

Worksheet 7.2 Growth and Decay

Objective: To solve problems involving constant growth/decay rates.

If a quantity grows at a constant rate of $r\%$ per period, then
new value after n periods = original value $\times (1 + r\%)^n$

- $r\%$ is called the growth rate 增長率.
- $(1 + r\%)$ is called the growth factor.

If a quantity decreases at a constant rate of $r\%$ per period, then

new value after n periods = original value $\times (1 - r\%)^n$

- $r\%$ is called the decay rate 衰減率.
- $(1 - r\%)$ is called the decay factor.

1. Find the new values when \$13 000 grows with an annual growth rate of 2% for 5 years
 (Give the answers correct to the nearest dollar.)

Demonstration

Find the new value when \$5000 grows with a annual growth rate of 3% for 2 years.

Solution

$$\begin{aligned} \text{New value} &= \$5000 \times (1 + 3\%)^2 \\ &= \underline{\underline{\$5304.5}} \end{aligned}$$

2. The present price (現值) of a bag is \$3000. If its price increases by 5% each year, find the price of the bag after 3 years.
 (Give the answer correct to the nearest dollar.)

Demonstration

The price of a tour is \$4500 five years ago. Over the past five years, the price of the tour increased by 3% each year. Find the present price of the tour.

(Give the answer correct to the nearest dollar.)

Solution

$$\begin{aligned} \text{The present price of the tour} &= \$4500 \times (1 + 3\%)^5 \\ &= \underline{\underline{\$5217}}, \text{ cor. to the nearest dollar} \end{aligned}$$

3. There was 500 students studying in a college in 2011. The number of students studying in the college is estimated to increase by 4% every year. Find the number of students studying in the college in 2015.
 (Give the answer correct to the nearest integer.)

4. Vivian is 170 cm tall now and her height has increased by 3.5% every half year over the past two years. How tall was Vivian two years ago?
 (Give the answer correct to the nearest cm.)

Demonstration

Jacky weighs 130 lb now. His weight has increased by 2% every half year over the past three years. Find the weight of Jacky three years ago.

(Give the answer correct to the nearest lb.)

Solution

$$\begin{aligned} \text{Let } x \text{ lb be the weight of Jacky three years ago.} \\ x(1 + 2\%)^6 &= 130 \quad \text{3 years means 6 half years} \\ 1.02^6 x &= 130 \\ x &= 115, \text{ cor. to the nearest integer} \\ \therefore \text{ The weight of Jacky was 115 lb three years ago.} \end{aligned}$$

5. Find the new values when \$54 000 decreases with a decay rates of 3% after 5 periods.
(Give the answers correct to the nearest dollar.)

Demonstration

Find the new value after 6 periods when \$22 000 decreases with a decay rate of 5% per period.

(Give the answer correct to the nearest dollar.)

Solution

$$\begin{aligned} \text{New value} &= \$22\,000 \times (1 - 5\%)^6 \\ &= \underline{\$16\,172}, \text{ cor. to the nearest dollar} \end{aligned}$$

6. The present price of a mobile phone is \$6500. If its price decreases by 7% each year, find its price after two years.

Demonstration

The present annual membership fee of a club is \$2800. If the annual membership fee decreases by 2% each year, find the annual membership fee after three years.

(Give the answer correct to the nearest dollar.)

Solution

$$\begin{aligned} \text{Annual membership fee after three years} \\ &= \$2800 \times (1 - 2\%)^3 \\ &= \underline{\$2635}, \text{ cor. to the nearest dollar} \end{aligned}$$

7. The value of a set of tea wares decreases at a constant rate of 9% per year. If the present value of the set of tea wares is \$1997, find its value five years ago.
(Give the answer correct to the nearest dollar.)

Demonstration

The value of a gold coin decreases at a constant rate of 2.8% per year. If the present value of the gold coin is \$2173, find its value two years ago.

(Give the answer correct to the nearest dollar.)

Solution

Let \$x be the value of the gold coin two years ago.

$$x(1 - 2.8\%)^2 = 2173$$

$$0.972^2x = 2173$$

$$x = 2300, \text{ cor. to the nearest integer}$$

\therefore The value of the gold coin was \$2300 two years ago.

8. The number of secondary students in a city has decreased by 2% each year. In 2013, there were 96 040 secondary students in the city. Find the number of secondary students in 2011.

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9. Frankie bought a car six years ago. The value of the car has decreased by 4% every half year and the present value of the car is \$88 800. Find the amount Frankie paid for the car.
(Give the answer correct to the nearest hundred dollars.)