PAP Algebra 2 **Name:** Key

Exponential Applications Intro.

ngage

A) Your favorite shoes are on sale 30% off. The original price was $74.99. What is the sale price of the shoes?

$74.99(1-.30)$ $\$52.49$

B) You and your friend go to dinner and the bill is $45.62. You want to tip the waiter 23% because 23 is your favorite number. What will be the total including the tip?

$45.62(1+.23)$

$\$56.11$

Explain

General Growth/Decay

$$y = a(b)^x$$

Percentage Rate Growth/Decay

$$y = a(1+r)^x$$

$$y = a(1-r)^x$$

Half-Life

$$y = a\left(\frac{1}{2}\right)^{\frac{\text{time}}{\text{half-life}}}$$

1. Ed bought a new mustang for $20,000. Mustangs depreciate at a rate of 22% per year. 1-r

a) What is the initial value? 20,000

b) What is the growth/decay rate? $1-.22=.78$

c) Write an equation. $Y=20,000(.78)^x$

d) How much will the Mustang be worth in 6 years when he graduates from college?

$20,000(.78)^6 = 4503.99$

e) When will the car be worth $1000?

$1000 = 20000(.78)^x$

$.05 = .78^x$

$\log .78 .05 = x$

$x = 12$ years

2. The school currently has 1800 students and a 25% rate of growth due to people moving in to the school each year. 1+r

a) What is the initial amount? 1800

b) What is the growth rate? 1+.25

c) Write an equation. $y = 1800(1+.25)^x$

d) Predict the number of students in 2 years.

$y = 1800(1.25)^2$

$y = 2812.5$

3. The Interwrite Pad Mrs. Granier is using this year has become famous and is now considered a collector's item. As a result, it will appreciate at a rate of 15% per year. The school paid $150 for the pad initially.

a) What is the initial value? 150

b) What is the growth/decay rate? 1+.15

c) Write an equation. $y = 150(1.15)^x$

d) How much will it be worth in 10 years?

$150(1.15)^{10} = 606.83$

e) When will it be worth $10,000?

$10{,}000 = 150(1.15)^x$

$66.667 = 1.15^x$

$\log_{1.15}(66.667) = x$ $\quad x = 30$

4. The number of redhawks in Frisco is doubling every 6 months. Currently there are 200 redhawks in Frisco. 2 times/year

a) What is the initial amount? 200

b) What is the growth/decay rate? 2

c) Write an equation. $y = 200(2)^{2x}$

d) How many redhawks will there be in 4 years?

$y = 200(2)^{8}$ $\quad y = 51{,}200$

e) When will there be 10,000 redhawks in the area?

$10{,}000 = 200(2)^x$

$5 = 2^x$

$\log_2 5 = x$ $\quad x = 2.8$ years

5. Mr. Smith had to take 50 mg of Iodine-131 to treat his thyroid disease. Iodine-131 has a half-life of 8 hours.

a) What is the initial amount? 50

b) What is the growth/decay rate? 1/2

c) Write an equation. $y = 50(1/2)^{x/8}$

d) How much was left in his body after 1 day?

↳ 24 hours

$y = 50(1/2)^{24/8}$ $y = 6.25$

e) When did the amount drop below 1 mg?

$1 = 50(1/2)^{x/8}$ $\frac{1}{50} = (\frac{1}{2})^{x/8}$ $\log 1/2 \frac{1}{50} = \frac{x}{8}$

$x = 8 \log .5 \frac{1}{50}$

$x = 45.15$

6. A new drug to treat a disease has a half-life of 3 hours. If 50cc is initially administered, how much will still be in your system 24 hours later?

$y = 50(1/2)^{24/3}$ $y = .195$

7. Nobelium -259 has a half-life of 58 minutes. How much remains of a 1 kg sample of 1 day?

↳ 1440 mins

$1(1/2)^{\frac{x}{58}}$

$1(.5)^{\frac{1440}{58}}$ .0000000033586 OR 3.3586×10^{-8}

8. Dubnium-262 has a half-life of 34 seconds. How many grams did we begin with if, after 5 minutes, we are left with only 1 gram?

↳ 300 sec

$1 = x(\frac{1}{2})^{\frac{300}{34}}$ $1 = x(1/2)^{\frac{300}{34}}$

$x = \frac{1}{(1/2)^{\frac{300}{34}}}$ $x = 453.1$

9. Caffeine in the blood stream has a half-life of 5 hours as shown in the table below. A venti sized coffee from Starbucks has 415 mg of caffeine. How much caffeine would be left behind in your body 24 hours after drinking a venti coffee?

Time (hours)	Amount of caffeine in body (mg)
0	415
5	207.5
10	103.75
15	51.875

$415(1/2)^{x/5}$

14.897 mg

PAP Algebra 2 **Name:** Key

Exponential Applications Intro. HW

For the given equation find the initial value, identify if it a growth or decay, and the rate of growth/decay.

1. $y = 2(3)^x$

Initial: 2

Growth or Decay: Growth

Rage of g/d: 3

2. $y = 1.5^x$

Initial: 1

Growth or Decay: Growth

Rage of g/d: .5

3. $y = 4(1.05)^x$

Initial: 4

Growth or Decay: Growth

Rage of g/d: .05

4. $y = .87^x$

Initial: 1

Growth or Decay: Decay

Rage of g/d: .13

$1 - r = .87$

5. $y = 4(.32)^x$

Initial: 4

Growth or Decay: Decay

Rage of g/d: .68 $1 - r = .$

6. $y = 2.3(1.27)^x$

Initial: 2.3

Growth or Decay: Growth

Rage of g/d: .27

Solve the following.

7. The number of guppies in the Liberty High fish tank starts at 2 and increases 30% per week.

a) Write an equation to represent this situation $y = 2(1+.30)^x$

b) How many guppies in 6 weeks? $2(1.3)^6 = 9.65 \rightarrow$ 10 guppies

c) When will the guppies outnumber the population of Frisco? (72,000)

$\frac{72,000}{2} = \frac{2(1.3)^x}{2}$

$36000 = 1.3^x$

$\log_{1.3} 36000 = x$

$x = 39.99$

8. Chuck Norris has figured out a way to clone himself. He is able to triple the number of Chuck Norrises every 3 days through cloning.

a) What is the percent of growth? 3

b) Write an equation to model this situation. $y = 1(3)^{\frac{x}{3}}$

c) How many Chuck Norrises will there be in 21 days?

$y = 3^{\frac{21}{3}} =$ 2187

9. The number of cell phones in use in the United States t years after 1995 can be approximated by $N(t) = 0.4(1.63)^t$ where N(t) is the number of cell phones in use, in millions.

a) Determine in what year 150 million cell phones will be in use.

$\frac{150}{.4} = \frac{.4(1.63)^t}{.4}$ $\quad 375 = 1.63^t$ $\quad \log_{1.63}(375) = t$ $\quad t = 12.13 \rightarrow$ **2007**

b) In what year will the number of cell phones be double that of 1995?

$\frac{.8}{.4} = \frac{.4(1.63)^t}{.4}$ $\quad 2 = 1.63^t$ $\quad \log_{1.63}(2) = t$ $\quad t = 1.41 \rightarrow$ **1996**

10. An isotope of cesium has a half-life of 30 years. If 10 mg. of cesium disintegrates over a period of 90 years, how many mg. of cesium would remain?

$Y = 10(1/2)^{90/30}$

$Y = 1.25$

11. The half-life of thorium is 25 days. If you start with 70 grams of thorium, how much is left after 100 days?

$Y = 70(1/2)^{\frac{100}{25}}$

$Y = 4.375$

12. Coach Byrd decides to spend his lucrative coaching stipend on a classic Mustang. He buys it for $47,321.53. Being a classic, it appreciates in value by 18% per year.

a) Write an equation to model this situation.

$Y = 47,321.53(1.18)^x$

b) How much will her Mustang be worth after 10 years?

$Y = 47,321.53(1.18)^{10}$

$Y = 247,673.10$

c) When will her Mustang be worth $100,000?

$\frac{100,000}{47,321.53} = \frac{47,321.53(1.18)^x}{47,321.53}$

$2.113 = 1.18^x$

$\log_{1.18}(2.113) = x$

$x = 4.5$ years

13. Mr. Loney has saved every cent of his salary for the last several years. He can now afford to buy a brand-new Kia Rio for $6,200. Unfortunately, the Kia depreciates at a rate of 42% per year.

a. Write an equation to model this situation.

$y = 6{,}200(1-.42)^x$

b. How much will Mr. Loney's Kia be worth after 2 years?

$6200(1-.42)^2 = 2085.68$

c. When will his Kia Rio be worth $250?

$\frac{250}{6200} = \frac{6200(1-.42)^x}{6200}$

$.040 = .58^x$

$109.58(.040) = x$

$x = 5.9 \approx$ 6 years

14. The number of coyotes in Frisco has been decreasing according to the following table:

Year	0	1	2	3
Coyotes	27,000	9,000	3,000	1,000

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a. Is this situation growth or decay?

b. What is the rate of growth/decay? 1/3

c. What equation would model this situation?

$y = 27{,}000(1/3)^x$

d. How many coyotes would you expect in year 10?

$y = 27{,}000(1/3)^{10}$

$y = .457 \therefore$ 0 coyotes