Name: Key

Date:

UNIT 5

LESSON 9

Do Now:

a. For each of the following exponential functions below, determine if it is a *growth* or *decay* model. Explain.

$y = 500(1.2)^x$

growth
$b > 1$

$h(x) = 20(.25)^x$

decay
$0 < b < 1$

b. You buy a new car for $24,000. The value of the car decreases by 16% each year. Guess how much the car will be worth in 20 years from now?

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

$Y = 24{,}000(1-.16)^{20}$

$Y = \$734.17$

AIM: SOLVING EXPONENTIAL WORD PROBLEMS

The "YART" Formula for Exponential GROWTH

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

Y = final amount

A = initial amount

r = rate as a decimal

t= time

1. Jack has $500 to invest. The bank offers an interest rate of 6% compounded annually.

   a. How much money will Jack have after three years?

$A = 500$
$r = 6\% = .06$
$t = 3$

$Y = 500(1+.06)^3$

$Y = 595.51$

   b. What about after ten years?

$Y = 500(1+.06)^{10}$

$Y = 895.42$

2. Mr. Smith invested $2,500 in a savings account that earns 3% interest compounded annually. He made no additional deposits or withdrawals. Which expression can be used to determine the number of dollars in this account at the end of 4 years?

$A = 2{,}500$
$r = 3\% \rightarrow .03$
$t = 4$ years

1) $2500(1 + 0.03)^4$

2) $2500(1 + 0.3)^4$

3) $2500(1 + 0.04)^3$

4) $2500(1 + 0.4)^3$

3. In 2005, the population of a city was 25,000. The population increased by 20% in the following year. If this rate of increase continues, what will be the population of the city in 2012?

$A = 25{,}000$
$r = 20\% \rightarrow .2$
$t = 7$
$2012 - 2005 = 7$

$Y = A(1+r)^t$
$Y = 25{,}000(1+.2)^7$
$Y = 89{,}579.52$
$Y = 89{,}579$

4. A sum of $9,000 is invested at an annual percentage rate (APR) of 8.5% compounded annually. Find the balance in the account after 3 years. Round to the nearest dollar.

$A = 9{,}000$
$r = 8.5\% \rightarrow .085$
$t = 3$

$Y = A(1+r)^t$
$Y = 9{,}000(1+.085)^3$
$Y = \$11{,}495.60$

The "YART" Formula for Exponential DECAY

$$Y = A(1-r)^t$$

Y = final amount
A = initial amount
r = rate as a decimal
t= time

5. You purchase an I-Pod for $70. After you take it home from the store, the value of the I-Pod decreases 3% each year. What is the value of the I-Pod after 2 years? Round to the nearest cent.

$A = 70$
$r = .03$
$t = 2$

$Y = A(1-r)^t$
$Y = 70(1-.03)^2$
$Y = \$65.86$

6. Is the equation $A = 21000(1 - 0.12)^t$ a model of exponential growth or exponential decay, and what is the rate (percent) of change per time period?

decay

~~1)~~ exponential growth and 12%

~~2)~~ exponential growth and 88%

$1 - .012 = .88 \rightarrow 88\%$

3) exponential decay and 12%

(4) exponential decay and 88%

PARTNER PTRACTICE:

7. Raymond buys a new car for \$21, 500. The car depreciates by about 11% per year. What is the value of the car after 5 years? Round to the *nearest dollar*.

$A = 21{,}500$
$r = 11\% = .11$
$t = 5$

$y = A(1-r)^t$
$y = 21{,}500(1-.11)^5$
$y = \$12{,}005.72$

$\boxed{y = \$12{,}006}$

8. Kirsten invested \$1000 in an account at an annual interest rate of 3%. She made no deposits or withdrawals on the account for 5 years. The interest was compounded annually. Find the balance in the account, to the *nearest cent*, at the end of 5 years.

$A = 1000$
$r = .03$
$t = 5$

$y = A(1+r)^t$
$y = 1000(1+.03)^5$
$\boxed{y = \$1159.27}$

9. A student invests \$500 for 3 years in a savings account that earns 4% interest per year. No further deposits or withdrawals are made during this time. Which statement does not yield the correct balance in the account at the end of 3 years?

~~1)~~ $500(1.04)^3$ decay!
2) $500(1-.04)^3$
~~3)~~ $500(1+.04)(1+.04)(1+.04)$
4) $500 + 500(.04) + 520(.04) + 540.8(.04)$

$y = A(1+r)^t$
$y = 500(1+.04)^3$

10. Daniel's Print Shop purchased a new printer for \$35,000. Each year it depreciates at a rate of 5%. What will its value be at the end of the fourth year?

$A = 35{,}000$
$r = .05$
$t = 4$

$y = A(1-r)^t$
$y = 35{,}000(1-.05)^4$
$\boxed{y = \$28{,}507.72}$