b^0 = 1$	$3^0 =$	$7e^0 =$
$b^{\left(\frac{1}{n}\right)}$ $= \sqrt[n]{b}$	$16^{1/2} =$ $8^{1/3} =$ $9^{3/2} =$	$\sqrt[5]{e^x} =$
$b^{-x} = \dfrac{1}{b^x}$	$2^{-3} =$ $27^{-1/3} =$	$\dfrac{1}{e^x} =$
b^{x+y} $= b^x b^y$	$x^2 x^3 =$	$e^x e^{3x} =$
$\dfrac{b^x}{b^y} = b^{x-y}$	$\dfrac{x^8}{x^3} =$	$\dfrac{e^{5x}}{e^{2x}} =$
$(b^x)^y$ $= b^{xy}$	$(x^2)^3 =$	$(e^3)^x =$

Solving with powers and roots

Powers/Roots:

$$y = x^n \leftrightarrow y^{(1/n)} = \sqrt[n]{y} = x$$

(Taking an even root? you need "$\pm$")

Get out your calculator

Solve

1. $x^2 = 7$

2. $\sqrt{y} = 3$

3. $t^5 = 60$

4. $\sqrt[5]{w} = 3$

5. $\sqrt[3]{(2x-1)^5 - 5} = 3$

Exponentials/Natural Logarithm

$$y = e^x \leftrightarrow \ln(y) = x$$
$$y = b^x \leftrightarrow \log_b(y) = x$$

Let's find some new buttons on your calculator (get your calculator out)

Example 1: Using your calculator:

STEP 1: Compute $e^2 \approx$ BLAH

STEP 2: Compute ln(BLAH) = ??

Example 2: Using your calculator:

STEP 1: Compute ln(3) = BLAH

STEP 2: Compute e^{BLAH} = ??

Solve

1. $e^x = 7$

2. $\ln(y) = 14$

3. $e^{3x} = 4$

4. $2e^{10x} - 5 = 7$

Logarithm Facts

Rule	Example
$1 = e^0$ and $\ln(1) = 0$ $e = e^1$ and $\ln(e^1) = 1$ $\ln(e^2) = 2$, $\ln(e^3) = 3$, and so on…	
$\ln(ab) =$ $\ln(a) + \ln(b)$	$\ln(3) + \ln(5) =$
$\ln\left(\dfrac{a}{b}\right) =$ $\ln(a) - \ln(b)$	$\ln(20) - \ln(2) =$
$\ln\left(a^b\right)$ $= b\ln(a)$	$\ln(2^x) =$
$\ln(e^x) = x$ $e^{\ln(y)} = y$	$\ln(e^2) =$ $e^{\ln(3)} =$

Example:

Compute $\ln\left(\dfrac{e^3 e^4}{e^2}\right)$

Review of all solving facts

We solve by using inverses in the correct order to get the variable by itself

Equation	Inverse
$x + 3 = 14$ $y - 5 = 22$	$x =$ $y =$
$3t = 16$ $\dfrac{m}{0.2} = 100$	$t =$ $m =$
$x^2 = 7$ $\sqrt{y} = 3$	$x =$ $y =$
$t^5 = 20$ $\sqrt[5]{w} = 3$	$t =$ $w =$
$e^x = 10$ $\ln(y) = 3$	$x =$ $y =$
$5^t = 60$	$t =$