

### Math 111

#### Solutions for Group Activity: Percent and Proportionate Change

Suppose you are awarded a 5% raise in your salary. We call 5% the **percentage change** (or just **percent change**) in your salary and that percentage expressed as a decimal, 0.05, the **proportionate change**. To compute your NEW salary, add your OLD salary to the dollar amount of the raise, which is 5% of your OLD salary:

$$\text{NEW} = \text{OLD} + 0.05 \cdot \text{OLD}.$$

1. If your current annual salary is \$38,000, what is your salary after a 5% raise?

**ANSWER:** OLD=\$38,000. Then NEW= \$38,000 + 0.05 · 38,000 =  $\boxed{\$39,900}$ .

2. You inherit a diamond ring appraised at \$5000. Diamonds are expected to appreciate by 8% per year. What would you expect the ring to be worth in one year?

**ANSWER:** OLD=\$5000 and an 8% change is a proportionate change of 0.08. NEW=  $\boxed{\$5400}$ .

3. You plan to buy a TV that is regularly priced at \$450. The store is offering 25% off every product in the store. What is the sale price of the TV? (HINT: You can still use an equation similar to the salary equation. But, since this is a reduction in the cost of the TV, your proportionate change is *negative*.)

**ANSWER:** NEW = \$450 - 0.25 · 450 =  $\boxed{\$337.50}$ .

4. In general, if a quantity changes by  $p \times 100\%$  from an OLD value to a NEW value,

$$\text{NEW} = \text{OLD} + p \cdot \text{OLD}.$$

Solve this equation for the proportionate change,  $p$ .

**ANSWER:** 
$$p = \frac{\text{NEW} - \text{OLD}}{\text{OLD}}$$

5. Use either the formula, NEW=OLD+p·OLD or the formula you found in #4 to answer the following questions.

- (a) The population of a town was 4000 people in 2010 and 4093 in 2012. What was the percentage change in the population?

**ANSWER:**  $p = \frac{4093 - 4000}{4000} = 0.02325$ .  $\boxed{\text{The population increases by 2.325\%}}$ .

- (b) A pair of shoes that regularly costs \$103 is on sale for \$60. What percent savings is this? (Again, your proportionate change will be *negative*.)

**ANSWER:**  $p = \frac{60 - 103}{103} = -0.4175$ .  $\boxed{\text{This is a 41.75\% savings}}$ .

- (c) A business purchased for \$650,000 in 1994 sold for \$850,000 in 1997. What was the percent change in its value?

**ANSWER:**  $p = \frac{850000 - 650000}{650000} = 0.3077$ .  $\boxed{\text{The value of the business increases by 30.77\%}}$ .

- (d) A collectible lunchbox increases in value by 1.4% per year. If it is worth \$507 one year from now, what is its value today?

**ANSWER:** We have NEW = \$507 and  $p = 0.014$ . Let  $x = \text{OLD}$ , plug values and variables into either NEW=OLD+p·OLD or  $p = \frac{\text{NEW} - \text{OLD}}{\text{OLD}}$ , and solve for  $x$ .  $\boxed{\text{The lunchbox is worth \$500 today}}$ .

- (e) You start a new job with a starting salary of \$40,000 and a 2% cost-of-living raise each year. Fill in the following table:

$t$ (in years)	salary after $t$ years	dollar amount of raise
0	\$40,000	$\$40,000 \cdot 0.02 = \$800$
1	\$40,800	$\$40,800 \cdot 0.02 = \$816$
2	\$41,616	\$832.32
3	\$42,448.32	\$848.97
4	\$43,297.29	\$865.95

Is it true that a salary that increases by 2% per year increases by 8% in four years? Explain.

**ANSWER:** NO! That is FALSE! The proportionate change in the salary over four years is:

$$p = \frac{43297.29 - 40000}{40000} = 0.0824.$$

A 2% annual increase is an 8.24% increase in four years.