

Percent Change

One of the most useful types of problems with percent deal with percent change. For instance, if your pay is \$ 12.00 per hour and you receive a 7 % raise, it is very useful to know how much your raise is, and what your new pay per hour is. This is really a special application of Section 2:

$$\text{Percent} \cdot (\text{whole}) = \text{part}$$

The skill in this addendum is used for many applications: taxes, retail prices, and interest being only a few. The key to these problems is to consider what each of the three words (percent, whole, part) represent.

- a) Using the example of \$ 12.00 per hour pay with a 7 % raise, the raise is the “part”, and the “whole” is the base pay (before the raise). Find the amount of the raise.

$$\begin{aligned}\text{percent} &= 7 \% = .07 \\ \text{whole} &= \text{base pay} = \$ 12.00 \text{ per hour} \\ \text{part} &= \text{raise per hour} = x\end{aligned}$$

$$\begin{aligned}\text{Formula:} \quad \text{Percent} \cdot (\text{whole}) &= \text{part} \\ .07 (12.00) &= x \\ .84 &= x\end{aligned}$$

Your raise is \$.84 per hour.

- b) In many cases, “part” will be more than the whole. Consider example a), but instead of finding the raise: what is your total pay after the raise? It should be obvious that your new pay is equal to the \$ 12.00 plus \$.84 per hour, for a total of \$ 12.84. However, let’s find your new pay directly. With your 7 % raise, you are now making 107 % of what you did before (the old 100 % plus the 7 % raise).

$$\begin{aligned}\text{percent} &= 107 \% = 1.07 \\ \text{whole} &= \text{base pay} = \$ 12.00 \text{ per hour.} \\ \text{part} &= \text{your new hourly pay} = x\end{aligned}$$

$$\begin{aligned}\text{Formula:} \quad \text{Percent} \cdot (\text{whole}) &= \text{part} \\ 1.07 (12.00) &= x \\ 12.84 &= x\end{aligned}$$

Your new pay is \$ 12.84 per hour.

- c) Percent change is often needed. Suppose a car dealer sells 220 cars in one year, and 253 cars the second year. What percent increase is this?

percent increase = x

whole = number of cars sold the first year = 220

part = increase in the number of cars sold the second year = $253 - 220 = 33$

Formula: Percent \cdot (whole) = part
 $x (220) = 33$
 $x = .15$

There was a 15 % increase in the number of cars sold the second year.

- d) Sometimes, the “part” is known, and the “whole” is needed. A jeweler wishes to price a necklace so that when she puts it on the inevitable 20 % off sale, she will actually receive \$ 100.00 from the customer. What should be her advertised price? {It almost seems obvious that the price should be \$ 120, but that is not correct. If a 20 % discount is taken from the \$ 120.00 price, that would amount to \$ 24.00 which would only leave \$96.00 for the jeweler, instead of the \$ 100.00 .} In this case, the amount actually paid is \$100.00: the percent is what is left AFTER the discount, or 100 % minus 20 % = 80 %.

percent = 80 % = .80

whole = advertised cost of item = x

part = actual amount received from purchase = \$ 100.00

Formula: Percent \cdot (whole) = part
 $.80 (x) = \$ 100.00$
 $x = 125.00$ ($x = \$ 100 / .80$)

The jeweler sets the advertised price at \$ 125.00 .

- e) The social security tax taken from most salaries is 7.65 %. If the social security tax on such a salary was \$ 244.80, what should the salary have been?

percent = 7.65 % = .0765

whole = base salary = x .

part = social security tax taken out of salary = \$ 244.80

Formula: Percent \cdot (whole) = part
 $.0765 (x) = \$ 244.80$
 $x = 3,200.00$

The original salary should have been \$ 3,200.

- f) A store has guaranteed a patron it will sell him a boat in one year for exactly \$ 13,100 (ignore taxes, registration, etc). The patron has found a place guaranteeing him 4.8 % interest for the next year. How much should he invest at 4.8 % to have \$ 13,100 to buy the boat?

$$\text{percent} = 104.8 \% = 1.048$$

$$\text{whole} = \text{amount invested} = x$$

$$\text{part} = \text{value of investment in one year} = \$ 13,100$$

$$\text{Formula: } \text{Percent} \cdot (\text{whole}) = \text{part}$$

$$1.048 (x) = 13,100$$

$$x = 12,500$$

The amount invested is \$12,500.

Homework for Chapter 5 Section 2 Addendum

Set up and solve.

1. If October home sales were 7 % higher than August home sales, and there were 2,300 homes sold in August, how many were sold in October?
2. The sales tax rate in a particular city is 6.5 %. When purchasing a \$ 998 refrigerator, what is the total amount which must be paid, including tax?
3. Suzie's pay is now \$ 2,246.75 per pay period, after a 4 ½ % pay raise. What was her pay before the pay raise?
4. While visiting another city, a tourist was shocked that when she decided to purchase an item for \$ 644.00 , the total, including sales tax, was \$ 698.74 . What was the sales tax rate?
5. A certain pollutant in the air had a concentration of 42 parts per million. After a major fire, the concentration had increased to 62 ppm. By what percent did the pollutant increase? (Round to the nearest percent).
6. Sales for this year for a certain company were \$ 1,259,700 . This was a fourteen percent increase over last year. What were sales last year?
7. Baby Ryan's weight increased 180 % by his first birthday. If he weighed 9.8 kilograms on his first birthday, how much did he weigh at birth?
8. An English professor decided to give each of his students a 12 % bonus based on a test's original score. 1) How much was the bonus for a student with a 75 for the original score, and 2) what was the final score?
9. Joe invested \$1,000 at 5 % interest at the end of 2006. Then he took the total amount he received at the end of the year 2007 and invested that at 5 % interest for 2008. How much did he have at the end of 2008? (This is the essence of "compound interest", although the money is left in the same account and the amount at the end of one year becomes the new amount invested for the second year).

Answer Key for Chapter 5 Section 2 Addendum

1. $x = 2,461$
2,461 homes were sold in October
2. $1,062.87 = x$
The total amount paid, including tax, for the refrigerator is \$ 1,062.87 .
3. $1.045x = 2,246.75$
 $x = 2,150$
Suzie's pay before the raise was \$ 2,150.00 per pay period.
4. $x = 1.085$, the additional percentage was .085
The sales tax rate was 8.5 % .
5. $x = 1.4762$, the increase was .4762
The pollutant increased by 48 % .
6. $x = 1,105,000$
Sales last year were \$ 1,105,000.
7. $2.80x = 9.8$ { note that the 180 % increase gave a total of 280 % }
 $x = 3.5$
Baby Ryan weighed 3.5 kg when he was born.
8. part 1): $x = 9$
The bonus for the 75 point score was 9 points.
part 2): $x = 1.12(75) = 84$
The final score was 84 points.
9. $x_{2007} = 1,050$
 $x_{2008} = 1,050(1.05) = 1,102.50$
Joe had a total of \$ 1,102.50 at the end of 2008