7.8 - Compound and Simple interest Notes

Name: _______________

-When making an investment, you are paid interest on what you deposit (put in the account). The interest you earn on the loan depends on the terms of the loan. **Interest** can be added **once** a **year** or at different times throughout the year.

- **Simple Interest** occurs when the amount earned at the end of each year is a percent of the original deposit.

$$A = P(1+r)^t$$
Appreciation/Growth

$$A = P(1-r)^t$$
Depreciation/Decay

A = Final Amt   P = Principal Amt   r = Interest Rate 5% → 0.05   t = time

- **Compound Interest** occurs when interest is added to the principal each period and the interest before the next period is calculated on this new principal.

$$A = P(1+\frac{r}{n})^{nt}$$

What do these letters stand for?

A= Final Amt   P= Principal Amt   r= Interest rate 2.7% → 0.027   t= time

n is conditional:

annually - 1   biannually/semi-annually - 2   monthly – 12   quarterly - 4   daily – 365

weekly - 52

Let's Compare: Edward deposits $500 into an account that earns 2% interest. The bank gives him the option of simple or compound interest on the account. Edward wants to analyze the two models to determine what the best deal is.

Compound → get more $ over time

Simple:

t = 5

$500(1+0.02)^5 = \$552.04$

t = 10

$500(1+0.02)^{10} = \$609.50$

t = 15

$500(1+0.02)^{15} = \$672.93$

Compound:

t = 5 compounded quarterly

$500(1+\frac{0.02}{4})^{4(5)} = \$552.45$

t = 10 compounded monthly

$500(1+\frac{0.02}{12})^{12(10)} = \$610.60$

t = 15 compounded biannually

$500(1+\frac{0.02}{2})^{2(15)}$

$\$673.92$

******An exponential function*** *will always outgrow a* ***linear function*** *given enough time.*

***You deposit $8000 in an account that earns 2.5% annual interest. Compare the balance in the account at the end of 4 years compounded annually, quarterly and monthly.

$8000\left(1+\frac{0.025}{1}\right)^{1\times4}$ $8000\left(1+\frac{0.025}{4}\right)^{4(4)}=$ $8000\left(1+\frac{0.025}{12}\right)^{12(4)}$

$8830.50 $8838.62 $8840.45

So now that we have talked about compounding money, let's talk about real things.

Shopping!

- A couch is $800 with an 8% sales tax. How much is the couch? Did the price grow or decay?

$800(1+0.08) = \$864$ Grow

- A $30 hoodie is on sale for 20% off. How much is the hoodie? Did the price grow or decay?

$30(1-0.2) = \$24$ Decay

- A chair is $600 with an 8% sales tax. How much is it?

$600(1+0.08) = \$648$

- You're shopping at Kohls and find some pants for $50 at 20% off. But then you have a coupon for additional 20% off. How much are the pants?

$50(1-0.2)^2 = \$32$

- You have eight coupons for 15% off, and the store is going to let you use all 8 coupons on the same purchase. What you want to buy is $100. How much is the item after applying the coupons?

$100(1-0.15)^8 = \$27.25$

- The principal is $500. The rate of increase is 13%. The amount of years that went by is 5. To find out how much money you have now, what do you put into the calculator? **(then type it in the get an answer)**

a.) $500(1 + 13)^5$ b.) $500(1 + .13)^5$ c.) $13(1 + 500)^5$ d.) $500(1 + .05)^{13}$

$921.22

How much is a $25,000 car worth after 7 years if it **depreciates** at a 9% annually? $25000(1-0.09)^7$	What is a house worth now if we bought it at $120,000, and it has gained 1.2% annually in value for the past 3 years? $120000(1+0.012)^3$

$12,919.03

$124,372.05

Market Value $120000(1+0.098)^3$

$158,850.38

Growth rate: the percent the y-values are growing by

Growth factor: the ratio the y values are growing by

Decay rate: the percent the y values are decaying by

Decay factor: the ratio the y values are decaying by

Given: $y = 48(0.25)^x$ base	Given: $y = 7(1 + 0.02)^x$
a) Principle amount: 48	a) Principle amount: 7
b) Growth or decay? Decay	b) Growth or decay? Growth
c) Ratio of y values: 0.25 → in ( )	c) Ratio of y values: 1.02
d) Rate of growth/decay 100 → 25 → Decay of 75%	d) Rate of growth/decay 100 → 102 +2%
e) How much do we have after 2 years? $48(0.25)^2 = 3$	e) How much do we have after 2 years? $7(1+0.02)^2 = 7.28$

$y = 5(4)^x$

initial amount	Ratio	Rate
5	4	300%

Solve when x= 4

1280

1 → 4 +3

+300%

X	Y
2	80
3	320
4	1280

$y = 8(.3)^x$

$8(0.3)^5 = 0.019$

initial amount	Ratio	rate
8	0.3	-70%

Solve when x = 5

1 → 0.3 − 0.7

−70%

$A = 700(1.41)^t$

initial amount	Ratio	rate
700	1.41	41%

Solve when x = 6.5

1 → 1.41

+0.41 → 41%

$700(1.41)^{6.5}$

6531.64

$A = 74(0.85)^t$

initial amount	Ratio	rate
74	0.85	-15%

Solve when x = 35

1 → 0.85

−0.15 →

$74(0.85)^{35} = 0.251$

- Given an **equation**, how can you tell the difference between a growth problem and a decay problem?

Growth → goes up
ratio/base > 1

Decay → goes down
ratio/base < 1

Read the following scenarios. Figure out whether they are growth or decay. Create the equation and see if you can find what the growth or decay factor is.

a. Linda is opening a shop selling brownies. She starts by telling 3 people about the opening and then they each tell 3 people and it continues on and on. What is the growth factor here?

$1(3)^t$ 1 → 3 +2

200%

0	1
1	3
2	9
3	27

ratio/base

3

b. Biologists have found a new virus that decays over time. In the beginning, there are 162 virus cells that they are working with. After 1 hour, there are 54 cells, after 2 hours there are 18 cells and so on. What is the decay factor here?

162x3=

X	Y
0	162
1	54
2	18

$\frac{1}{3}$ $\frac{1}{3}$

$\cancel{\frac{162}{54}}$ $\cancel{3}$ OR $\frac{54}{162}$ $\frac{1}{3}$

$162\left(\frac{1}{3}\right)^x$

Ratio: $\frac{1}{3}$

$1 \to \frac{1}{3}$

Decay Factor

$\frac{2}{3}$