College Algebra
Section 3.5
Exponential and Logarithmic Models

$$A = Pe^{rt}$$

Initial Investment	Annual % Rate	Time to Double	Amount after 10 years
$5000	7%	9.9 years	$10,068.76

Double $5000 = $10,000

$$10{,}000 = 5000e^{.07t}$$

$$\frac{10{,}000}{5000} = \frac{5000e^{.07t}}{5000}$$

$$2 = e^{.07t}$$

$$\ln 2 = \ln e^{.07t}$$

$$.693 = .07t$$

$$\frac{.693}{.07} = \frac{.07t}{.07}$$

$$9.902 = t$$

9.9 years

10 years
$t = 10$

$$A = 5000e^{.07(10)}$$

$$A = 10{,}068.76$$

Initial Investment	Annual % Rate	Time to Double	Amount after 10 years
$500	.0693 6.93%	10 years	$1000

$A = Pe^{rt}$

$\frac{1000}{500} = \frac{500e^{r(10)}}{500}$

Double
$500
= $1000

$2 = e^{10r}$

$\ln 2 = \ln e^{10r}$

$\frac{.693}{10} = \frac{10r}{10}$

$.0693 = r$

Initial Investment	Annual % Rate	Time to Double	Amount after 10 years
$1000	.0825 8.25%	8.4 years	$2281.88

$A = Pe^{rt}$

Double $1000 = $2000

$\frac{2000}{1000} = \frac{1000e^{.0825t}}{1000}$

$2 = e^{.0825t}$

$\ln 2 = \ln e^{.0825t}$

$\frac{.693}{.0825} = \frac{.0825t}{.0825}$

$8.4 = t$

Work first

$\frac{2281.88}{1000} = \frac{1000e^{r(10)}}{1000}$

$2.28188 = e^{10r}$

$\ln 2.28188 = \ln e^{10r}$

$\frac{.825}{10} = \frac{10r}{10}$

$.0825 = r$

Isotope	Half-Life (years)	Initial Quantity	Amount after 1000 years
^{226}Ra	1599	4g	2.59 g

Can still use $A=Pe^{rt}$

Half of 4 = 2

$$\frac{2}{4} = \frac{4e^{r(1599)}}{4}$$

$$\frac{1}{2} = e^{1599r}$$

$$\ln\frac{1}{2} = \ln e^{1599r}$$

$$-.693 = 1599r$$

$$\frac{-.693}{1599} = \frac{1599r}{1599}$$

$$-.00043335 = r$$

Watch for scientific notation on your calculator

$$A = 4e^{(-.0004335)(1000)}$$

$$A = 2.59$$

Isotope	Half-Life (years)	Initial Quantity	Amount after 1000 years
^{14}C	5715	3.95g	3.5

$A = Pe^{rt}$

Half-life
half remains

$\frac{1}{2} = e^{r(5715)}$

$\ln \frac{1}{2} = \ln e^{5715r}$

$\frac{-.693}{5715} = \frac{5715r}{5715}$

$-.000121 = r$

$3.5 = Pe^{(-.00121)(1000)}$

$3.5 = P(.8858)$

$\frac{3.5}{.8858} = \frac{P(.8858)}{.8858}$

$3.95 = P$

Growth $y = ae^{bx}$

$A = Pe^{rt}$

Decay $y = ae^{-bx}$