05 - Standardized Proportions

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Outline

Terms

$$\text{percentage} : \text{base} :: \text{rate} : 100$$

- Percent is a standardize proportion where a ratio between percentage and base is related to parts of 100. (Literally the same as saying "x out of 100")
- The **percentage** is the part of a number computed by the rate.
- The **base** is the number on which the percentage is computed. (This can often be thought of as the total amount, original amount, or total population in most problems.)
- The **rate**, also referred to as the percent, is the parts out of 100 to be taken from the base.

Terms

$$\text{percentage} : \text{base} :: \text{rate} : 100$$

- **Amount** is the sum obtained by adding the percentage to the base.
- **Difference** is the remainder obtained by subtracting the percentage from the base.

Notation

A percent may be written as:

- A ratio 25 : 100 or 1 : 4.
- A fraction $\frac{25}{100}$ or $\frac{1}{4}$
- A decimal 0.25
- Using the % sign 25%

Problem Notation

Frequently, a problem can be searched for keywords. For example: “What **is** 25% **of** 200?”.

- The “is” portion corresponds to the percentage.
- The “of” portion corresponds to the base.
- We could rewrite the fraction’s proportion as the following mnemonic

$$\text{is} : \text{of} :: \text{percent} : 100$$

- Exercise: Rewrite this mnemonic proportion in fraction form.

Finding Parts of the Percent Proportion

To find any part of a percent, simply set up the proportion and solve.

1. What is 25% of 300?
   1. $x : 300 :: 25 : 100$
   2. $100x = 300 \times 25$
   3. $100x = 7500$
   4. $x = 75$
2. 120 is 30% of what number?
   1. $120 : x :: 30 : 100$
   2. $30x = 100 \times 120$
   3. $30x = 12000$
   4. $x = 400$
3. What percent of 400 is 50?
   1. $50 : 400 :: x : 100$
   2. $400x = 50 \times 100$
   3. $400x = 5000$
   4. $x = 12.5\%$

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Amounts and Differences

In problems dealing with amounts and differences, the base and percentage are used in the sum or difference.

1. A store sells shirts for \$15.00 apiece. If they have a 20% off sale, what is the price of the shirts?
    1. $\text{amount} = \text{base} - \text{percentage}$
    2. $x : 15.00 :: 20 : 100$
    3. $100x = 300.00$
    4. $x = 3.00$
    5. $\text{amount} = \$15.00 - \$3.00$
    6. $\text{amount} = \$12.00$

Amount and Difference (ctd.)

2. A merchant purchases rugs for \$10.00 apiece and sells them for \$15.00. What percent markup has the merchant applied?
   1. $\text{difference} = \text{amount} - \text{base}$
   2. $\text{difference} = \$15.00 - \$10.00$
   3. $\text{difference} = \$5.00$
   4. $5 : 10 :: x : 100$
   5. $10x = 5 \times 100$
   6. $10x = 500$
   7. $x = 50\%$

Amount and Difference (ctd.)

1. According to `worldometers.info`, the United States population increases by 0.71% each year. If the present population of the United States is 3.28×10^8 people, what will the population be next year?
    1. $\text{amount} = \text{base} + \text{percentage}$
    2. $x : 3.28 \times 10^8 :: 0.71 : 100$
    3. $100x = 3.28 \times 10^8 \times 0.71$
    4. $100x = 2.33 \times 10^8$
    5. $x = 2.33 \times 10^6$
    6. $\text{amount} = 3.28 \times 10^8 + 2.33 \times 10^6$
    7. $\text{amount} = 3.30 \times 10^8$

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Problem 2

If 8 workers in 24 days working 10 hours a day can reap 48 acres of wheat, how many acres could 12 workers reap in 20 days of 12 hours each?

Problem 3

If a staff of 4ft casts a shadow 7ft in length, what is the height of a tower which casts a shadow of 198ft at the same time?

Problem 4

A homeowner sells their house at a loss of 20%. If the selling price was $\$60,000.00$, what was the original price of the home?

Problem 5

In the erection of a house I paid twice as much for material as for labor. Had I paid 6% more for material, and 9% more for labor, my house would have cost $1284.00; what was its cost?