Compound Interest Examples – Not Compounded Annually

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

Where

A = Total value of loan/investment
P = principal
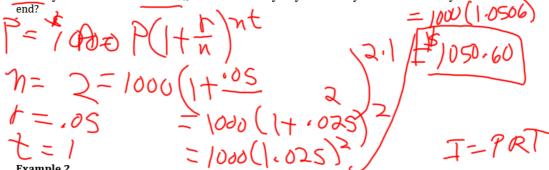r = interest rate (as a decimal) – get by dividing by 100
n = number of interest periods per year
(annually = 1, semi-annually = 2, quarterly = 4, monthly = 12, daily = 365)
t = investment period for the loan/investment

Example 1
If you have a bank account whose **principal** = $1000, and your bank compounds the **interest** semi-annually at **an interest rate** of 5%, how much money do you have in your account at the year's end?

$$P = \$1000 \quad P\left(1 + \frac{r}{n}\right)^{nt}$$
$$n = 2 = 1000\left(1 + \frac{.05}{2}\right)^{2} = 1000(1.0506)$$
$$r = .05$$
$$t = 1 \qquad = 1000(1 + .025)^{2} \qquad \boxed{\$1050.60}$$
$$= 1000(1.025)^{2}$$

$$I = PRT$$

Example 2
If you start a bank account with $10,000 and your bank compounds the interest quarterly at an **interest rate** of 8%, how much money do you have at the year's end ? (assume that you do not add or withdraw any money from the account)

$$P = 10,000 \qquad A = P\left(1 + \frac{r}{n}\right)^{nt}$$
$$n = 4 \qquad = 10000\left(1 + \frac{.08}{4}\right)^{4 \cdot 1} = 10,000(1.0824)$$
$$r = .08 \qquad = 10,000(1 + .02)^{4} \qquad \boxed{10824}$$
$$t = 1 \qquad = 10,000(1.02)^{4}$$

Example 3
Roger invested $20,000 in a mutual fund for 7 years. The interest rate is compounded monthly at 9%. Find the future value of Rogers investment after the 7 year term.

$$P = \$20,000 \qquad A = P\left(1 + \frac{r}{n}\right)^{nt}$$
$$t = 7 \qquad = 20,000\left(1 + \frac{.09}{12}\right)^{(12)(7)}$$
$$n = 12 \qquad = 20,000(1 + .0075)^{84}$$
$$r = .09 \qquad = 20,000(1.0075)^{84}$$
$$= 20000(1.8732)$$
$$\boxed{= \$37464.04}$$

$$I = A - 20,000$$
$$= 37464.04 - 2000$$
$$= 17464.04$$

1

$$I = PRT$$

$n=12$

Example 4

The first credit card that you got charges 12.49 % interest to its customers and compounds that interest **monthly**. Within one day of getting your first credit card, you max out the credit limit by spending $1,200.00 . If you do not buy anything else on the card and you do not make any payments, how much money would you owe the company after 6 months?

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

$$A = 1200\left(1 + \frac{0.1249}{12}\right)^{12(0.5)}$$

$$1200(1 + 0.0104)^{6}$$

$$1200(1.0104)^{6} = 1200(1.0604)$$

$$\$1276.92$$

$t = 0.5 \text{ y} \cdot \text{s} \cdot$

$P = \$1200$

$r = .1249$

$n = 12$

$t = 0.5$

Example 5

You win the lottery and get $1,000,000. You decide that you want to invest all of the money in a savings account. However, your bank has two different plans. In 5 years from now, which plan will provide you with more money

Plan 1	Plan 2
The bank gives you a 6% interest rate and compounds the interest *each month*.	The bank gives you a 12% interest rate and compounds the interest every *2 months (6 times a year)*.

.06

$n=12$

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

$$A = 1\,000\,000\left(1 + \frac{0.06}{12}\right)^{12(5)}$$

$$A = 1\,000\,000(1.005)^{60}$$

$$= 1\,348\,850.15$$

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

$$A = 1000\,000\left(1 + \frac{0.12}{6}\right)^{6(5)}$$

$$A = 1000\,000(1.02)^{30}$$

$$A = 1\,811\,361.58.$$