# Writing and using formulas

| LINEAR | EXPONENTIAL |
|---|---|
| $y = mx + b$ | $y = a(b)^x$ |
| m = slope (rate of change)<br>b = y-intercept (or starting value) | a = initial value<br>b = rate of change<br>(ex. doubling = 2)<br><br>IF RATE IS A %<br><u>Increasing by a %</u><br>b = 1 + %<br><u>Decreasing by a %</u><br>b = 1 - %<br>(percent must always be in decimal form) |

# Determine how the numbers in the problem are changing

## LINEAR:

To turn on the natural gas at your new apartment there is a $25 turn on fee and then it is .54 per therm.  Write an equation to model this situation

$$y = mx + b$$

$$y = .54x + 25$$

# EXPONENTIAL

8 bunnies were left on an island and their population is tripling every month.  Write a equation that models this
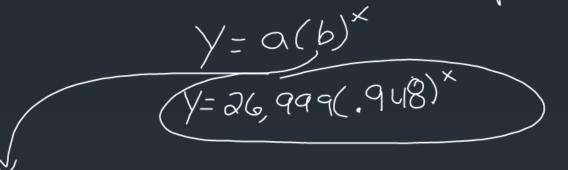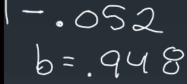
$$y = a(b)^x$$

$$y = 8(3)^x$$

# EXPONENTIAL (Percent Decrease):

A new car is valued at 26,999 and it depreciates in value 5.2% every year.  Write an equation that models this situation
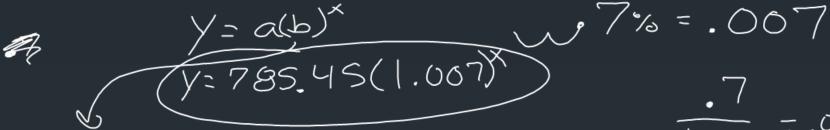
PERCENTS ALWAYS EXPONETIAL

$$y = a(b)^x$$

$$y = 26,999(.948)^x$$

$$1 - .052$$

$$b = .948$$

# EXPONENTIAL (Percent Increase):

The value of one share of Google stock is $785.45 and has been increasing at a rate of 0.7% each year.  Write a model that demonstrates this

$$y = a(b)^x$$

$$y = 785.45(1.007)^x$$

$$7\% = .007$$

$$\frac{.7}{100} = .007$$

$$b = 1 + .007$$

$$b = 1.007$$

# RECURSIVE SEQUENCES

- A different way to write a formula

- Uses the previous value to find the next value

- Written using the same numbers (information) but different variables

# RECURSIVE

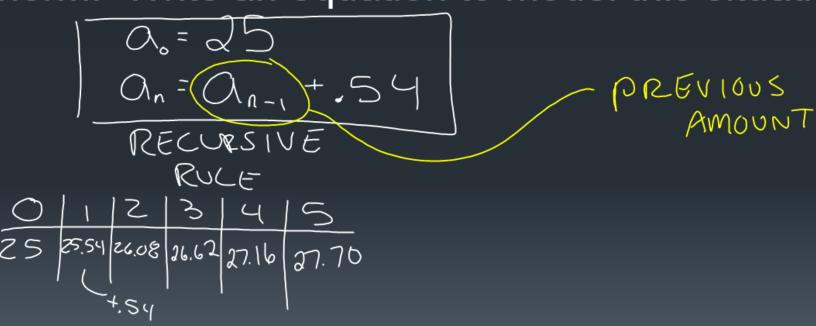| LINEAR | EXPONENTIAL |
|---|---|
| $a_0 = \underline{\quad}$ <br> $a_n = a_{n-1} + d$ | $a_0 = \underline{\quad}$ <br> $a_n = ra_{n-1}$ |
| $d$ = rate of change <br> $a_0$ = initial term <br> $a_{n-1}$ = value of previous term <br> (do not subtract anything!) <br> $a_n$ = value of term (y) | $r$ = rate of change <br> $a_0$ = initial term <br> $a_{n-1}$ = value of previous term <br> (do not subtract anything!) <br> $a_n$ = value of term (y) |

# Write a recursive rule for the following

## LINEAR:

To turn on the natural gas at your new apartment there is a $25 turn on fee and then it is .54 per therm.  Write an equation to model this situation
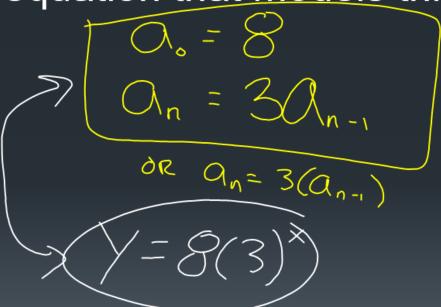
$$a_0 = 25$$
$$a_n = a_{n-1} + .54$$

RECURSIVE
RULE

PREVIOUS
AMOUNT

| 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 25 | 25.54 | 26.08 | 26.62 | 27.16 | 27.70 |

+.54

# Write a recursive rule for the following

## EXPONENTIAL

8 bunnies were left on an island and their population is tripling every month.  Write a equation that models this

$$a_0 = 8$$

$$a_n = 3a_{n-1}$$

OR $a_n = 3(a_{n-1})$

$$Y = 8(3)^x$$

| | |
|---|---|
| 0 | 8 |
| 1 | 24 |
| 2 | 72 |
| 3 | 216 |
| 4 | 648 |

# Write a recursive rule for the following

## EXPONENTIAL (Percent Decrease):

A new car is valued at 26,999 and it depreciates in value 5.2% every year.  Write an equation that models this situation

$$1 - .052$$
$$.948$$

$$a_0 = 26,999$$

RECURSIVE
SEQUENCE

$$a_n = .948\, a_{n-1}$$

EXPLICIT

$$y = 26,999(.948)^x$$

# Write a recursive rule for the following

## EXPONENTIAL (Percent Increase):

The value of one share of Google stock is $785.45 and has been increasing at a rate of 0.7% each year. Write a model that demonstrates this

$$a_0 = 785.45$$
$$a_n = 1.007\, a_{n-1}$$

# When to use Recursive:
- When making a list or chart (keep using the [ANS] function on your calc!

# When to use Explicit:

- When looking for a specific value!

IV.A Student Activity Sheet 2: Recursion and Linear Functions

1. Coen decides to take a job with a company that sells magazine subscriptions. He is paid $20 to start selling and then earns $1.50 for each subscription he sells. Fill in the following table, showing the amount of money (M) Coen earns for selling n subscriptions. Use the process column to note what is happening in each line.

MAGAZINE SUBSCRIPTIONS

$a_0$ = MONEY

| $n$ | Process | $M_n$ |
|---|---|---|
| 0 | | $M_0 = 20$ |
| 1 | $20 + 1.50$ | $M_1 = 21.50$ |
| | | $M_2 =$ |
| | | $M_3 =$ |
| | | $M_4 =$ |

2. Write a recursive rule for the amount of money Coen can earn selling magazine subscriptions.

3. REFLECTION: The rule in Question 2 defines a term $(M_{n+1})$ with respect to the term that