Ex: Jason is 6 ft tall. You are told Janice is 100% shorter than Jason. Does this make sense?

SOLUTION: NO. If this is true, then Janice is this tall:

$$6\text{ft} - 6\text{ft}(100\%) = 6\text{ft} - 6\text{ft}\cdot 1$$
$$= 0\text{ ft}.$$

§3B Putting Numbers in Perspective

Ex1: Economic Stimulus Package

With the \$780,000,000,000 stimulus package, how much money is this for each of the 300,000,000 US citizens?

Solution: "\$ per person = $\frac{\$}{\text{person}}$"

$$\frac{\$78\cancel{0},\cancel{000},\cancel{000},\cancel{000}}{30\cancel{0},\cancel{000},\cancel{000}\,p} = \frac{\$7{,}800}{3\,p}$$

$= \$2,600$ per person

Ex2: National Debt

The US national debt stands at around \$10 trillion. In 1985, the national debt was about \$3 trillion. Find the absolute change and relative change in debt. How much of the \$10 trillion is owed by each US citizen if the debt were evenly distributed over the population?

SOLUTION:

$$A = \$10 \text{ trillion} - \$3 \text{ trillion} = \$7 \text{ trillion}$$

$$R = \frac{\$7 \text{ trillion}}{\$3 \text{ trillion}} = \frac{7}{3} \approx 2.3 = 230\%$$

$$\frac{\$10{,}000{,}\cancel{000}{,}\cancel{000}{,}\cancel{000}}{} \Big| \frac{}{300{,}\cancel{000}{,}\cancel{000} \text{ people}} = \frac{\$100{,}000}{3p}$$

$\approx \$33{,}333$ per person

Scale ratios:

Ratios can be used to relate actual size to a "scale" model.

Ex: A map says: "One cm represents one km." What is its scale ratio?

Solution: We want a ratio involving cm. So, convert one km into cm:

$$\frac{1\ \cancel{km}}{} \Big| \frac{1{,}000\ \cancel{m}}{1\ \cancel{km}} \Big| \frac{100\ cm}{1\ \cancel{m}} = 100{,}000\ cm$$

So, the scale ratio will be

1 to 100,000

Meaning 1 cm on the map is the same as 100,000 cm on the Earth

Ex: Find the scale ratio: 2 in represents 2 miles

Solution: $\frac{2\ \cancel{mi}}{} \Big| \frac{5{,}280\ \cancel{ft}}{1\ \cancel{mi}} \Big| \frac{12\ in}{1\ \cancel{ft}} = 126720\ in$

So, $\frac{2\ in}{126720\ in} = \frac{1}{63360}$, or 1 to 63360

Thus, 1 in equates to 63360 in on the ground.

Writing Large and Small Numbers: Scientific Notation

Def: Scientific Notation is a format in which a number is expressed as a number between 1 and 10 multiplied by a power of 10.

Examples:

Ex 1: Express 15.5 in scientific Notation:

$15.5 = 1.55 \times 10^1$

Ex 2: Express -3.559 in Scientific Notation:

$-3.559 = -3.559 \times 10^0 = -3.559$

Ex 3: Write $-.0000519$ in scientific Not.

$-.0000519 = -5.19 \times 10^{-5}$

Ex 4: Write 7.5 trillion ¥ in Scientific Not.

7.5 trillion ¥ = 7,500,000,000,000 ¥

$= 7.5 \times 10^{12}$ ¥

Comparisons on Numbers

Ex: How much larger (or smaller) is the first number compared to the second?

a.) 1 thousand, 1 thousandth

Solution: $10^3/10^{-3} = 10^3 \cdot 10^3 = 10^6$

So 1 thousand is 10^6 = 1,000,000 times larger than 1 thousandth.

b.) 10^{35}, 10^{26}

Solution: $10^{35}/10^{26} = 10^{35-26} = 10^{9}$

So 10^{35} is 10^{9} times larger than 10^{26}.

c.) 2×10^{-9}, 2×10^{-6}

Solution: $2\times10^{-9}/2\times10^{-6} = \frac{\cancel{2}\times10^{-9}}{\cancel{2}\times10^{-6}}$

$= 10^{-9}\cdot10^{6} = 10^{-3}$

So 2×10^{-9} is 10^{3} times smaller than 2×10^{-6}

§ 3C Dealing With Uncertainty

A review of significant digits:

Def: Digits in a number that represent actual measurements are termed significant.

Determining significance:

1.) Zeros between nonzero digits are always significant.

2.) Nonzero digits are always significant

3.) Zeros following a nonzero digit and residing to the right of the decimal point are always significant

4.) Zeros to the left of the first nonzero digit are Never significant.

5.) Zeros to the right of the last nonzero digit but before the decimal point are not significant unless stated otherwise