Exponential Modeling
Students will be able to apply exponential formulas

HPC/RPC

Key

A = Future Amount
P = Principle (Beginning Amount)
r = % → as a decimal
t = years
n = times per year interest is compounded

Common Exponential Functions (a.k.a. "Formulas")

Interest compounded annually (or population growth . . .)

$$A = P(1 + r)^t$$

Interest compounded *n* times per year

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

Interest compounded continuously

$$A = Pe^{rt}$$

Half-life

$$A = A_0(0.5)^{t/h}$$

h = half life

Example 1

Krysti invests $2000 in an account with a 6% interest rate, making no other deposits or withdrawals. What will Krysti's account balance be after 15 years if the interest is compounded:

a. Annually?

$A = 2000(1 + .06)^{15}$

$A = \$4793.12$

b. Semi-annually?

$A = 2000\left(1 + \frac{.06}{2}\right)^{2 \cdot 15}$

$A = \$4854.52$

c. Continuously?

$A = 2000e^{.06(15)}$

$A = \$4919.21$

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Example 2

Krysti invests $2000 in an account with a 6% interest rate, making no other deposits or withdrawals. How long will it take for Krysti's account to be worth $5000 if interest is compounded:

a. Quarterly?

$5000 = 2000\left(1 + \frac{.06}{4}\right)^{4t}$

$\frac{5}{2} = (1.015)^{t}$

$\log_{1.015} \frac{5}{2} = 4t$

$\frac{4t}{4} = \frac{61.5}{4}$

$t = 15.38$ or About 15 years 4 months

b. Continuously?

$5000 = 2000 e^{.06t}$

$\frac{5}{2} = e^{.06t}$

$\frac{\ln \frac{5}{2}}{.06} = \frac{.06t}{.06}$

$t = 15.27$ or About 15 years 3 months

c. What interest rate would Krysti need in order for her account to be worth $8000 after 20 years, if interest is compounded annually? Continuously?

$8000 = 2000(1 + .\cancel{06})^{20}$

$4 = (1 + r)^{20}$

$\sqrt[20]{4} = \sqrt[20]{(1+r)^{20}}$

$1.07177 = 1 + r$

$-1 \qquad -1$

$0.072 = r$

about 7.2%