

5. Rich wants to save \$1000 to put toward the purchase of a motorcycle. For his birthday, he receives \$500. He thinks that he will buy a GIC rather than leave the money in his bank account. His bank offers GICs at a simple interest rate of 2%.

- At this interest rate, how much would Rich earn in 1 year?
- How much would he earn in 2 years?
- How long will it take for Rich's \$500 to double?
- Suggest a better strategy for Rich to achieve his goal.

(a)  $I = Prt$        $P = \$500$   
 $I = (500)(0.02)(1)$        $r = 2\%$   
 $I = \$10$        $r = 0.02$   
                                   $t = 1$

(b)  $I = Prt$        $t = 2$   
 $I = (500)(0.02)(2)$   
 $I = \$20$

(c)  $I = Prt$   
 $500 = (500)(0.02)t$   
 $\frac{500}{10} = \frac{10t}{10}$   
 $50 = t$

(d) Get a job.  
 Higher interest  
 Take a loan

↳ In 50 years he'll have \$1000.

8. a) What amount of money, invested at 5% interest, will earn \$100 interest in 2 years?
- b) What interest rate will allow \$2000 to earn \$120 interest in 2 years?
- c) How long will it take \$1000 to earn \$100 at an interest rate of 1%?

$$I = Prt$$

(a)  $I = 100$   
 $P = ?$   
 $r = 0.05$   
 $t = 2$

$$I = Prt$$

$$100 = P(0.05)(2)$$

$$\frac{100}{0.1} = \frac{P(0.1)}{0.1}$$

$$\underline{\$1000 = P}$$

(b)  $I = 120$       (c)  $I = 100$   
 $P = 2000$   
 $r = ?$   
 $t = 2$

$$I = Prt$$

$$120 = 2000(r)(2)$$

$$\frac{120}{4000} = \frac{4000r}{4000}$$

$$0.03 = r$$

$$\underline{3\% = r}$$

$$I = 100$$

$$P = 1000$$

$$r = 0.01$$

$$t = ?$$

$$I = Prt$$

$$100 = 1000(0.01)t$$

$$\frac{100}{10} = \frac{10t}{10}$$

$$10 = t$$

$$\underline{t = 10 \text{ years}}$$

**compound interest** Let's look at how this works...

- interest that is earned on the original investment plus the interest earned during the previous calculation period(s)
- Ben wants to buy a new moped, as Metro Transit just isn't cutting it anymore. He can't afford this purchase with his day job (paper route), so he asks Mawson for a loan. Mawson agrees, and loans him \$5000 with an interest rate of 20 %.
- a) How much would Ben owe if he pays him back in 3 years, assuming simple interest?

- b) How much would Ben owe if he pays him back in 3 years, assuming interest compounded annually.

$P = 5000$   $r = 0.20$   
 $t = 3$

(a)  $I = Prt$   
 $I = (5000)(0.2)(3)$   
 $I = 3000$   
 $A = I + P$   
 $A = 3000 + 5000$   
 $A = \$8000$

(b) Year 1  
 $I = Prt$   
 $I = (5000)(0.2)(1)$   
 $I = \$1000$   
 $A = P + I$   
 $A = 5000 + 1000$   
 $A = \$6000$

Year 2  
 $I = Prt$   
 $I = (6000)(0.2)(1)$   
 $I = \$1200$   
 $A = \$6000 + 1200$   
 $A = \$7200$  after 2 yrs.

Year 3  
 $I = Prt$   
 $I = (7200)(0.2)(1)$   
 $I = \$1440$

$A = \$8640$  after 3 yrs.

\$6000 after 1 year.

with compound, extra \$640!

There must be a better way to do this...

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

A = Amount at some time

P = Principal  
(starting amount)

r = interest rate  
(always per year)

t = time (years)

n = how many times  
compounded per year.

annually...  $n=1$

Semiannually...  $n=2$   
(or bi)

quarterly...  $n=4$

monthly...  $n=12$

Weekly...  $n=52$

daily...  $n=365$

## From Simple to Compound Interest

Rhonda sells clothing at markets. She plans to set up an Internet business one day. Her goal is to eventually sell her merchandise worldwide. Rhonda made a profit of \$2000 last month. Rhonda's banker offers her a savings opportunity that pays **compound interest**. Rhonda invests the \$2000 at 3.5%, with interest **compounded annually** for 3 years.

- What is the future value of Rhonda's \$2000?
- Compare the future value of this investment to what the future value would be if the investment earned simple interest.

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

$P = 2000$   
 $r = 3.5\%$   
 $r = 0.035$   
 $t = 3$   
 $n = 1$

$$A = 2000 \left(1 + \frac{0.035}{1}\right)^{1(3)}$$
$$A = 2000 (1 + 0.035)^{1(3)}$$
$$A = 2000 (1.035)^{1(3)}$$
$$A = 2000 (1.035)^3$$
$$A = 2000 (1.1087)$$
$$A = 2217.40$$

(b)  $I = Prt$

$$I = (2000)(0.035)(3)$$

$$I = \$210$$

$$A = P + I$$

$$A = \$2210$$

$$\begin{array}{r} \$2217.40 \\ - \$2210 \\ \hline \end{array}$$

Extra \$7.40 with  
compounding!

## From Simple to Compound Interest

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4. Sometimes, investments that are fixed for a longer time period earn a higher interest rate. Ian invested \$1000 for a 5-year fixed term. The annual interest rate is 3.8%, with interest compounded annually. Calculate the future value of Ian's investment.

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

$$A = 1000 \left( 1 + \frac{0.038}{1} \right)^{1(5)}$$

$$A = 1000 (1 + 0.038)^5$$

$$A = 1000 (1.038)^5$$

$$A = 1000 (1.2050)$$

$$\underline{A = \$1205}$$

$$\begin{aligned} P &= 1000 & t &= 5 \\ r &= 3.8\% & n &= 1 \\ r &= 0.038 \end{aligned}$$