Compound Interest

Compounded Interest

Regular Compounding

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

(Compounded Continuously)

A = accumulated or end amount

P = principal (initial amount, investment)

r = interest rate or growth/decay rate
must be in decimal form (not %)

n = # of times interest compounded in a year

t = time in years

n =	Compounding Periods
1	annually (yearly)
2	semi-annually
4	quarterly
12	monthly
52	weekly
365	daily
use $A=Pe^{rt}$	Continuous

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

Reg. Compounding

Bob is depositing $400 in a savings account with 7% interest, compounded monthly. How much will be in the savings account in 10 years?

$A = ?$
$P = 400$
$r = 7\% = .07$
$n = 12$
$t = 10$

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

$A = 400(1 + \frac{.07}{12})^{(12)\cdot(10)}$

$A = \$803.86$

Janet started a bank account 12 years ago which paid 6% interest, compounded quarterly. and then forgot about it. She just remembered she had the account and checked the balance. She now has $10,217.39. How much was her initial deposit?

$A = 10{,}217.39$
$P = ?$
$r = 6\% = .06$
$n = 4$
$t = 12$

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

$10{,}217.39 = P(1 + \frac{.06}{4})^{48}$

$\frac{10{,}217.39}{(1 + \frac{.06}{4})^{48}} = \frac{P(1 + \frac{.06}{4})^{48}}{(1 + \frac{.06}{4})^{48}}$

$P = \frac{10{,}217.39}{(1 + \frac{.06}{4})^{48}}$

$P = \$5000$

How long will it take for Robert to earn $1200 on $500 that earns 9% interest, compounded daily? Reg. compounding

$A = 1200$
$P = 500$
$r = 9\% = .09$
$n = 365$
$t = ?$

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

$\frac{1200}{500} = \frac{500}{500}(1 + \frac{.09}{365})^{365t}$ (exp)

$2.4 = (1 + \frac{.09}{365})^{365t}$ (b, exp)

Exp. Eq. so rewrite as Log

$\log_{(1 + \frac{.09}{365})} 2.4 = 365t$ (b)

calc → then ÷365

$t = 9.7$ years

Michael decides to invest his graduation money ($2000) in a money market account which pays 7.2%, compounded continuously. Continuous compounding formula

How much will he have in 5 years?

$A = ?$
$P = 2000$
$r = 7.2\% = .072$
$t = 5$

$A = Pe^{rt}$

$A = 2000e^{.072(5)}$

$A = \$2866.06$

When will the money double in value?

$A = 4000$
$P = 2000$
$r = .072$
$t = ?$

$A = Pe^{rt}$ (exp)

$\frac{4000}{2000} = \frac{2000e^{.072t}}{2000}$ (b)

$2 = e^{.072t}$ (#, b, exp)

Exp. Eq. $b^{exp} = \#$ Rewrite as $\log_b \# = exp$

$\log_e 2 = .072t$

$\log_e = \ln$

$\ln 2 = .072t$

$\div .072$

$t = 9.6$ years

Exponential Growth + Decay

Exponential Growth : $y = a(1+r)^t$

y = end amt. a = beginning amt

use when "increased", "appreciates", "spreading"

Exponential Decay : $y = a(1-r)^t$

use when "decreased", "depreciate" "decline", "lose value"