Pre-Calculus 12

7.3 Part 2 Growth and Decay Problems

Growth and Decay $A = A_0(c)^{\frac{t}{T}}$

$A =$ Final Amount
$A_0 =$ Initial Amount
$c =$ Rate
$t =$ time
$T =$ How often the rate changes

If $c > 1$ Increasing Growth
$0 < c < 1$ Decreasing Decay

1. A colony of insects grows from 1000 to 64000 in 15 days. What is the doubling rate?

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

$A = 64000$
$A_0 = 1000$
$c = 2$
$t = 15$
$T =$

$\frac{64000}{1000} = \frac{1000(2)^{15/T}}{1000}$

$64 = 2^{15/T}$

$2^6 = 2^{15/T}$

$T\,6 = \left(\frac{15}{T}\right)T$

$6T = 15$

$T = 15/6 = 2.5$ days

2. A radioactive substance has a half-life of 18.2 hours. How long will it take until only 12.5% of the sample remains?

$A = 12.5\%$

$A_0 = 100\%$

$c = \frac{1}{2}$

$t =$

$T = 18.2$

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

$12.5 = 100\left(\frac{1}{2}\right)^{t/18.2}$

$\frac{12.5}{100} = \left(\frac{1}{2}\right)^{t/18.2}$

$.125 = \left(\frac{1}{2}\right)^{t/18.2}$

$\left(\frac{1}{2}\right)^3 = \left(\frac{1}{2}\right)^{t/18.2}$

$18.2(3) = \left(\frac{t}{18.2}\right)^{18.2}$

$18.2(3) = t$

$t = 54.6$ hrs

3. A painting doubles in value every 5 years. It is currently worth $1000. How much time is needed for it to be worth $32000.

$A = 32000$

$A_0 = 1000$

$c = 2$

$t =$

$T = 5$

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

$\frac{32000}{1000} = \frac{1000(2)^{t/5}}{1000}$

$32 = 2^{t/5}$

$2^5 = 2^{t/5}$

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

$25 = t$

25 years

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

$A =$ Final Amount
$P =$ Initial Amount (Principle)
$r =$ rate
$t =$ time (years)
$n =$ # of times compounded per year

n=1 compounded annually
n=12 compounded monthly
n=52 compounded weekly
n=4 compounded quarterly

4. You invest $1000 at 2% compounded monthly. How much will it be worth in 15 years?

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

$A = 1000(1 + \frac{0.02}{12})^{12 \cdot 15}$

$A = \$1349.52$

$A =$
$P = 1000$
$r = 0.02$
$n = 12$
$t = 15$