7.3 Word Problem Sheet

Monday, April 6, 2020 4:01 PM

Pre-Calculus 12 $A = A_0(c)^{t/T}$ $A = P\left(1 + \frac{r}{n}\right)^{nt}$

Name : _____ Block : _____

7.3 Models of Growth and Decay Exponential Functions

Write an exponential function for each situation then solve the problem.

1. There are now 300 insects in a colony. The population doubles every 5 days. What is the population in 18 days?

$A_0 = 300$, $c = 2$, $T = 5$, $A = ?$, $t = 18$

$A = A_0(c)^{t/T}$

$A = 300(2)^{18/5}$

$A = 3638$

2. For every meter a diver descends below the surface, the light intensity is reduced by 2.5%. P is the percent of surface light present. At a depth of 10m how much light remains?

$D = 1$, $c = 100\% - 2.5\% = 97.5\% = 0.975$, $d = 10$, $P_0 = 100$

$P = P_0(c)^{d/D}$

$P = 100(.975)^{10/1}$

$P = 77.63\%$

3. A radioactive substance has a half-life of 6 years. If 20 grams are present initially, how much will remain after 2 years?

$c = \frac{1}{2}$, $T = 6$, $A_0 = 20$, $t = 2$

$A = A_0(c)^{t/T}$

$A = 20\left(\frac{1}{2}\right)^{2/6}$

$A = 15.87\ g$

4. The half-life of radioactive iodine is 8.2 days. After how long will only 25% of the iodine be present?

$c = \frac{1}{2}$, $T = 8.2$, $A = 25\%$, $A_0 = 100\%$, $t = ?$

$A = A_0(c)^{t/T}$

$\frac{25}{100} = \frac{100\left(\frac{1}{2}\right)^{t/8.2}}{100}$

$\frac{1}{4} = \left(\frac{1}{2}\right)^{t/8.2}$

$\left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^{t/8.2}$

$2 = \frac{t}{8.2}$

$t = 2(8.2) = 16.4$ days

5. A bacteria starts with 6250 bacteria and doubles every 3 hours. When will the bacteria count be 50000?

$A_0 = 6250$, $c = 2$, $T = 3$

$A = A_0(c)^{t/T}$

$50\,000 = 6250(2)^{t/3}$

$2^3 = 2^{t/3}$

$3 = t$

$A_0 = 6250$

$c = 2$

$T = 3$

$A = 50000$

$t = ?$

$$\frac{50000}{6250} = \frac{6250(2)^{t/3}}{6250}$$

$$8 = 2^{t/3}$$

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

$$t = 9 \text{ hrs}$$

6. A colony of insects numbers 500 and doubles every 8 days. How long ago was the population 125?

$A_0 = 500$
$c = 2$
$T = 8$
$A = 125$
$t = ?$

$A = A_0(c)^{t/T}$

$\frac{125}{500} = \frac{500(2)^{t/8}}{500}$

$\frac{1}{4} = 2^{t/8}$

$2^{-2} = 2^{t/8}$

$-2 = \frac{t}{8}$

$t = -2(8)$

$t = -16$

16 days ago

7. A radioactive substance has a half-life of 3.5 years. How long will it take for only 6.25% of it to remain?

$c = \frac{1}{2}$
$T = 3.5$
$A = 6.25\%$
$A_0 = 100\%$
$t =$

$A = A_0(c)^{t/T}$

$\frac{6.25}{100} = \frac{100(\frac{1}{2})^{t/3.5}}{100}$

$.0625 = (\frac{1}{2})^{t/3.5}$

$(\frac{1}{2})^4 = (\frac{1}{2})^{t/3.5}$

$4 = \frac{t}{3.5}$

$t = 4(3.5)$

$t = 14$

8. A painting triples in value every 8 years. It is currently worth $1000. When will the painting be worth $243000?

$c = 3$
$T = 8$
$A_0 = 1000$
$A = 243000$
$t =$

$A = A_0(c)^{t/T}$

$\frac{243000}{1000} = \frac{1000(3)^{t/8}}{1000}$

$243 = 3^{t/8}$

$3^5 = 3^{t/8}$

$5 = t/8$

$t = 40$

9. A piece of machinery valued at $30, 000 depreciates at a rate of 10% per year. How much will it be worth in 7 years?

$A_0 = 30\,000$
$c = 100\% - 10\%$
$c = 90\% = .9$
$t = 7$
$T = 1$

$A = A_0(c)^{t/T}$

$A = 30\,000(.9)^{7/1}$

$A = \$14\,348.91$

10. $1000 is invested at a rate of 3.2% compounded monthly. How much will it be worth is 50 years?

$P = 1000$
$r = 3.2\% = .032$
$n = 12$
$t = 50$
$A = ?$

$A = P(1 + \frac{r}{n})^{nt}$

$A = 1000(1 + \frac{.032}{12})^{12(50)}$

$A = 4942.50$