

Sec. 2.10 Change Expressed as a Percent

Percent Change

$$\text{percent change, \%} = \frac{\text{amount of increase/decrease}}{\text{original amount}}$$

$$\text{amount of increase} = \text{new amt} - \text{original amt.}$$

$$\text{amount of decrease} = \text{original amt} - \text{new amt.}$$

Problem 1:

A popular hybrid car cost \$21,500 in 2008, but dropped to \$19,780. What is the decrease expressed as a percent change?

$$\frac{\text{original} - \text{new}}{\text{original}} = \frac{21,500 - 19,780}{21,500}$$

$$\text{percent change} \approx 0.08$$

8%

$$\frac{19780}{21500}$$

$$1 - .92$$

Problem 2:

In 1990, there were 1330 registered alpacas in the U.S. By 2008 there were 53,000. What is the increase expressed as a percent change?

$$\frac{53,000}{1330} - \frac{1330}{1330} \approx 39.85 - 1$$

3885%

$$\frac{53000 - 1330}{1330} \approx 38.85 \rightarrow 3885\%$$

original amount: 7.5

new amount: 9.5

$$\frac{\text{difference}}{\text{original}} = \frac{9.5 - 7.5}{7.5} = \frac{2}{7.5} \approx .26$$

increase; 27%

Relative error / Percent error

$$\text{relative error} = \frac{|\text{measured or estimated value} - \text{actual value}|}{\text{actual value}}$$

Problem 3:

A cube's volume is estimated to be 8 cm^3 .
When measured, each side was 2.1 cm in length. What is the percent error (in the estimated volume)?

$$V = 8$$

$$8 \text{ cm}^3$$

$$\rightarrow l = 2.1$$

$$V = (2.1)^3$$

$$\frac{|8 - (2.1)^3|}{(2.1)^3}$$

$$\frac{|8 - 9.261|}{9.261} \approx 0.1366$$

$$13.6\%$$

Problem 4:

a. A student's height is measured as 144 cm to the nearest centimeter. What are the student's minimum and maximum possible heights?

up to $\frac{1}{2}$ the unit of measurement
 $\frac{1}{2}$ cm.

$$\text{minimum: } 144 - 0.5 = 143.5 \text{ cm}$$

$$\text{maximum: } 144 + 0.5 = 144.5 \text{ cm}$$

$$143.5 \leq h < 144.5$$

b. An ostrich egg has a mass of 1.1 kg to the nearest tenth of a kilogram.

1.1 kg

$\frac{1}{2}$ of a tenth 0.10

0.05

$$\text{min: } 1.10 - 0.05 = 1.05 \text{ kg}$$

$$\text{max: } 1.10 + 0.05 = 1.15 \text{ kg}$$

Problem 5:

What is the greatest possible percent error in calculating the volume for a cube with a side measured at 2.1 cm?

Measured
volume

$$V = (2.1)^3$$

$$V = 9.261$$

$2.1 - 0.05$

Minimum
volume

$$V = (2.05)^3$$

$$V = 8.615125$$

$$\underline{\quad - 9.261 \quad}$$

$(0.1) \frac{1}{2} = 0.05$

$2.1 + 0.05$

Maximum
volume

$$V = (2.15)^3$$

$$V = 9.93875$$

$$\underline{\quad - 9.261 \quad}$$

$$0.677$$