Math Clinic

Session 1: Solutions

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Practice Problem

2 (a) A firm's annual sales rise from 50 000 to 55 000 from one year to the next. Express the rise as a percentage of the original.
(b) The government imposes a 15% tax on the price of a good. How much does the consumer pay for a good priced by a firm at \$1360?
(c) Investments fall during the course of a year by 7%. Find the value of an investment at the end of the year if it was worth \$9500 at the beginning of the year.

Solution

(a) Percentage rise in sales:

The percentage increase is given by:

$$\text{Percentage Increase} = \frac{\text{Final Value} - \text{Initial Value}}{\text{Initial Value}} \times 100$$

$$= \frac{55\,000 - 50\,000}{50\,000} \times 100 = \frac{5\,000}{50\,000} \times 100 = 0.1 \times 100 = \boxed{10\%}$$

(b) Amount consumer pays after 15% tax:

Sales tax amount:

$$\text{Tax Amount} = 0.15 \times \$1360 = \$204$$

Total price consumer pays:

$$\text{Total Price} = \$1360 + \$204 = \boxed{\$1564}$$

or, equivalently,

$$\text{Total Price} = \$1360 \times (1 + 0.15) = \$1360 \times 1.15 = \boxed{\$1564}$$

(c) Value after a 7% fall:

Decrease amount:

$$\text{Decrease} = 0.07 \times \$9500 = \$665$$

Value at the end of the year:

$$\text{Final Value} = \$9500 - \$665 = \boxed{\$8835}$$

or, equivalently,

$$\text{Final Value} = \$9500 \times (1 - 0.07) = \$9500 \times 0.93 = \boxed{\$8835}$$

Practice Problem

(a) The value of a good rises by 13% in a year. If it was worth \$6.5 million at the beginning of the year, find its value at the end of the year.

(b) The GNP of a country has increased by 63% over the past 5 years and is now \$124 billion. What was the GNP 5 years ago?

(c) Sales rise from 115 000 to 123 050 in a year. Find the annual percentage rise.

(a) A 13% rise corresponds to a multiplier of $1 + 0.13 = 1.13$.

$$V_{\text{end}} = 6.5 \text{ million} \times 1.13 = 7.345 \text{ million}.$$

Value at year end:

Initial value $= \$6.5$ million

Percentage increase $= 13\%$

Increase $= 0.13 \times 6.5 = 0.845$ million

End value $= 6.5 + 0.845 = \boxed{\$7.345 \text{ million}}$

Or, directly:

$$\text{End value} = 6.5 \times 1.13 = \boxed{\$7.345 \text{ million}}$$

(b) Let G be the GNP 5 years ago. A 63% increase gives the equation

$$1.63\,G = 124 \text{ billion} \implies G = \frac{124}{1.63} \approx 76.1 \text{ billion}.$$

Original GNP before 5 years:

Current $= \$124$ billion

Increase over 5 years $= 63\%$

Let original GNP $= x$:

$$x \times 1.63 = 124 \implies x = \frac{124}{1.63} \implies x \approx \boxed{76.07 \text{ billion}}$$

(c) Absolute increase:

$$\Delta = 123\,050 - 115\,000 = 8\,050.$$

Percentage rise:

$$\frac{\Delta}{115\,000} \times 100\% = \frac{8\,050}{115\,000} \times 100\% = 7\%.$$

Annual percentage rise:

$$\text{Percentage increase} = \left(\frac{123\,050 - 115\,000}{115\,000}\right) \times 100 = \frac{8\,050}{115\,000} \times 100 = 0.07 \times 100 = \boxed{7\%}$$

Practice Problem

4 **(a)** Current monthly output from a factory is 25 000. In a recession, this is expected to fall by 65%. Estimate the new level of output.
(b) As a result of a modernization programme, a firm is able to reduce the size of its workforce by 24%. If it now employs 570 workers, how many people did it employ before restructuring?
(c) Shares originally worth \$10.50 fall in a stock market crash to \$2.10. Find the percentage decrease.

Solution

(a) **New output after 65% fall:**
Current output $= 25\,000$
Decrease $= 65\%$
Output remaining $= 100\% - 65\% = 35\%$

$$\text{New output} = 25\,000 \times 0.35 = \boxed{8\,750}$$

(b) **Original number of workers:**
Final number $= 570$
Workers remaining after 24% reduction:
Remaining proportion $= 100\% - 24\% = 76\%$
Let original number be x:

$$x \times 0.76 = 570 \implies x = \frac{570}{0.76} \approx \boxed{750}$$

(c) **Percentage decrease in share price:**
Original price $= \$10.50$, New price $= \$2.10$
Decrease $= 10.50 - 2.10 = 8.40$

$$\text{Percentage decrease} = \left(\frac{8.40}{10.50}\right) \times 100 \approx 80\%$$

$$\boxed{80\%}$$

Practice Problem

5 Find the single percentage increase or decrease equivalent to
(a) an increase of 30% followed by an increase of 40%
(b) a decrease of 30% followed by a decrease of 40%
(c) an increase of 10% followed by a decrease of 50%.

Solution

(a) **Two successive increases:**

Let initial value be 100.

After 30% increase: $100 \times 1.3 = 130$
After next 40% increase: $130 \times 1.4 = 182$
This is an overall increase from 100 to 182:

$$\text{Total percentage increase} = \frac{182 - 100}{100} \times 100 = 82\%$$

$\boxed{82\% \text{ increase}}$

(b) **Two successive decreases:**

Let initial value be 100.

After 30% decrease: $100 \times 0.7 = 70$
After 40% decrease: $70 \times 0.6 = 42$
This is an overall decrease from 100 to 42:

$$\text{Total percentage decrease} = \frac{100 - 42}{100} \times 100 = 58\%$$

$\boxed{58\% \text{ decrease}}$

(c) **An increase of 10% followed by a decrease of 50%:**

Let initial value be 100.

After 10% increase: $100 \times 1.1 = 110$
After 50% decrease: $110 \times 0.5 = 55$
This is an overall decrease from 100 to 55:

$$\text{Total percentage decrease} = \frac{100 - 55}{100} \times 100 = 45\%$$

$\boxed{45\% \text{ decrease}}$