Name: _____ Date: _____

Learning Goal 7.1	Applying one or more transformations to an exponential function, including translations, stretches and reflections.

An exponential function has an equation of the form $f(x) = Ab^x$, where *A* and *b* are constants and $b > 0$.

Example The population of a bacterial culture triples every hour. When the scientist observed the culture, it had already been growing for some time. She developed the equation for the population, P, after t hours as $P = 700(3)^t$, based on $t = 0$ representing the time she started her measurements. How many bacterial cells were there 2 hours before she started measuring?

↳ $t = -2$

$P = 700 \times 3^t$

initial population ↑ ↑ showing the population is tripling

700×3^0
$= 700 \times 1$
$= 700$

$P = 700 \times 3^{-2}$
$= 700 \times \frac{1}{9}$
$\doteq 78$ Bacteria

Example The half-life of a radioactive element can be modelled by

$$M = M_0\left(\frac{1}{32}\right)^{t/45}$$

where M_0 is the initial mass of the element; t is the elapsed time, in hours and M is the mass that remains after time t. Determine the half-life of the element.

↑ how long it takes for half the mass to ... disappear?

need to make this a 2!

$\left(\frac{1}{32}\right)^{t/45}$
$= \left(\frac{1}{2^5}\right)^{t/45}$
$= \left(\frac{1}{2}\right)^{\frac{5t}{45}}$

$\frac{5t}{45}$
$= \frac{t}{9}$

the half life is 9 hours.

Assignment p. 354 # 1 – 7, 11, 13, C2 Quiz Next Day!

Example Cobalt-60, which has a half-life of 5.3 years is used in medical radiology. A sample of 60 mg of the material is present today.

a. Write an equation to relate the amount of colbalt-60 remaining and the number of half-life periods.

$A = 60\left(\frac{1}{2}\right)^{t/5.3}$

60: initial quantity

$\frac{1}{2}$: half-life

$t/5.3$: half-life is 5.3 years.

b. What amount will be present in 10.6 years?

$\frac{10.6}{5.3} = 2 \Rightarrow$ 2 half lives have been completed.

$A = 60\left(\frac{1}{2}\right)^2$

$= 60\left(\frac{1}{4}\right) = 25$ mg

c. How many years will it take for the amount of cobalt-60 to decay to 12.5% of its initial amount?

$12.5\% = \frac{12.5}{100} = \frac{125}{1000} = \frac{5}{40} = \frac{1}{8}$

$\frac{1}{8}$ of $60 = 7.5$ mg

$\frac{7.5}{60} = \frac{60}{60}\left(\frac{1}{2}\right)^{t/5.3}$

$\frac{1}{8} = \left(\frac{1}{2}\right)^{t/5.3}$

$\left(\frac{1}{2}\right)^3 = \left(\frac{1}{2}\right)^{t/5.3}$

$3 = \frac{t}{5.3}$

$t = 15.9$ years.