

Questions  $A$   $t$

9) Morgan has an investment worth \$130,000 dollars after 20 years. If his original investment was for \$50,000 what must the interest rate have been?

$$r = \frac{I}{Pt} \times 100\%$$

$$= \frac{80000}{50000(20)} \times 100\%$$

=

80000/(50000*20)	
Ans*100	.08
■	8%



\*  $I = A - P$

$$= 130000$$

$$- 50000$$


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$$I = 80000$$

12. Lin invested  $\overset{P}{\$4700}$ . After  $\overset{t}{8}$  years, the investment's value was  $\overset{A}{\$9400}$ .
- What was the annual simple interest rate?
  - Suppose that the interest rate continued for another 8 years. What would be the value of the investment?

$$\begin{aligned} \text{a) } I &= 9400 - 4700 \\ I &= 4700 \end{aligned}$$

$$\begin{aligned} r &= \frac{I}{Pt} \\ &= \frac{4700}{4700(8)} \times 100\% \\ &= \textcircled{12.5\%} \end{aligned}$$

$$\begin{aligned} \text{b) } A &= 4700 + 4700(0.125)(16) \\ A &= \textcircled{\$14100} \end{aligned}$$

# 8.3

## Compound Interest: Future Value

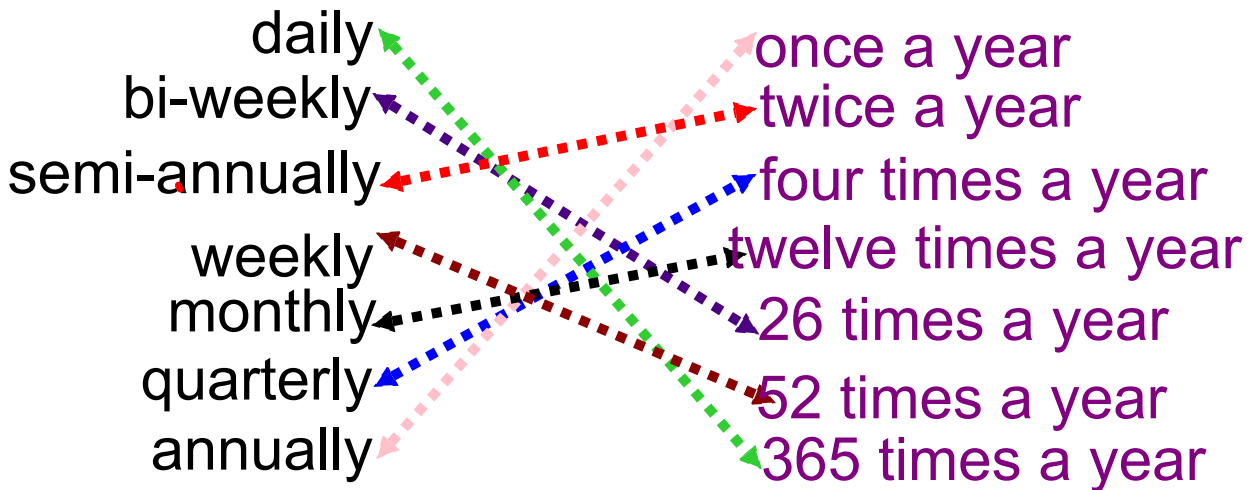
$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

**GOAL**

Determine the future value of an investment that earns compound interest.

### Terminology Tango

Click on the picture to verify the match.



## COMPOUND Interest

Interest is added to the principal periodically throughout the year. New interest may be paid on the principal plus the interest. The interest rate is stated per annum and is divided by the number of **compounding periods**.

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

$$I = A - P$$

A = final value of the investment ...(principal + interest)

P = principal

r = annual interest rate

n = number of compounding periods in a year

t = term of the investment or loan in number of years

**EXAMPLE #1:** If \$1000 is invested at 8 %/a compounded semi-annually for 2 years, how much will the investment be worth?

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Using the simple interest formula...

$$I = 1000(0.08)(6/12)$$

$$= \$40 \text{ (after 1st interest period)}$$

$$\text{New principal} = 1000 + 40$$

$$= \$1040$$

$$I = 1040(0.08)(6/12)$$

$$= \$41.60 \text{ (after 2nd interest period)}$$

$$\text{New Principal} = 1040 + 41.60$$

$$= \$1081.60$$

$$I = 1081.60(0.08)(6/12)$$

$$= \$43.26 \text{ (after 3rd interest period)}$$

$$\text{New Principal} = 1081.60 + 43.26$$

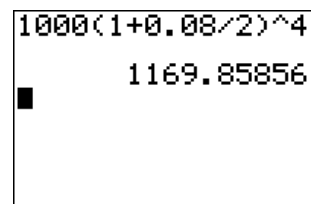
$$= \$1124.86$$

$$I = 1124.86(0.08)(6/12)$$

$$= \$44.99 \text{ (after 4th interest period)}$$

$$\text{New Principal} = 1124.86 + 44.99$$

$$= \$1169.85$$



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1000(1+0.08/2)^4
1169.85856
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## Compound Interest Formula...

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

**SAME  
ANSWER?**

**EXAMPLE #2:**

Calculate the final value of an initial investment of \$6000.00. Interest is paid at 4% per annum, compounded semi-annually, for three years.

A = final value of the investment ...(principal + interest)  
 P = principal  
 r = annual interest rate  
 n = number of compounding periods in a year  
 t = term of the investment or loan in number of years

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

^  
 OR  
y<sup>x</sup>

$$A = 6000 \left( 1 + \frac{0.04}{2} \right)^{(2)(3)}$$

**EX #3:** Maggie invests \$30 000 at 10% /a compounded quarterly for 20 years. Determine...

- How much will this investment be worth?
- How much interest did you earn?

$$a) A = 30000 \left(1 + \frac{0.10}{4}\right)^{4 \times 20}$$

$= \frac{30000(1+0.10/4)^{80}}{80}$	$216287.0345$
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$$b) \begin{array}{r} I = A - P \\ = 216287.03 \\ - 30000 \\ \hline \$186287.03 \end{array}$$

## EXAMPLE #4...

A keen MVHS student wants to save some money from their summer employment. They decide to take out a Canada Savings Bond which pays 2.5 % interest per year compounded monthly. If the student invests \$850 into the bond how much interest will they earn if they don't touch the money for 3 years?

$$A = 850 \left( 1 + \frac{0.025}{12} \right)^{12 \times 3}$$

$$A = \$916.13$$

$$I = A - P$$

$$= 916.13$$

$$- 850$$

$$\hline \$66.13$$



# HOMEWORK...

p. 457: #1, 2

p. 468: #2, 6, 7

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## Simple

$$I = Prt$$

&

$$A = P + I$$

$$A = P + Prt$$

$$A = P(1 + rt)$$

## Compound

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

$$I = A - P$$