|  |
| --- |
| **Germs! Germs! Germs!**Certain bacteria, under the right conditions, multiply themselves. You will use strips of paper, each representing a bacterium, to model its growth.For this activity, each member of your group must choose a role: * Recorder – records data
* Counter – counts pieces for recorder
* Reader – reads questions for other members in the group
* Facilitator – keeps discussion of topic going
 |

Cut #1: Cut your paper into \_\_\_\_ equal pieces.

How many total pieces do you have? \_\_\_\_\_

Cut #2: Cut each piece into \_\_\_\_ equal pieces.

How many total pieces do you have? \_\_\_\_\_

Cut #3: Cut each piece into \_\_\_\_ equal pieces.

How many total pieces do you have? \_\_\_\_\_

Cut #4: Cut each piece into \_\_\_\_ equal pieces.

How many total pieces do you have? \_\_\_\_\_

Cut #5: Cut each piece into \_\_\_\_ equal pieces.

How many total pieces do you have? \_\_\_\_\_



**Graph** your result on the grid provided.

**Identify** the characteristics of your graph.

* X – intercept
* Y - intercept

Create an equation to model the data in y = abx form.

y is total amount (leave y as is)

a is initial amount

b is growth factor (# of equal pieces each cut)

x is number of cuts (leave x as is)

**EXAMPLE 2:**

An antique costs $800. Its value increases at a rate of 50% each year. **Fill** out the chart below.

[***NOTE****: 50% is called the* ***growth rate*** *because the initial amount is increasing over time.*]



|  |  |  |  |
| --- | --- | --- | --- |
| **End of** **Year** | **Increase in** **Value** | **Total Value at the end of Year** | **Growth****Factor (b)** |
| 0 |  | = $800 *\* initial value (a)* |  |
| 1 | = 800 x 50%= 800 x 0.50= $400  | = 800 + 400= $1200 | 1200 / 800= 1.5 |
| 2 | = 1200 x 0.50= |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |

**Graph** your result on the grid provided. Y scale (Total Value) 400 for one square; x scale (time) 1 year for two squares.

**Identify** the characteristics of your graph

x – Intercept:

y – Intercept:

**Equation**:

**EXAMPLE 3:** The population of Luckville is 50,000. Each year, the population decreases at a rate of 40%.

[***NOTE****: 40% is called the decay rate because initial amount is decreasing over time.*]



|  |  |  |  |
| --- | --- | --- | --- |
| **End of** **Year** | **Decrease in** **Population** | **Total Population at the end of Year** | **Decay****Factor (b)** |
| 0 |  | 50,000*\* initial value* (a) |  |
| 1 | = 50,000 x 40%= 50,000 x 0.40= 20,000  | = 50,000 – 20,000= 30,000 | 30,000/50,000= 0.60 |
| 2 | = 30,000 x 0.40= |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |

**Graph** your result on the grid provided. Y scale (Total Value) 2500 for one square; x scale (time) 1 year for two squares.

**Identify** the characteristics of your graph

x – Intercept:

y – Intercept:

**Equation**:

|  |  |  |
| --- | --- | --- |
| **Exponential models** represent quantities that change at a constant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; that is, the quantity is \_\_\_\_\_\_\_\_\_\_\_\_ by a fixed amount at regular intervals.**KEY WORDS**Percent rateMultipliedGrowth/decayExponentialy = abx*a**b*variablegrowingdecaying* In a table of values, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ / \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ factors are equal
* The graph resembles an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ curve
* The equation is written in the form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where \_\_\_ is the initial value and \_\_\_ is the growth/decay factor. Notice that the exponent is the \_\_\_\_\_\_\_\_\_\_\_\_\_

***Growth/Decay Factors***In an exponential equation, , the growth/decay factor is given by the value of ***b***

|  |  |
| --- | --- |
| * If ***b*** > 1, the relation is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* y = *a* (1 + r) x
* Growth rate = growth factor – 1
 | * If 0 < ***b*** < 1, the relation is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* y = *a* (1 – r) x
* Decay rate = 1 – decay factor
 |

 |

***EXAMPLE 1*** Determine the growth/decay factor or growth/decay rate in each of the following:

|  |  |  |
| --- | --- | --- |
| a) **Growth factor (b) = 1.071****Growth rate****=** 1.071 – 1 = 0.071 \* convert to percent= 0.071 x 100= 7.1% | b) | c) A = 2000(1.045) n |

***EXAMPLE 2*** Which models represent exponential relations? [*Hint: Calculate growth factor by dividing latter y value by the former one]*

* ***If growth /decay factor is constant, then it is exponential***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |

|  |  |
| --- | --- |
| ***t*** | ***A*** |
| 0 | 35 |
| 1 | 25 |
| 2 | 15 |
| 3 | 5 |

$$\frac{25}{35}=0.71$$$$\frac{15}{25}=$$$$\frac{15}{25}=$$ |  |

|  |  |
| --- | --- |
| ***d*** | ***P*** |
| 0 | 51.2 |
| 1 | 64 |
| 2 | 80 |
| 3 | 100 |

 |
|  |  |  |  |
|  |  |  |  |