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$$A = P(1+r)^t$$

Date \_\_\_\_\_  
Algebra II

## Finding Exponential Rate

1. A bank account opened up 3 years ago with an initial balance of \$12000 now has a balance of \$12824. Find the annual growth rate, to the nearest tenth of a percent.

$$A = 12824$$

$$P = 12000$$

$$r = r$$

$$t = 3$$

$$\frac{12824}{12000} = \frac{12000(1+r)^3}{12000}$$

$$(1.0686\overline{6}) = (1+r)^3$$

$$\sqrt[3]{1.0686\overline{6}} = \sqrt[3]{(1+r)^3}$$

$$1.0223 = 1+r$$

$$0.0223 = r$$

$$2.2\%$$

2. Jack bought a new car in 2010 for \$16100. In 2018, the car is now worth \$6125. What is the annual rate of decrease to the nearest percent?

$$A = 6125$$

$$P = 16100$$

$$r = r$$

$$t = 8$$

$$\frac{6125}{16100} = \frac{16100(1-r)^8}{16100}$$

$$(0.38043) = (1-r)^8$$

$$\sqrt[8]{0.38043} = \sqrt[8]{(1-r)^8}$$

$$0.8862 = 1-r$$

$$-0.11379 = -r$$

$$11\%$$

3. A collectible toy was bought 15 years ago for \$5 and is now worth \$42. Find the annual growth rate to the nearest tenth of a percent.

$$A = 42$$

$$P = 5$$

$$r = r$$

$$t = 15$$

$$\frac{42}{5} = \frac{5(1+r)^{15}}{5}$$

$$(8.4) = (1+r)^{15}$$

$$\sqrt[15]{8.4} = \sqrt[15]{(1+r)^{15}}$$

$$1.1524 = 1+r$$

$$15.2\%$$

4. A colony of 120 timberwolves increased to 245 over a 6 year span. Assuming exponential growth, what was the annual growth rate to the nearest percent?

$$A = 245$$

$$P = 120$$

$$r = r$$

$$t = 6$$

$$\frac{245}{120} = \frac{120(1+r)^6}{120}$$

$$(2.0416\overline{6}) = (1+r)^6$$

$$\sqrt[6]{2.0416\overline{6}} = \sqrt[6]{(1+r)^6}$$

$$1.1263 = 1+r$$

$$13\%$$

5. The principal value of a loan is \$424,100. If there is \$110,000 remaining on the loan after 19 years, what was the annual rate of decrease to the nearest tenth of a percent?

$$\begin{aligned}
 A &= 110,000 \\
 P &= 424,100 \\
 r &= r \\
 t &= 19
 \end{aligned}$$

$$\begin{aligned}
 110,000 &= 424,100(1-r)^{19} \\
 \frac{110,000}{424,100} &= \frac{424,100}{424,100}(1-r)^{19} \\
 (.2593...) &= (1-r)^{19} \\
 .9314... &= 1-r \\
 -1 & \quad -1 \\
 \frac{.9314...}{-1} &= \frac{-r}{-1} \\
 .9314... &= r \\
 \text{6.9\%} &
 \end{aligned}$$

6. An endangered species has dropped from 937 animals to 375 animals over the past 8 years. What is the annual rate of decrease rounded to the nearest percent?

$$\begin{aligned}
 A &= 375 \\
 p &= 937 \\
 r &= r \\
 t &= 8
 \end{aligned}$$

$$\begin{aligned}
 375 &= 937(1-r)^8 \\
 \frac{375}{937} &= \frac{937}{937}(1-r)^8 \\
 (.4002...) &= (1-r)^8 \\
 .8918... &= 1-r \\
 -1 & \quad -1 \\
 \frac{.8918...}{-1} &= \frac{-r}{-1} \\
 .8918... &= r \\
 \text{11\%} &
 \end{aligned}$$

7. A house purchased 5 years ago for \$100,000 was just sold for \$135,000. Assuming exponential growth, approximate the annual growth rate, to the nearest percent.

$$\begin{aligned}
 A &= 135,000 \\
 P &= 100,000 \\
 r &= r \\
 t &= 5
 \end{aligned}$$

$$\begin{aligned}
 135,000 &= 100,000(1+r)^5 \\
 \frac{135,000}{100,000} &= \frac{100,000}{100,000}(1+r)^5 \\
 (1.35) &= (1+r)^5 \\
 1.0618... &= 1+r \\
 -1 & \quad -1 \\
 \frac{1.0618...}{-1} &= \frac{r}{-1} \\
 1.0618... &= r \\
 \text{6\%} &
 \end{aligned}$$

8. Over the past 4 years, the value of a stock increased from \$1200 to \$2300. What is the monthly growth rate, rounded to the nearest tenth of a percent?

$$\begin{aligned}
 2300 &= 1200(1+r)^4 \\
 \frac{2300}{1200} &= \frac{1200}{1200}(1+r)^4 \\
 (1.916...) &= (1+r)^4 \\
 1.1766... &= 1+r \\
 -1 & \quad -1 \\
 \frac{1.1766...}{-1} &= \frac{r}{-1} \\
 1.1766... &= r \\
 \text{17.66\%} &
 \end{aligned}$$

$$\begin{aligned}
 A &= (1.1766)^4 \\
 A &= (1.1766)^{\frac{1}{12}} \\
 A &= 1.01364... \\
 \text{1.4\%} &
 \end{aligned}$$