Math 105 – Week 2 Name: _____

Finance Day 1

Practice: Simple Interest

1. You borrow $1850 for tuition costs with the agreement that you will repay it in 6 months. Your lender offers you an APR of 11%. How much will you have to repay in 6 months?

6 months is 0.5 years

. Since the interest rate is annual, we have to give time in years also.

$I = P_0 \cdot r \cdot t = 1850(0.11)(0.5) = \$101.75$

You will have to repay $1850 + 101.75 = \$1951.75$

2. Replace "6 months" in the previous question with "4 months." What will you have to repay, and how much did you save compared to a 6 month agreement?

4 months is $\frac{4}{12} = 0.33$ years.

$I = P_0 \cdot r \cdot t = 1850(0.11)(0.33) = \$67.83$

You will have to repay $1850 + 67.83 = \$1917.83$.

You saved $33.92.

3. A loan company charges $25 interest for a two-month loan of $275. Find the APR they are charging. Round your answer to the nearest tenth of a percent.

$25 = 275(r)\left(\frac{2}{12}\right)$

$25 = 45.83 \cdot r$

$r = 0.55$ or 55% interest (wow!) Rounding note: I got 0.54549 which rounds to o.55 or you could also write 54.5%

4 a. Suppose you purchase a $5,000 (starting value) T-note with a 3% annual rate, paid quarterly, with maturity in 5 years. How much interest will you earn over the course of the 5 years?

I assumed $5000 was the purchase price of the T-note. Also the total amount of interest you get over 5 years will be the same whether you are paid quarterly or not.

If I just use the annual interest rate and 5 years: $I = 5000 \cdot 0.03 \cdot 5 = \$750$

If I use the quarterly interest rate and the number of quarters:

$I = 5000 \cdot \frac{0.03}{4} \cdot 20 = \$750$

b. How much are you paid every quarter?

5 years $\cdot$ 4 quarters per year = 20 quarters. take the amount of interest ($750) and divide by the number of quarters. $\frac{\$750}{20} = \$37.50$

5. A friend asks to borrow $60 and agrees to pay you back $65. How much time should you give your friend if you want to make sure the APR is below 50%? Use appropriate time units.

I'm expecting the amount of time to be pretty small. The amount of interest I'm plugging in is $5. Can you see why? Also even though I want the apr to be below 50%, I plug in r = 0.50 because that will give me the cut off value for time.

$I = P_0 \cdot r \cdot t$

$5 = 60(0.50)(t)$

$5 = 30t$

$t = 0.166666..$ years (t is always years)

This is the number of years (0.1666 is the decimal version of ⅙).. ⅙ of a year...If I multiply this by 12 months per year, then I get 2 months. 2 months is the cut-off, so if I give the friend 2 months the interest rate WILL be 50%. Do you think I should give the friend more time, or less? Try using 1 month.

$5 = 60 \cdot r \cdot \frac{1}{12}$

$5 = 5 \cdot r$

$r = 1$ or 100%.

Better give the friend more time, and then the effective interest rate will be lower.

$5 = 60 \cdot r \cdot \frac{3}{12}$

$5 = 15 \cdot r$

$r = 0.3333$ or 33%.If you give the friend more than 2 months, then the interest rate/apr will be lower than 50%.

Finance Day 2

Practice: Compound Interest

Compound interest and the power of feedback loops:

1. You have $1000, and you earn 5% interest each year. The interest you earn stays in the account, so that you earn interest on the principal as well as the interest the next year. Assume that the ending balance for each year becomes the starting balance for the following year.

Year	Starting Balance	Interest Earned	Ending Balance
1	$1000	$50	$1050
2	$1050	$1050*0.05=$52.50	$1050+52.50=$1102.50
3	$1102.50	$55.13	$1157.63 = 1000(1+.05)^(3*1)
4	$1157.63	$57.88	$1215.51
5	$1215.51	$60.78	$1276.29
6	$1276.29	$63.81	$1340.10

Now use the compound interest formula to predict the ending balance in the account after

2. 10 years

Here is the compound interest formula. We will use k=1 because interest is calculated just once a year. $P_N = P_0\left(1+\frac{r}{k}\right)^{N\cdot k}$

$P_N = 1000\left(1+\frac{0.05}{1}\right)^{10\cdot 1} = \$1628.89$

3. 19 years

$P_N = 1000\left(1+\frac{0.05}{1}\right)^{19\cdot 1} = \$2526.95$

4. 20 years.

$P_N = 1000\left(1+\frac{0.05}{1}\right)^{20\cdot 1} = \$2653.30$

5. How much interest did you earn during year 20? (Subtract the year 20 ending balance from the year 19 ending balance.)

$\$2653.30 - \$2526.95 = \$126.35$

6. Why is that interest amount so much greater than the interest you earned the first year?
The interest is greater because the principal is so much greater. The starting amount for year 20 is more than double what it was at the beginning of the problem.

Using the Compound Interest Formula

In the chart below, please write the formula you will use to calculate the result. Then write the dollar amount that results. Some of the results have been entered for you –- use those to check your work.

Type of Interest	Future Value of $2500 at 8% Interest		
	After 1 Year	After 10 Years	After 30 Years
Simple interest	$A = P_0(1 + r \cdot t)$ $A = 2500(1 + 0.08 \cdot 1)$ $2700.00	$2500(1 + 0.08 \cdot 10)$ $4500	$2500(1 + 0.08 \cdot 30)$ $8500
Compounded annually	$P_N = P_o\left(1 + \frac{r}{k}\right)^{N \cdot k}$ $P_N = 2500\left(1 + \frac{0.08}{1}\right)^{1 \cdot 1}$ $2700	$2500\left(1 + \frac{0.08}{1}\right)^{10 \cdot 1}$ $5397.31	$2500\left(1 + \frac{0.08}{1}\right)^{30 \cdot 1}$ $25,156.64
Compounded quarterly	$2500\left(1 + \frac{0.08}{4}\right)^{1 \cdot 4}$ $2706.08	$2500\left(1 + \frac{0.08}{4}\right)^{10 \cdot 4}$ $5520.10	$2500\left(1 + \frac{0.08}{4}\right)^{30 \cdot 4}$ $26,912.91
Compounded monthly	$2500\left(1 + \frac{0.08}{12}\right)^{1 \cdot 12}$ $2707.50	$2500\left(1 + \frac{0.08}{12}\right)^{10 \cdot 12}$ $5549.10	$2500\left(1 + \frac{0.08}{12}\right)^{30 \cdot 12}$ $27,339.32
Compounded daily	$2500\left(1 + \frac{0.08}{365}\right)^{1 \cdot 365}$ $2708.19	$2500\left(1 + \frac{0.08}{365}\right)^{10 \cdot 365}$ $5563.36	$2500\left(1 + \frac{0.08}{365}\right)^{30 \cdot 365}$ $27,550.69