

Chapter 9 – Percentages and Ratio and Proportion

9.1 Percentage

Percentage problems generally amount simply to a multiplication or a division.

Example 1:

Express 5 as a percentage of 6.

$$\text{(e.g. } = \frac{5}{6} \times \frac{100\%}{1} = 83.4\% \text{)}$$

1. Set the hair line over 5 on the D scale.
2. Place the 6 of the C scale under the hair line.
3. Read off 83.4% on the D scale as the answer.

Example 2:

Find 17% of \$400

$$\text{(e.g. } = \frac{17}{100} \times 400 = \$68 \text{)}$$

Note $17\% = \frac{17}{100}$ and “of” is taken as meaning multiplication. Thus we just multiply 17 by 4 to calculate the above.

Example 3: Find the quantity of which 52 is 13%.

(e.g. Let $52 = 13\%$ of A

$$\begin{aligned} 52 &= \frac{13}{100} \times A \\ \therefore A &= \frac{52 \times 100}{13} \\ &= 400 \end{aligned}$$

Note in this case we simply divide 52 by 13.

Exercise 9(a)

Express as a Percentage:

- | | |
|---------------------|-----------------------|
| (i) $\frac{3}{5}$ | (iii) $\frac{4}{300}$ |
| (ii) $\frac{1}{16}$ | (iv) $\frac{11}{6}$ |
| (v) | |

Find the value of:

- | | |
|--------------------------------|---------------------|
| (vi) 5% of \$25 | (viii) 14% of \$250 |
| (vii) $22\frac{1}{2}\%$ of 180 | (ix) 85% of 132 |

Find the quantity of which:

- | | |
|----------------------------|--------------------|
| (x) 3 is $12\frac{1}{2}\%$ | (xii) 31 is 62% |
| (xi) 66 is 85% | (xiii) 146 is 125% |
- (xiv) A man buys goods costing \$9, and he pays a deposit of 15%. How much does he still owe?
- (xv) The population of a town in 1971 was 26,800, which 11% less than it was in 1961. What was the population in 1961?

- (xvi) A man's salary was \$5440 in 1969 and was increased by 15% in 1970. If he pays 12½% in taxes, how much tax did he pay in 1970?

9.2 Ratio and Proportion

Definitions

- (i) The *ratio* of two numbers A and B is the quotient $\frac{A}{B}$, sometimes expressed A:B.
- (ii) A proportion is the statement of equality of two ratios, e.g. $\frac{A}{B} = \frac{C}{D}$.

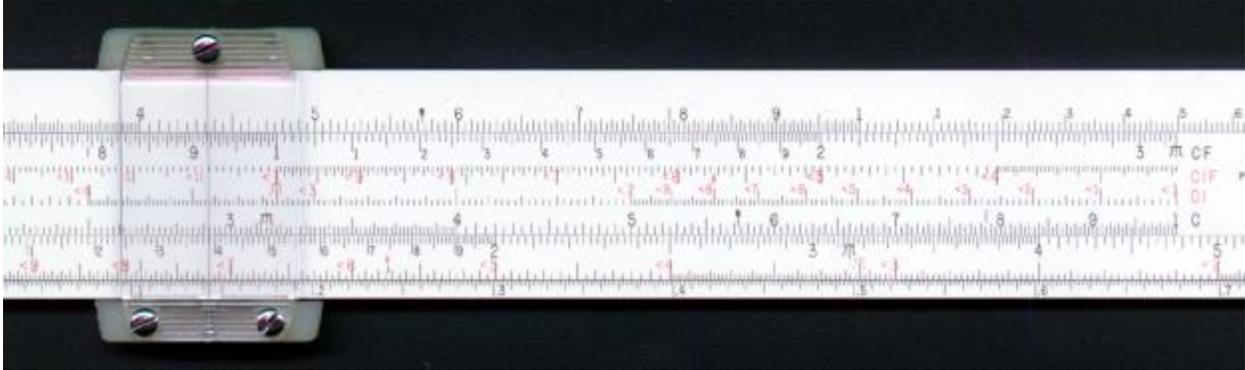


Fig 9-1

Example 1: Find x for $\frac{x}{29.2} = \frac{1.26}{8.43}$ (fig. 9-1)

This could be done by rearranging the proportions as $x = \frac{1.26 \times 29.2}{8.43}$ and then calculating the right hand side in the usual way.

A better method would be as follows: (See Fig. 9-1)

1. Set the hair line over 1.26 on the DF scale.
2. Place 8.43 of the C scale under the hair line.
3. Reset the hair line over 29.2 on the C scale.
4. Under the hair line read off 4.36 on the DF scale as the answer.

Note: The above method could be applied in solving an equation of the form $\frac{29.2}{x} = \frac{8.43}{1.26}$ as this can be written as $\frac{x}{29.2} = \frac{1.26}{8.43}$.

Example 2: Find x and y if $\frac{45.1}{73} = \frac{2.8}{x} = \frac{y}{15.5}$

Both x and y can be found with only one move of the slide, as follows:

1. Set the hair line over 73 on the D scale.
2. Place 45.1 of the scale below the hair line.
3. Reset the hair line over 3.3 on the C scale, and under the hair line read of $x = 4.52$ on the D scale.
4. Reset the hair line over 15.5 on the DF scale, and under the hair line read off $y = 9.6$ on the CF scale.

Note:

- (a) Once the ratio is set up on the C and D scales, we can reset the hair line and read off any number of values for the numerators or denominators of equivalent fractions.
- (b) The only time this will be impossible, is when we run off the end of the scale. This occurs when the numerator and denominator of the given ratio are at opposite ends of the C and D scales (e.g. $\frac{11.6}{9.3}$ or $\frac{87}{119}$). This is overcome as shown in example 3.

Example 3: Find x and y if $\frac{92}{143} = \frac{x}{66} = \frac{183}{y}$

1. Set the hair line over 143 on the DF scale.
2. Place 92 of the CF scale below the hair line.
3. Reset the hair line over 66 on the DF scale, and under the hair line read off $x = 42.5$ on the CF scale.
4. Reset the hair line over 183 on the CF scale, and under the hair line read off $y = 248$ on the DF scale.

Exercise 9(b)

Find the number in the following:

- (i) $\frac{x}{32.7} = \frac{423}{67.7}$
- (ii) $\frac{1.09}{4.93} = \frac{x}{18.18}$
- (iii) $\frac{8.42}{x} = \frac{21.3}{3.72}$
- (iv) $\frac{5.12}{65.6} = \frac{x}{3.45} = \frac{y}{176}$
- (v) $\frac{32.7}{14.25} = \frac{x}{4.65} = \frac{21.2}{y}$
- (vi) $\frac{13.6}{74.5} = \frac{x}{6.24} = \frac{42}{z}$
- (vii) $\frac{0.394}{59} = \frac{R_1}{6.4} = \frac{R_2}{26.7} = \frac{R_3}{1.35}$
- (viii) $\frac{47.7}{7.16} = \frac{38.2}{V_1} = \frac{275}{V_2} = \frac{1050}{V_3}$

Complete the following tables:

- (ix) $\frac{\text{Feet}}{\text{Meters}} = \frac{3.281}{1} = \frac{625}{\quad} = \frac{83.6}{\quad} = \frac{2560}{\quad}$

$$(x) \frac{Kg}{lb.} = \frac{1}{2.204} = \frac{6.52}{9.48} = \frac{73.5}{9.48}$$

$$(xi) \frac{Miles/hr.}{Km/hr.} = \frac{1}{1.609} = \frac{63.2}{15.6} = \frac{49.3}{15.6}$$

$$(xii) \frac{sq.in.}{sq.cm} = \frac{1}{6.45} = \frac{11.2}{258} = \frac{63.8}{258}$$

(xiii) For $R = 1.34T$, find the corresponding values of R for $T = 1.25, 3.5$ and 7.25 .

(xiv) For $y = 5.2/x$, find the corresponding values of y for $x = 1.5, 3.4$ and 7.6 .