**7.1 Zero and Negative Exponents**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Zero as an exponent
	+ For any nonzero number $a$:
	+ Example:
* Negative exponent
	+ For every nonzero number $a$ and integer $n$:
	+ Example:
* Consider using 0 as a base with 0 as the exponent. Why is $0^{0}$ undefined?
* Consider using 0 as a base with negative exponents. Why is $0^{-2}$ undefined?

Example: What is the simplified form of each expression?

1. $9^{-2}$ d. $\left(-5\right)^{0}$
2. $-3.6^{0} $ e. $3^{-2} $
3. $4^{-3}$ f. $\left(4x\right)^{0} $
* An algebraic expression is in simplest form powers with a variable base are written with only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Example: What is the simplified form of each expression?

1. $5a^{3}b^{-2}$ d. $\frac{1}{x^{-5}}$
2. $x^{-9} $ e. $\frac{2}{a^{-3}}$
3. $4c^{-3}b $ f. $\frac{n^{-5}}{m^{2}}$

**Objective 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* When you evaluate an exponential expression, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example: Evaluate the following expressions.

1. What is the value of $3s^{2}t^{-2}$ for $s=2$ and $t=-3$?
2. What is the value of $n^{-4}w^{0}$ for $n= -2$ and $w=5$?
3. What is the value of $\frac{1}{xy^{-1}}$ for $x=3$ and $y= -3$?

Example: A population of marine bacteria doubles every hour under controlled laboratory conditions. The number of bacteria is modeled by the expression $1000·2^{h}$, where $h$ is the number of hours after a scientist measures the population size. Evaluate the expression for $h=0$ and $h=-3$. What does each value of the expression represent in the situation?

**7.2 Multiplying Powers with the Same Base**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* What does $2^{3}$ mean? What does $2^{3} ·2^{4}$ mean?
	+ What do you notice about the relationship between the exponents?
* To multiply powers with the same base:

Example: Write each expression using each base only once.

1. $12^{4} ·12^{3} $
2. $\left(-5\right)^{-2}\left(-5\right)^{7} $ $ $
3. $\left(0.5\right)^{-3}\left(0.5\right)^{-8}$
4. $9^{-3} ·9^{2}·9^{6}$
* When variable factors have more than one base, be careful to combine only those powers with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Example: Simplify each expression.

1. $4z^{5} ·9z^{-12} $
2. $2a ·9b^{4}·3a^{2} $ $ $
3. $5x^{4} ·x^{9}·3x$
4. $-4c^{3} ·7d^{2}·2c^{-2}$
* Properties of exponents can be used to multiply two numbers written in scientific notation.

Example: At 20°C, one cubic meter of water has a mass of about $9.98 x 10^{5}$ g. Each gram of water contains about $3.34 x 10^{22}$ molecules of water. About how many molecules of water does a droplet with a volume of $1.13 x 10^{-7}$ m3 contain?

**Objective 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Exponents can also be expressed as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These exponents are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ In general, $a^{\frac{1}{m}}=b$ means that $b$ multiplied as a factor$ m $times equals $a$.
	+ Example:

Example: Simplify the expression with rational exponents.

1. $81^{\frac{1}{4}}$
2. $27^{\frac{1}{3}}$
3. $64^{\frac{1}{2}}$

Example: Simplify the expression with rational exponents.

1. $64^{\frac{3}{2}}$ c. $27^{\frac{2}{3}}$
2. $25^{\frac{3}{2}}$ d. $16^{\frac{3}{4}}$

Example: Simplify the expressions.

1. $2c^{\frac{3}{5}} ·2c^{\frac{1}{5}} $ c. $\left(b^{\frac{2}{3}} ·c^{\frac{2}{5}}\right)\left(b^{\frac{4}{9}}·c^{\frac{9}{10}}\right)$
2. $n^{\frac{1}{3}} ·n^{\frac{4}{3}}$ d. $\left(3j^{\frac{2}{3}} ·7m^{\frac{1}{4}}\right)\left(3j^{\frac{1}{6}}·7m^{\frac{3}{2}}\right)$

**7.3 More Multiplication Properties of Exponents**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Raise a power to a power: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Example:

Example: Simplify each expression.

1. $\left(n^{4}\right)^{7}$
2. $(x^{\frac{2}{3}}) ^{\frac{1}{2}} $ $ $
3. $\left(p^{\frac{1}{4}}\right)^{\frac{1}{2}}$
* Use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when simplifying an exponential expression.

Example: Simplify the following expressions.

1. $y^{3}\left(y^{\frac{5}{2}}\right)^{-2}$
2. $w^{-2}\left(w^{\frac{5}{3}}\right)^{3} $ $ $
3. $\left(s^{-5}\right)^{-\frac{1}{2}}(s^{\frac{3}{2}})$

**Objective 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Raising a Product to a Power: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Example:

Example: Simplify the expression.

1. $\left(5x^{3}\right)^{2}$
2. $\left(7m^{9}\right)^{3}$
3. $\left(2z\right)^{-4}$
4. $(3g^{4})^{-2}$

Example: Simplify the expressions.

1. $\left(n^{\frac{1}{2}}\right)^{10}\left(4mn^{-\frac{2}{3}}\right)^{3}$ c. $\left(3c^{\frac{5}{2}}\right)^{4}\left(c^{2}\right)^{3}$
2. $\left(x^{-2}\right)^{2}\left(3xy^{5}\right)^{4}$ d. $\left(6ab\right)^{3}\left(5a^{-3}\right)^{2}$

Example: (Use properties of exponents to solve the problem.) The expression $\frac{1}{2}mv^{2}$ gives the kinetic energy, in joules, of an object with a mass of $m$ kg traveling at a speed of $v$ meters per second. What is the kinetic energy of an experimental unmanned jet with a mass of $1.3 x 10^{3}$ kg traveling at a speed of about $3.1 x 10^{3}$ m/s?

**7.4 Division Properties of Exponents**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Dividing powers with the same base: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Example:

Example: Simplify each expression.

1. $\frac{x^{4}}{x^{7}}$ d. $\frac{y^{\frac{3}{4}}}{y^{\frac{1}{2}}}$
2. $\frac{x^{\frac{5}{2}}}{x^{2}} $ e. $\frac{a^{-3}b^{7}}{a^{5}b^{2}}$

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1. $\frac{m^{2}n^{4}}{m^{5}n^{3}}$ f. $\frac{x^{4}y^{-1}z^{8}}{x^{4}y^{-5}z} $

Example: Population density describes the number of people per unit area. During one year, the population of Angola was $1.21 x 10^{7}$ people. The area of Angola is $4.81 x 10^{5}$ mi2. What was the population density of Angola that year?

**Objective 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Raising a Quotient to a Power: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Example:

Example: Simplify the expression.

1. $\left(\frac{x^{2}}{y^{3}}\right)^{4}$
2. $\left(\frac{z^{\frac{2}{3}}}{5}\right)^{3}$
3. $\left(\frac{4}{x^{3}}\right)^{2}$

Example: Simplify the expressions.

1. $\left(\frac{2x^{6}}{y^{4}}\right)^{-3}$
2. $\left(\frac{a}{5b}\right)^{-2}$

**7.5 Rational Exponents and Radicals**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Rational exponents can be used to represent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ The number under the radical sign is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ The number in the crook of the radical sign is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
		- If there is no index, the degree is \_\_\_\_\_\_\_, which means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Example:

Example: Simplify each expression.

1. $\sqrt[3]{125}$ d. $\sqrt[5]{32}$
2. $\sqrt[4]{16}$ e. $\sqrt[3]{64}$

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1. $\sqrt[3]{27}$ f. $\sqrt[2]{36} $
* You can also write expressions that have rational exponents like $\frac{2}{3}$ in radical form.
	+ Converting between rational and radical form:
	+ Example: $8^{\frac{2}{3}}$

Example: Convert the expression to radical form.

1. $12a^{\frac{2}{3}}$ c. $5x^{\frac{1}{3}}$
2. $a^{\frac{5}{6}}$ d. $\left(54y\right)^{\frac{2}{3}}$

Example: Convert the expression to exponential form.

1. $\sqrt[5]{b^{3}}$ d. $12\sqrt[3]{x^{4}}$
2. $\sqrt[3]{s^{2}}$ e. $\sqrt{\left(4y\right)^{5}}$
3. $\sqrt[3]{27d^{5}}$ f. $\sqrt[4]{256a^{8}}$

Example: You can estimate the metabolic rate of living organisms based on body mass using Kleiber’s Law. The formula $R=73.3\sqrt[4]{M^{3}}$ relates metabolic rate $R$ measured in Calories per day to body mass $M$ measured in kilograms. What is the metabolic rate of a dog with a body mass of 18 kg?

**7.6 Exponential Functions**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* An exponential function is a function in the form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, where $a \ne 0, b>0, and b\ne 1$.
	+ Example:
* When given a table of values or ordered pairs and the x-values have a common difference:
	+ If the y-values have a common difference, the values represent a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ If the y-values have a common ratio, the values represent an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Example: Does the table or rule represent a linear or an exponential function?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | 0 | 1 | 2 | 3 |
| Y | -1 | -3 | -9 | -27 |

1.
2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | 1 | 2 | 3 | 4 |
| Y | -1 | 1 | 3 | 5 |

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1. $y=3x$
2. $y=3·6^{x}$ $ $

Example: Suppose 30 flour beetles are left undisturbed in a warehouse bin. The beetle population doubles each week. The function $f\left(x\right)=30·2^{x}$ gives the population after $x$ weeks. How many beetles will there be after 56 days?

**Objective 2:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Example: Graph $y=2^{x}$ and $y=4^{x}$.



Example: Graph $y=\frac{1}{2}(3^{x})$ and $y= -\frac{1}{2}(3^{x})$.



Example: Computer mapping software allows you to zoom in on an area to view it in more detail. The function $f\left(x\right)=100 ·0.25^{x}$ models the percent of the original area the map shows after zooming in $x$ times. Graph the function.

Example: You can also zoom out to view a larger area on the map. The function $f\left(x\right)=100·4^{x}$ models the percent of the original area the map shows after zooming out $x$ times. Graph the function.



**7.7 Exponential Growth and Decay**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Exponential growth can be modeled by the function \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ The base $b$ is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Example:
	+ Graph:

Example: Since 2005, the amount of money spent at restaurants in the United States has increased about 7% each year. In 2005, about $360 billion was spent at restaurants.

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Example: Suppose that in 1985, there were 285 cell phone subscribers in a small town. The number of subscribers increased by 75% each year after 1985. How many cell phone subscribers were in the small town in 1994? Write an expression to represent the equivalent monthly cell phone subscription increase.

* Compound interest – when a bank pays interest on both the principal and the interest an account has already earned.
	+ Example: Create a table to represent the amount in an account that earns compound interest for 5 years.
	+ Formula for compound interest:

Example: Suppose that when your friend was born, your friend’s parents deposited $2000 in an account paying 4.5% interest compounded quarterly. What will the account balance be after 18 years?

Example: Suppose that the account from above pays interest compounded monthly. What will the account balance be after 18 years?

* Exponential decay can be modeled by the function \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ The base $b$ is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Example:
	+ Graph:

Example: The kilopascal is a unit of measure for atmospheric pressure. The atmospheric pressure at sea level is about 101 kilopascals. For every 1000-m increase in altitude, the pressure decreases about 11.5%. What is the approximate pressure at an altitude of 3000 m?

**7.8 Geometric Sequences**

**Objective 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* In a geometric sequence, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of any term to its preceding term is a constant value.
	+ Example:
	+ Recursive formula:
	+ Explicit formula:

Example: Determine whether the sequence is a geometric sequence.

1. $20, 200, 2000, 20,000, 200,000$, …
2. $2, 4, 6, 8, 10$, …
3. $5, -5, 5, -5, 5$, …
4. $3, 6, 12, 24, 48, …$
5. $\frac{1}{3},\frac{1}{9}.\frac{1}{27},\frac{1}{81}, …$

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Example: Find the recursive and explicit formulas for each sequence.

1. $7, 21, 63, 189, …$

Recursive:

Explicit:

1. $2, 4, 8, 16, …$

Recursive:

Explicit:

1. $40, 20, 10, 5, …$

Recursive:

Explicit:

Example: Two managers at a clothing store created sequences to show the original price and the marked-down price of an item. Write a recursive formula and an explicit formula for each sequence. What will the price of the item be after the 6th markdown?

 First Sequence: $\$60, \$51, \$43.35, \$36.85, …$ Second Sequence: $\$60, \$52, \$44, \$36$

* You can also represent a sequence by using function notation. This allows you to plot the sequence.

Example: Writing geometric sequences as functions

1. A geometric sequence has an initial value of 6 and a common ratio of 2. Write a function to represent the sequence. Graph the function.
2. A geometric sequence has an initial value of 2 and a common ratio of 3. Write a function to represent the sequence. Graph the function.

