GUIDED NOTES: Compound Interest

Compounded over time period:

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

Compounded continuously:

$$A = Pe^{rt}$$

A: final amount money

P: Principle (initial amount)

r: rate (interest rate) → as a decimal.

n: number of times compounded in 1 year.

t: time in YEARS!

How many times per year

Compounded.....	n =
yearly, annually	1
semiannually	2
quarterly	4
monthly	12

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

← see this ↑ head to this formula.

EX1. What amount will an account have after 5 years (t) if $75 is invested at 8.5% (r) interest compounded continuously? $A = Pe^{rt}$

A: ?
P: 75
r: .085
t: 5

$A = 75e^{.085(5)}$

$A = \$114.72$

EX2. Find the amount owed at the end of 9 years (t) if $5000 is loaned (initial loan) at a rate of 6% (.06) interest compounded quarterly.

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

A: ?
P: 5000
r: .06
n: 4
t: 9

$A = 5000\left(1 + \frac{.06}{4}\right)^{4(9)}$

$A = \$8545.70$

.06

EX3. Determine the amount that must be invested at 6% interest compounded monthly so that $200,000 will be available for retirement in 20 years.

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

A: 200,000
P: ?
r: .06
t: 20
n: 12

$200{,}000 = P\left(1+\frac{.06}{12}\right)^{12\cdot 20}$

$\frac{200{,}000}{3.31} = \frac{P\ 3.31}{3.31}$

$P = \$60422.96$

EX4. What amount invested at 7% interest compounded continuously for 4 years will yield $700? produce, give you

$A = Pe^{rt}$

A: 700
P: ?
r: .07
t: 4

$700 = Pe^{.07(4)}$

$\frac{700}{1.32} = \frac{P(1.32)}{1.32}$

$P = \$530.30$

EX5. If $600 is invested at 6% interest compounded continuously, how long will it take before the amount is $900?

$A = Pe^{rt}$ .06

A: 900
P: 600
r: .06
t: ?

$\frac{900}{600} = \frac{600e^{.06t}}{600}$

$1.5 = e^{.06t}$

$\ln 1.5 = \ln e^{.06t}$

$\ln 1.5 = .06t$

$\frac{\ln 1.5}{.06} = t$

$t = 6.76$ years!

EX6. How long does it take $1500 to double if it is invested at 6% interest compounded semiannually?

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

A: 3000 (1500 x 2)
P: 1500
r: .06
n: 2
t: ?

$\frac{3000}{1500} = \frac{1500\left(1+\frac{.06}{2}\right)^{2t}}{1500}$

$2 = \left(1+\frac{.06}{2}\right)^{2t}$

$2 = (1.03)^{2t}$

$\ln 2 = \ln(1.03)^{2t}$

$\ln 2 = 2t \ln(1.03)$

$\frac{\ln 2}{\ln 1.03} = 2t$

$\frac{23.45}{2} = \frac{2t}{2}$

$t = 11.73$ years