

Worksheet 7.1

Objective: To review the concepts and formulas about percentage change.

Percentage change represents the change in value as a percentage of the original value.

The following three formulas are often used in solving problems involving percentage change:

1. **Percentage change(百分變化) = $\frac{\text{change}}{\text{original value}} \times 100\%$**
2. **Change = original value \times percentage change**
3. **New value = original value \times (1 + percentage change)**

1. Find the percentage change(百分變化) when a value changes from

- (a) 260 to 338,
- (b) 300 to 231.

Demonstration

Find the percentage change when a value changes from 180 to 144.

Solution

$$\begin{aligned} \text{Percentage change} &= \frac{144 - 180}{180} \times 100\% \\ &= \underline{\underline{-20\%}} \end{aligned}$$

2. The price of a wallet is \$380. Find the new price of the wallet if the percentage change is +10%,

3. When a number decreases by 12%, it becomes 220. Find the original number(原值).

Demonstration

When a number increases by 8%, it becomes 54. Find the original number.

Solution

Let x be the original number.

$$x(1 + 8\%) = 54$$

$$1.08x = 54$$

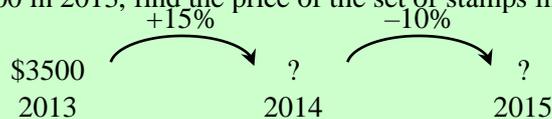
$$x = 50$$

\therefore The original number is 50.

We should consider the change of value at each stage when the value is changing successively.

For example:

The price of a set of stamps increased by 15% from 2013 to 2014 and decreased by 10% from 2014 to 2015. If the price of the set of stamps is \$3500 in 2013, find the price of the set of stamps in 2015.



The price of the set of stamps in 2014 = $\$3500 \times (1 + 15\%)$

The price of the set of stamps in 2015 = $[\$3500 \times (1 + 15\%)] \times (1 - 10\%)$
 $= \underline{\underline{\$3622.5}}$

4. Find the final value when 100 increases by 15% and then decreases by 5%.

Demonstration

Find the final value when 45 cm is decreases by 5% and then increases by 20%.

Solution

The final value
 $= 45 \times (1 - 5\%) \times (1 + 20\%) \text{ cm}$
 $= \underline{51.3 \text{ cm}}$

5. A number first increases by 10% and then further increases by 80%. If the resulting number is 1227.6, find the original number.

Demonstration

A number first increases by 40% and then decreases by 30%. If the resulting number is 1029, find the original number.

Solution

Let x be the original number.
 $x(1 + 40\%)(1 - 30\%) = 1029$
 $x(1.4)(0.7) = 1029$
 $x = \frac{1029}{(1.4)(0.7)}$
 $= 1050$
 \therefore The original number is 1050.

When we handle situations involving component percentage changes, we have to calculate the change in each component individually and then combine the components to find the required value(s).

For example:

The number of visitors of a theme park was 600 000 last year and 450 000 of them were children. The number of adult visitors increases by 10% and the number of child visitors decreases by 2% this year. Find the total number of visitors of the theme park this year.

Number of adult visitors last year = 600 000 – 450 000 = 150 000

	Adult visitors	Child visitors
Last year	150 000	450 000
	↓ +10%	↓ -2%
This year	$150\,000 \times (1 + 10\%)$	$450\,000 \times (1 - 2\%)$
Total number of visitors this year	$= 150\,000 \times (1 + 10\%) + 450\,000 \times (1 - 2\%)$	
	$= \underline{606\,000}$	

6. S is the sum of two parts x and y . The original values of x and y are 100 and 50 respectively. If the value of x decreases by 20% and the value of y increases by 30%, find the change in the value of S .

Demonstration

A is the sum of two parts m and n . The original values of m and n are 30 and 70 respectively. If the value of m increases by 40% and the value of n decreases by 10%, find the change in the value of A .

Solution

Change in the value of $m = 30 \times 40\%$
 $= 12$
 Change in the value of $n = 70 \times (-10\%)$
 $= -7$
 Change in the value of $A = 12 + (-7)$
 $= \underline{5}$

7. The width and the length of a rectangular(長方形) banner are 90 cm and 240 cm respectively. If the banner is resized such that the width is increased by 10% and the length is decreased by 10%, find the new area of the banner.

Demonstration

The length and the width of a rectangular handkerchief are 20 cm and 15 cm respectively. If the length and the width of the handkerchief both reduced by 2%, find the new area of the handkerchief.

Solution

$$\begin{aligned} \text{New area of the handkerchief} &= \underbrace{[20 \times (1 - 2\%)]}_{\text{new length}} \times \underbrace{[15 \times (1 - 2\%)]}_{\text{new width}} \text{ cm}^2 \\ &= \underline{288.12 \text{ cm}^2} \end{aligned}$$

8. In a school, there are 20 male members and 4 female members in the mathematics club. In the coming academic year, the number of male members will decrease by 5% while the number of female members will increase by 50%. Find the percentage change in the number of members in the mathematics club.
(Give the answer correct to 2 decimal places.)

Demonstration

In a competition, there are 8 male participants and 10 female participants in the first round. After the second round, the number of male participants and the number of female participants increased by 25% and 20% respectively. Find the percentage change in the number of participants in the competition.
(Give the answer correct to 2 decimal places.)

Solution

$$\begin{aligned} \text{Number of participants after the second round} &= 8 \times (1 + 25\%) + 10 \times (1 + 20\%) \\ &= 22 \end{aligned}$$

$$\begin{aligned} \text{Percentage change} &= \frac{22 - (8 + 10)}{8 + 10} \times 100\% \\ &= \underline{+22.22\%}, \text{ cor. to 2 d.p.} \end{aligned}$$

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9. The length of a side of a cube(立方體) is 4 cm. Find the percentage change in the volume of the cube if the length of each side of the cube is reduced by 25%.