

Lesson Worksheet 7.2B(I)

Objective: To solve problems involving constant decay rates.

If a quantity decreases at a **constant rate** of $r\%$ per **period**, then
 若一個量在每個時期以固定的率 $r\%$ 減少，則

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

$$n \text{ 期後的新值} = \text{原值} \times (1 - r\%)^n$$

- $r\%$ is called the decay rate. $r\%$ 稱為衰減率。
- $(1 - r\%)$ is called the decay factor. $(1 - r\%)$ 稱為衰減因子。

1. Find the new values when \$54 000 decreases with the following decay rates per period and the corresponding number of periods.

(a) Decay rate = 3%, number of periods = 5

(b) Decay rate = 9%, number of periods = 3

(Give the answers correct to the nearest dollar.)

(a) New value = $\$(\underline{54\,000}) \times (1 - \underline{3\%})^{(\underline{5})}$
 $= \$\underline{46372}$, corr. to the nearest dollar

(b) New value = $\$(\underline{54\,000}) \times (1 - \underline{9\%})^{(\underline{3})}$
 $= \$\underline{40693}$, corr. 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

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

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

Price of the mobile phone after two years

$$\begin{aligned} &= \$(\underline{6500}) \times (1 - \underline{7\%})^{(\underline{2})} \\ &= \$\underline{5621.85} \end{aligned}$$

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

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

3. The present room charge of a standard twin room of a hotel is \$2500 per night. If the charge decreases by 4% each year, find the charge after three years.
(Give the answer correct to the nearest ten dollars.)

How many times will the charge be decreased after three

Room charge of a standard twin room per night after three years

$$= \$(\underline{2500}) \times (1 - \underline{4\%})^{\underline{3}}$$

$$= \$\underline{2210}, \text{ corr. to nearest dollars}$$

Challenging Question(Optional)

old value

- *4. The average wedding expenses of a pair of couple in 2013 and 2014 were \$150 000 and \$145 050 respectively.

- (a) Find the percentage decrease in the average wedding expenses of a pair of couple from 2013 to 2014.
(b) If the percentage decrease of the average wedding expenses of a pair of couple is the same as the value in (a) in each subsequent year, find the average wedding expenses of a pair of couple in 2018. (Give the answer correct to the nearest thousand dollars.)

- (a) Percentage change

$$= \frac{[(\underline{145050}) - (\underline{150000})]}{(\underline{150000})} \times 100\%$$

$$= \underline{-3.3\%}$$

∴ Percentage decrease is 3.3%.

- (b) Average wedding expenses of a pair of couple in 2018

$$= \$(\underline{150000}) \times (1 - \underline{3.3\%})^{\underline{2018 - 2013}}$$

$$= \$\underline{127000}, \text{ corr. to the nearest thousand dollars}$$