Alg 3 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

 WS Assessment

 Target 11:

APPLICATION OF Exponential and LOGARITHM functions

**I can:**

* Apply exponential and logarithmic functions to solve problems.

**Unit 4: Logarithms & Exponentials**

* **C**[**CSS.MATH.CONTENT.HSF.LE.A.4**](http://www.corestandards.org/Math/Content/HSF/LE/A/4/): For exponential models, express as a logarithm the solution to *abct* = *d* where *a*, *c*, and *d*are
* [**CCSS.MATH.CONTENT.HSF.IF.C.8.B**](http://www.corestandards.org/Math/Content/HSF/IF/C/8/b/): Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)ᵗ, y = (0.97)ᵗ, y = (1.01)12ᵗ, y = (1.2)ᵗ/10, and classify them as representing exponential growth or decay.
* [**CCSS.MATH.CONTENT.HSF.BF.A.1**](http://www.corestandards.org/Math/Content/HSF/BF/A/1/): Write a function that describes a relationship between two quantities.\*
* [**CCSS.MATH.CONTENT.HSF.BF.A.1.A**](http://www.corestandards.org/Math/Content/HSF/BF/A/1/a/): Determine an explicit expression, a recursive process, or steps for calculation from a context.
* [**CCSS.MATH.CONTENT.HSF.BF.A.1.B**](http://www.corestandards.org/Math/Content/HSF/BF/A/1/b/): Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model*.
* [**CCSS.MATH.CONTENT.HSA.SSE.A.1.B**](http://www.corestandards.org/Math/Content/HSA/SSE/A/1/b/): Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P*.

HW# 11 Expo and Log function – [www.deltamath.com](http://www.deltamath.com)

**Interest Rate Problems** $A=P(1+\frac{r}{n})^{nt}$ A = Pert if continuously

A $1,000 deposit is made at a bank that pays 12% compounded annually. How much will you have in your account at the end of 10 years? What if it is compound monthly? weekly?

An $1,000 investment is made in a trust fund at an annual percentage rate of 12%, compounded monthly. How long will it take the investment to reach $2,000?

If you invested $1,000 in an account paying an annual percentage rate (quoted rate) compounded daily (based on a bank year of 360 days) and you wanted to have $2,500 in your account at the end of your investment time, what interest rate would you need if the investment time were 1 year, 10 years, 20 years, 100 years?

If you invested $1,000 in an account paying an annual percentage rate (quoted rate) of 12%, compounded continuously, how much would you have in your account at the end of 1 year, 10 years, 20 years, 100 years?

If you invested $1,000 in an account paying an annual percentage rate (quoted rate) of 12%, compounded weekly, how much would you have in your account at the end of 1 year, 10 years, 20 years, 100 years? How long will it take the investment to reach $2,000? What if you want to have $2000 in 1 year, then what would be the interest rate?

**Mortgage Problems** $P=\frac{rM}{1-(1+\frac{r}{n})^{-nt}}÷n$

 where P = the payment, r = the annual rate, M = the mortgage amount (loan),

t = the number of years, and n = the number of payments per year (most of time, monthly)

What is the monthly payment on a mortgage of $75,000 with an 8% interest rate that runs for 20 years, 25 years, 30 years? How much interest is paid over 20 years, 25 years, 30 years?

Check with calculator.net <https://www.calculator.net/loan-calculator.html>

A 30-year mortgage loan of $600K at 9.5% APR.

Find the monthly payments and how much interest the lender make

Show me both ways (desmos and calculator.net) for stamp.

Given the monthly payment, find the time needed

$$P=\frac{rM}{1-(1+\frac{r}{n})^{-nt}}÷n$$

time t = ?

A 30-year mortgage loan of $600K at 9.5% APR.

Find the monthly payments (did it last page) =

Now if you add to the payment $500 each month, how much you can save in term of time and money.

Check with calculator.net <https://www.calculator.net/mortgage-calculator.html>

A 15-year mortgage loan of $300K at 6.5% APR. If you add to the payment $500 each month, how much you can save in term of time and money. Show me both ways for stamp

**Population Problems**

Suppose that you are observing the behavior of cell duplication in a lab. In one experiment, you started with one cell and the cells doubled every minute. Write an equation with base 2 to determine the number (population) of cells after one hour.

Determine how long it would take the population (number of cells) to reach 100,000 cells.

Write an equation with base 5 that is equivalent to the equation *f* (*t*) = 2t.

Suppose that you are observing the behavior of cell duplication in a lab. In one experiment, you started with one cell and the cells tripling every minute. Write an equation with base 3 to determine the number (population) of cells after one hour.

Determine how long it would take the population (number of cells) to reach 100,000 cells.

Write an equation with base 10 that is equivalent to the equation *f* (*t*) = 3t.

**Radioactive Decay Problems** $f\left(t\right)=ae^{bt}$ b is called the decay constant

If you start a biology experiment with 5,000,000 cells and 45% of the cells are dying every minute, how long will it take to have less than 1,000 cells?

Hospitals utilize the radioactive substance iodine-131 in the diagnosis of conditions of the thyroid gland. The half-life of iodine-131 is eight days. Determine the decay constant b. If a hospital acquires 2 g of iodine-131, how much of this sample will remain after 20 days ? How long will it be until only 0.01 g remains?

**Earthquake Problems** Charles Richter scale $M=log\frac{I}{S}$

I is the intensity of the earthquake; S is the intensity of standard (A = 10-4 cm)

Early in the 20th century the earthquake in San Francisco registered 8.3 on the Richter scale. In the same year, another earthquake was recorded in South America that was four time stronger. What was the magnitude of the earthquake in South American?

A recent earthquake in San Francisco measured 7.1 on the Richter scale. How many times more intense was the San Francisco earthquake described above at the begin of the century.

Early in the century an earthquake measured 8.0 on the Richter scale. In the same year, another earthquake was recorded that measured six time stronger on the Richter scale. What was the magnitude of the earthquake of the stronger earthquake?

**Assessment Target 11**

**I can…** exponents and logarithms in real life application

Let’s say your family plan to buy a new house. After doing some research from the housing market <https://www.zillow.com/portland-or/> you have found a house on sale at the price of

$\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

With your good credit history, your bank agree to lend you this above loan at \_\_\_\_\_\_\_\_\_\_\_% <https://www.bankrate.com/oregon/mortgage-rates.aspx>

What is your monthly payment if you plan to pay off the loan in 30 years, 15 years.

What is the total interest? Show work. Check with calculator.net

|  |  |
| --- | --- |
| 15 yearsMonthly paymentTotal interest | 30 yearsMonthly paymentTotal interest |

Now with the payment above in 30 years. Let say you will help to contribute in $500 a month (add it into the payment), then how long it take to pay off the loan? Write the formula

How about just $100 a month? Show work