Lecture 5 Standardized Proportions and the Number 100

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Percentage Terms and Notation

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

Terms

- 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.
- **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%
- 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.

Percentage Calculations

- To find any part of a percent, simply set up the proportion and solve.
    1. What is 25% of 300?
    2. 120 is 30% of what number?
    3. What percent of 400 is 50?
- 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?
    2. A merchant purchases rugs for \$10.00 apiece and sells them for \$15.00. What percent markup has the merchant applied?
    3. 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?

Percentage and Proportion Problems

1. A besieged town, containing 22,400 inhabitants, has provisions to last 3 weeks; how many must be sent away that they may be able to hold out 7 weeks? [1]
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?
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? [2]
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?
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?[??].

[1] Transcribed from: *A Treatise on Arithmetic* by J. H. Smith. 1878
[2] Transcribed from: *The Prooressive Higher Arithmetic* edited by Daniel Fish. 1878