Honors Pre-Calculus Name___________________________________

Warm-Up

Date________________ Period____

Factor each completely.

1) $10m^2 - 11m - 8$

Simplify each expression.

2) $\dfrac{16n^2 - 48n}{32n}$

3) $\dfrac{10m + 60}{m + 6}$

4) $\dfrac{p^2 - 13p + 42}{10p - 60}$

Honors Pre-Calculus Name________________________________

Warm-Up

Date________________ Period____

Factor each completely.

1) $10m^2 - 11m - 8$

$(2m + 1)(5m - 8)$

Simplify each expression.

2) $\dfrac{16n^2 - 48n}{32n}$

$\dfrac{n - 3}{2}$

3) $\dfrac{10m + 60}{m + 6}$

10

4) $\dfrac{p^2 - 13p + 42}{10p - 60}$

$\dfrac{p - 7}{10}$

Unit 5

Exponents & Logarithms

5-1: Growth & Decay
Integral Exponents

Learning Targets:

- I can define and apply integral exponents

Suppose that the cost of a hamburger has been increasing at the rate of 9% per year. Then, each year the cost is _1.09_ times the cost in the previous year.

Suppose that the cost now is $\$4$. Some projected future costs are given in the table below.

Time (years from now)	0	1	2	3	t
Cost (dollars)	4	$4(1.09)$	$4(1.09)^2$	$4(1.09)^3$	$4(1.09)^t$

The table suggests that the cost is a function of time t. Since the variable t occurs as an exponent, the cost is said to be an *exponential function* of time:

$$C(t) = 4(1.09)^t$$

When $t > 0$, the function gives future costs, and when $t < 0$, the function gives costs in the past.

Example 1

Use the cost function $C(t) = 4(1.09)^t$ to find the cost of a hamburger:

a) 5 years from now

$$C(5) = 4(1.09)^5$$

$$\approx 4(1.54)$$

$$\approx 6.15 \Rightarrow \boxed{\approx \$6.15}$$

b) 5 years ago

$$C(5) = 4(1.09)^{-5}$$

$$\approx 4(0.65)$$

$$\approx 2.6 \Rightarrow \boxed{\approx \$2.60}$$

Fun fact: The world's most expensive hamburger

Cost: $5000.00

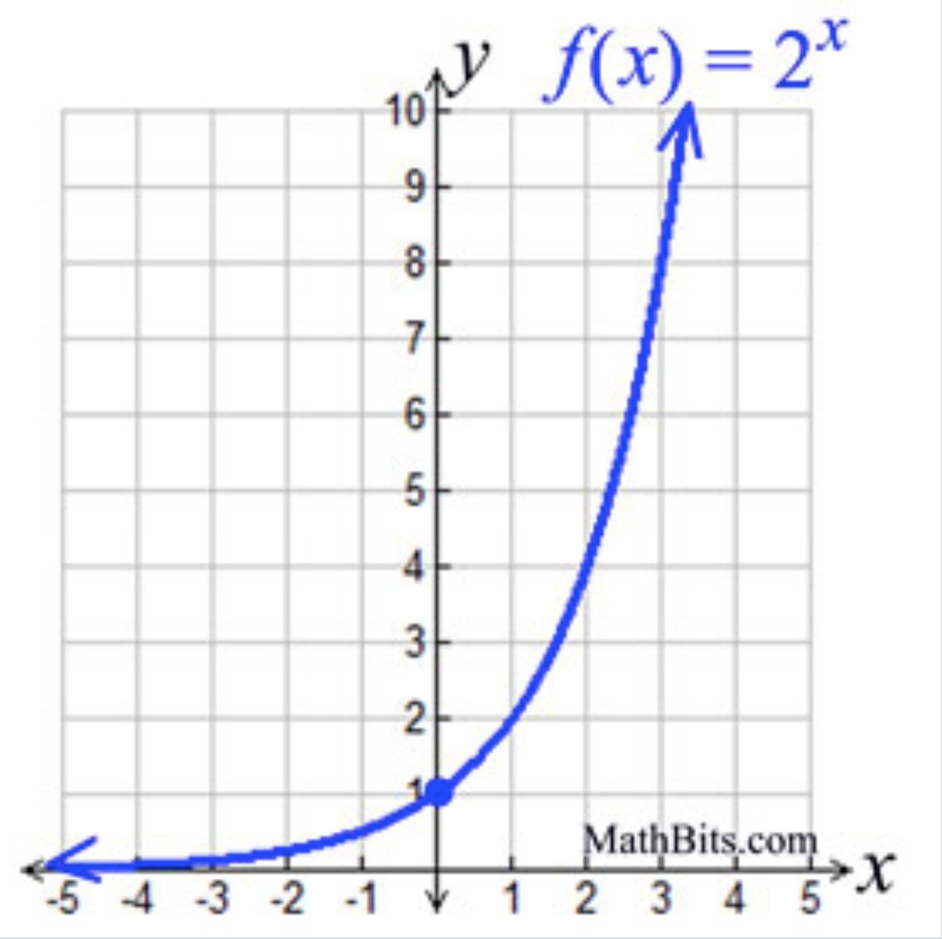
Location: Fleur restaurant, inside Mandalay Bay Casino in Las Vegas

Exponential Growth

$f(x) = ab^x$

$a \neq 0$

$b > 1$

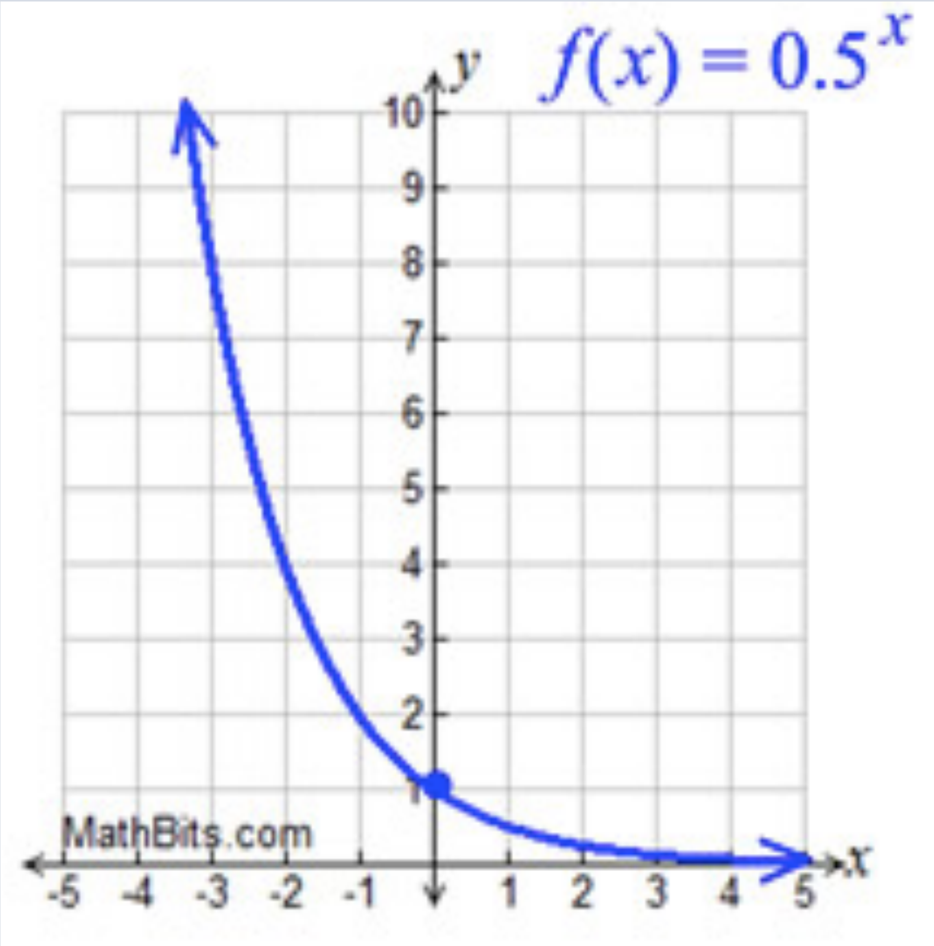


Exponential Decay

$f(x) = ab^x$

$a \neq 0$

$0 < b < 1$



Example 2

Suppose that a radioactive isotope decays so that the radioactivity present decreases by 15% per day. If 40 kg are present now, find the amount present:

a) 6 days from now

$$A(t) = A_0(1+r)^t$$

$$\approx 40(1-0.15)^6$$

$$\approx 15.1 \text{ kg}$$

b) 6 days ago

$$\approx 40(1-0.15)^{-6}$$

$$\approx 106.1 \text{ kg}$$

Radioactive Decay: Chernobyl disaster

What happened: Massive explosion at a nuclear power plant.

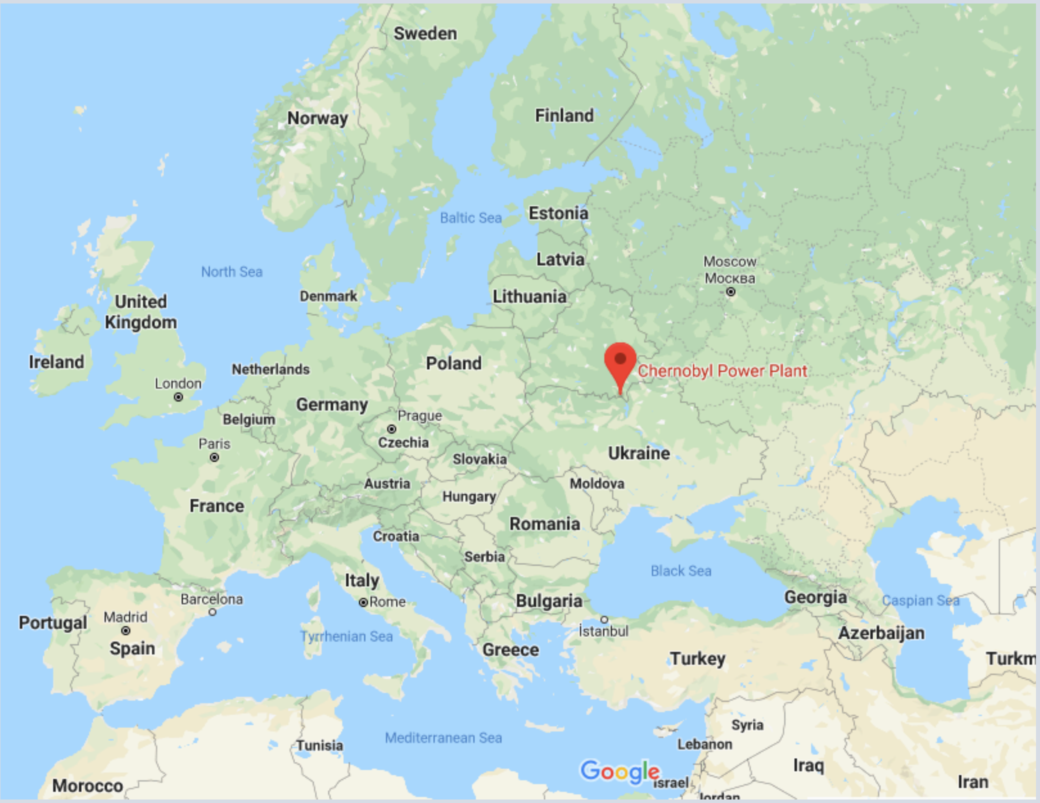
Radioactive Decay: Chernobyl disaster

Where is Chernobyl: Ukraine

When: 1986

Explosions are bad, but why is this one such a big deal?

The nuclear radiation levels released from the explosion were enormous. Worked were exposed to lethal doses in just one minute.



Radioactive Decay: Chernobyl disaster

Why is it still uninhabited?

The model represents the amount of plutonium P that remains after t years after an initial amount i:

$$P = i\left(\frac{1}{2}\right)^{t/24,360}$$

When will P be 0? Never…

Experts believe that, at the actual explosion site, it will be safe for humans in 20,000 years.

Rules of Exponents or Laws of Exponents	
Multiplication Rule	$a^x \times a^y = a^{x+y}$
Division Rule	$a^x \div a^y = a^{x-y}$
Power of a Power Rule	$(a^x)^y = a^{xy}$
Power of a Product Rule	$(ab)^x = a^x b^x$
Power of a Fraction Rule	$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
Zero Exponent	$a^0 = 1$
Negative Exponent	$a^{-x} = \frac{1}{a^x}$
Fractional Exponent	$a^{\frac{x}{y}} = \sqrt[y]{a^x}$

Examples: Simplify.

1) $2m^{-3}n^{-1}p^{3} \cdot 4nm^{3}p^{2} = 8p^{5}$

2) $2x^{-1}y^{-1} \cdot yx^{4}z^{-4} = \frac{2x^{3}}{z^{4}}$

Examples: Simplify.

3) $(2a^{-3}b^{-2}c^4)^4 = \dfrac{16c^{16}}{a^{12}b^8}$

4) $(2x^{-2}z^3)^{-3} = \dfrac{x^6}{8z^9}$

Examples: Simplify.

5) $$\frac{2m^{-4}p^{2}}{mp^{4}q^{2}} = \frac{2}{m^{5}p^{2}q^{2}}$$

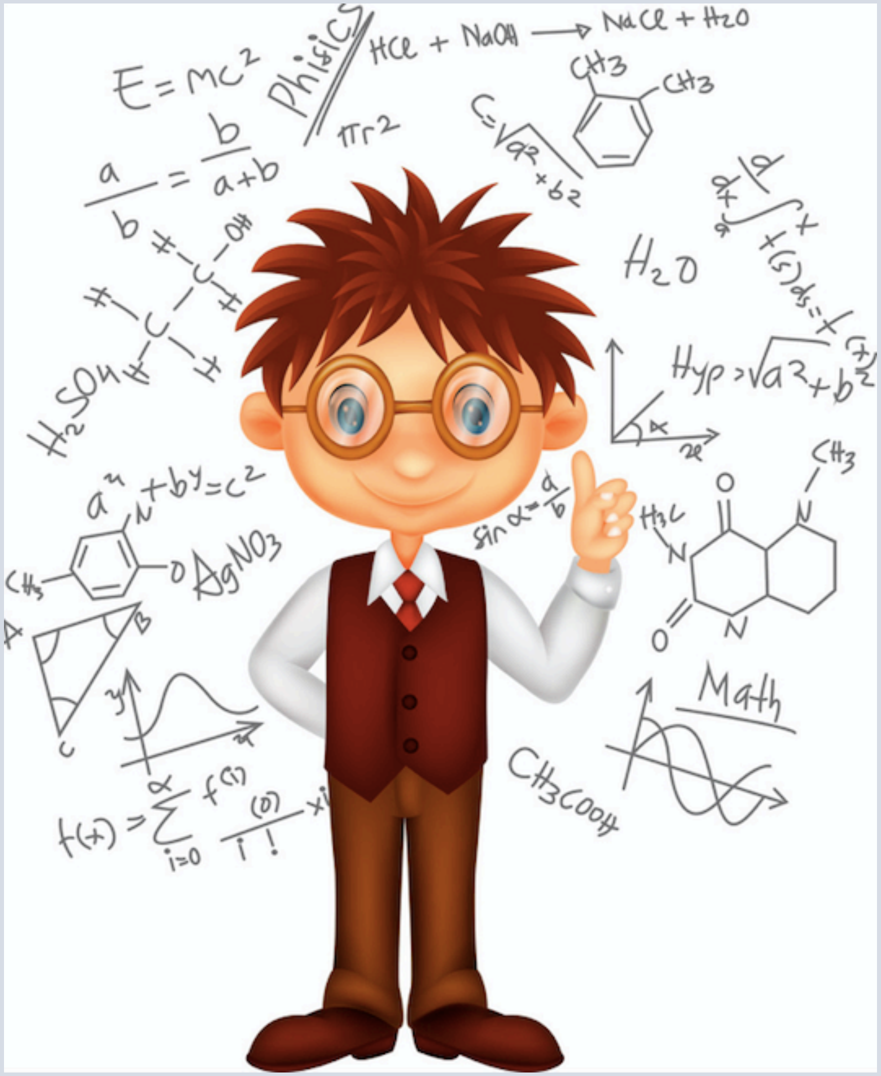
6) $$\frac{2r^{-3}}{4p^{4}q^{-4}} = \frac{q^{4}}{2r^{3}p^{4}}$$

Examples: Simplify.

7) $(2x^{-4}y^{-2}z^{3})^{-4} \cdot y^{2}z^{3} = \dfrac{x^{16}y^{10}}{16z^{9}}$

8) $\left(\dfrac{x^{3}y^{-1}z^{4}}{(2z^{3})^{2}}\right)^{4} = \dfrac{x^{12}}{256y^{4}z^{8}}$

You try…



Examples: Simplify.

9) $\dfrac{x^5 + x^{-2}}{x^{-3}} = \dfrac{x^5}{x^{-3}} + \dfrac{x^{-2}}{x^{-3}} = x^8 + x$

10) $\dfrac{x^5 \cdot x^{-2}}{x^{-3}} = \dfrac{x^3}{x^{-3}} = x^6$

Practice Problems

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