

2.7 GUIDED NOTES: Compound Interest

Compounded over time period:

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

Compounded continuously:

$$A = P e^{rt}$$

A: final amount

P: principal (initial)

r: interest rate \rightarrow decimal

n: number of times compounded in one year

t: time (years)

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

EX1. What amount will an account have after 5 years if \$75 is invested at 8.5% interest compounded continuously?

$$A = P e^{rt}$$

A: ?

P: 75

r: 0.085

t: 5

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

$$A = \$114.72$$

EX2. Find the amount owed at the end of 9 years if \$5000 is loaned at a rate of 6% interest compounded quarterly.

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

A: ?

P: 5000

r: .06

n: 4

t: 9

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

$$A = \$8545.70$$

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.

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

$$A: 200,000$$

$$P: ?$$

$$r: .06$$

$$n: 12$$

$$t: 20$$

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

$$\frac{200,000}{3.310} = \frac{P \cdot 3.310}{3.310}$$

$$P = \$60,419.23$$

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

$$A = Pe^{rt}$$

$$A: 700$$

$$P: ?$$

$$r: .07$$

$$t: 4$$

$$700 = P e^{.07(4)}$$

$$700 = P \cdot 1.323$$

$$P = \$529.05$$

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

$$A = Pe^{rt}$$

$$A: 900$$

$$P: 600$$

$$r: 0.06$$

$$t: ?$$

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

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

$$\frac{\ln 1.5}{.06} = \frac{.06t \ln e}{.06} \rightarrow 1$$

$$t = 6.758 \text{ years}$$

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

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

$$A: 3000$$

$$P: 1500$$

$$r: 0.06$$

$$n: 2$$

$$t: ?$$

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

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

$$\log_{1.03} 2 = 2t$$

$$\frac{23.449}{2} = \frac{2t}{2}$$

$$t = 11.725 \text{ years}$$