



Figure 3-7. Gear ratio.

$$\frac{10 \text{ teeth}}{40 \text{ teeth}} = \frac{160 \text{ rpm}}{S_p \text{ (speed of pinion gear)}}$$

To solve for S_p , multiply 40×160 , then divide by 10. The speed of the pinion gear is 640 rpm.

Example: If the cruising speed of an airplane is 200 knots and its maximum speed is 250 knots, what is the ratio of cruising speed to maximum speed? First, express the cruising speed as the numerator of a fraction whose denominator is the maximum speed.

$$\text{Ratio} = \frac{200}{250}$$

Next, reduce the resulting fraction to its simplest form.

$$\text{Ratio} = \frac{200}{250} = \frac{4}{5}$$

Therefore, the ratio of cruising speed to maximum speed is 4:5.

Another common use of ratios is to convert any given ratio to an equivalent ratio with a denominator of 1.

Example: Express the ratio 9:5 as a ratio with a denominator of 1.

$$R = \frac{9}{5} = \frac{?}{1} \quad \text{Since } 9 \div 5 = 1.8, \text{ then } \frac{9}{5} = \frac{1.8}{1}$$

Therefore, 9:5 is the same ratio as 1.8:1. In other words, 9 to 5 is the same ratio as 1.8 to 1.

Proportion

A proportion is a statement of equality between two or more ratios. For example,

$$\frac{3}{4} = \frac{6}{8} \text{ or } 3:4 = 6:8$$

This proportion is read as, “3 is to 4 as 6 is to 8.”

Extremes and Means

The first and last terms of the proportion (the 3 and 8 in this example) are called the extremes. The second and third terms (the 4 and 6 in this example) are called the means. In any proportion, the product of the extremes is equal to the product of the means.

In the proportion $2:3 = 4:6$, the product of the extremes, 2×6 , is 12; the product of the means, 3×4 , is also 12. An inspection of any proportion shows this to be true.

Solving Proportions

Normally when solving a proportion, three quantities are known, and the fourth is unknown. To solve for the unknown, multiply the two numbers along the diagonal and then divide by the third number.

Example: Solve for X in the proportion given below.

$$\frac{65}{80} = \frac{X}{100}$$

First, multiply 65×100 : $65 \times 100 = 6500$

Next, divide by 80: $6500 \div 80 = 81.25$

Therefore, $X = 81.25$.

Example: An airplane flying 300 miles used 24 gallons of gasoline. How many gallons will it need to travel 750 miles?

The ratio here is: “miles to gallons;” therefore, the proportion is set up as:

$$\frac{\text{Miles}}{\text{Gallons}} = \frac{300}{24} = \frac{750}{G}$$

$$\text{Solve for G: } (750 \times 24) \div 300 = 60$$

Therefore, to fly 750 miles, 60 gallons of gasoline is required.

Percentage

Percentage means “parts out of one hundred.” The percentage sign is “%.” Ninety percent is expressed as 90% (= 90 parts out of 100). The decimal 0.90 equals $\frac{90}{100}$, or 90 out of 100, or 90%.

Expressing a Decimal Number as a Percentage

To express a decimal number in percent, move the decimal point two places to the right (adding zeroes if necessary) and then affix the percent symbol.

Example: Express the following decimal numbers as a percent:

$$0.90 = 90\%$$

$$0.5 = 50\%$$