May 14

GUIDED NOTES: Compound Interest

Compounded over time period:

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

Compounded continuously:

$A = Pe^{rt}$

↑ e is a number

A: final amount

P: initial amount (principle)

r: interest rate

n: number of times compounded in one year

t: time periods (in YEARS!)

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

EX1. What amount will an account have after 5 years (t) if $75 (P) is invested at 8.5% (r) interest compounded continuously?

$A = Pe^{rt}$

A: ?

P: 75

r: 8.5% ÷ 100 = .085

t: 5

$A = 75e^{.085 \cdot 5}$

A = $114.72

EX2. Find the amount owed at the end of 9 years (t) if $5000 (P) is loaned at a rate of 6% interest compounded quarterly (n=4).

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

A: ?

P: 5000

r: 6% ÷ 100 = .06

n: 4

t: 9

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

A = $8545.70

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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.

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

A: 200,000
P: ?
r: 6% ÷ 100 = .06
n: 12
t: 20

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

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

\$60,419.23 = P

EX4. What amount invested at 7% interest compounded continuously for 4 years will yield \$700?

give out

$A = Pe^{rt}$

A: 700
P: ?
r: 7% ÷ 100 = .07
t: 4

$700 = Pe^{.07\cdot 4}$

$\frac{700}{1.32} = \frac{P\cdot 1.32}{1.32}$

\$529.05 = P

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

$A = Pe^{rt}$

A: 900
P: 600
r: 6% ÷ 100 = .06
t: ?

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

$1.5 = e^{.06t}$

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

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

$\frac{.41}{.06} = \frac{.06t}{.06}$

6.76 years = t

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

P; A=3000; r; n=2

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

A: 3000
P: 1500
r: 6% ÷ 100 = .06
n: 2
t: ?

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

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

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

$\frac{\ln 2}{\ln(1+\frac{.06}{2})} = \frac{2t\cdot \ln(1+\frac{.06}{2})}{\ln(1+\frac{.06}{2})}$

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

11.72 years = t

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