

# Lesson 115: Exponential functions / Compound Interest

$$A_t = A_0 e^{kt}$$

$A_0$  = initial amount;  $A$  at  $t=0$   
 $A_t$  = Amount at time  $t$   
 $k$  = rate       $t$  = time

1. In the beginning, there were 400 bacteria. The number of bacteria increased exponentially. Three days later, there were 2000 bacteria. How many would there be in 8 days?

$t$	$A_t$		$A_t = A_0 e^{kt}$	$A_8 = A_0 e^{k \cdot 8}$
0	$A_0 = 400$	}	$A_3 = A_0 e^{3k}$	$A_8 = 400 e^{(0.536) \cdot 8}$
3	$A_3 = 2000$		$2000 = 400 e^{3k}$	$A_8 = 400 e^{4.29}$
8	$A_8$		$5 = e^{3k}$	$A_8 = 400 \cdot e^{4.29}$
			$\ln 5 = \ln e^{3k}$	$= 400 \cdot 72.97$
			$1.61 = 3k$	$= 29,187$
			$k = 0.536$	

2. There were 4.25 ounces of radioactive material. Ten years later, 3.92 ounces remained. How much remained after 30 years?

$t$	$A_t$		$A_t = A_0 e^{kt}$	$A_{30} = 4.25 e^{30 \cdot k}$
0	$4.25 = A_0$	}	$A_{10} = A_0 e^{10k}$	$A_{30} = 4.25 e^{-2.74}$
10	$3.92 = A_{10}$		$3.92 = 4.25 e^{10k}$	$A_{30} = 4.25 e^{-2.74}$
30	$A_{30}$		$\frac{3.92}{4.25} = \frac{4.25 e^{10k}}{4.25}$	$A_{30} = 3.33 \text{ oz.}$
			$.922 = e^{10k}$	
			$\ln .922 = 10k$	

3. Rodney deposited \$5000 in an account that paid  $7\frac{1}{2}\%$  interest compounded continuously. How much did he have in 10 years?

$A_t = P e^{rt}$	$(0.075)(10)$
$A_{10} = 5000 e^{.75}$	$= 5000 e^{.75}$
$= 5000 e^{.75}$	$= \$10,585$

$P$  = Principal = 5000  
 $r$  = interest rate  $\leftarrow .075$   
 $t$  = time