Worksheet 22 (Finance 2): Simple and Compound Interest

Group names: _____

Recall:

P = principal / starting amount	r = annual interest rate (APR)
I = interest	n = number of compounding periods per year
A = final amount	t = number of years

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

For the following problems,

(i) Identify the value for each variable and which formula you should use

(ii) use a spreadsheet or a calculator to compute the quantities.

For each quantity, carefully write *what you need to compute* along with the answer.

To be efficient, you may want to write the following spreadsheet formula for compound interest (you would put in the correct numbers for each problem where it says [enter number]). You can fill down to compute A for each problem.

F2 =B2*(1+C2/D2)^(D2*E2)

	A	B	C	D	E	F	G
1	problem	P	r	n	t	A	
2		[enter #]	[enter #]	[enter #]	[enter #]	=B2*(1+C2/D2)^(D2*E2)	

Example: Your uncle gives you a simple interest loan of \$500 for one year, at 4% annual interest.

1. How much interest do you owe?
2. What is the total amount you will owe him at the end of the year?

Answer:
This is a simple interest problem. $P = 500$, $r = 0.04$, $t = 1$.
(a) Total interest: $I = Prt = 500 * 0.04 * 1 = \$20$
(b) Final amount: $A = 500(1 + 0.04) = \$520$

1. You borrowed \$1500 from a relative.

   (a) Suppose she charged you 5% APR, compounded monthly. If you paid her back 5 years later, how much money did you give her?

   (b) In the above situation, how much more interest did you pay than if she had charged you simple interest for 5 years?

2. You got a bonus of $7,500 and you want to start a college fund for your child. You find an account paying 9.75% APR compounded quarterly. If your child just turned two years old, how much will you have when they turn 18? How much of that account balance is interest?

3. Calculate how much you would have in the previous problem if it was compounded daily instead of quarterly. How much additional interest did you earn from the change in the number of compounding periods?

4. If you are considering a credit card with an APR of 27.49%, compounded daily, what annual rate are you effectively paying? (To determine this, compute the total interest I you paid for one year, and then compute I/P and convert it into a percentage.)

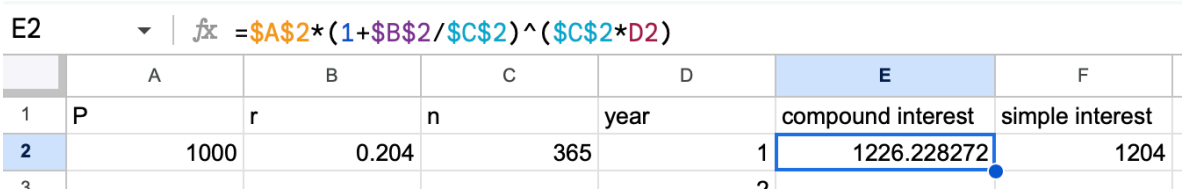
5. How much would you need to deposit today to have one million dollars if you can find an account that pays 10% interest, compounded daily, for 50 years?

   Note that if $A = P(1 + \frac{r}{n})^{nt}$ then by algebra, $P = \frac{A}{(1+\frac{r}{n})^{nt}}$.

6. For this problem, we want to compare simple interest to compound interest over time, in a graph.

   Scenario: You put $1000 on a credit card, which charges 20.4% APR, compounded daily. Suppose this is an unrealistic credit card that does not have monthly minimum payments (we will talk about how to handle those later).

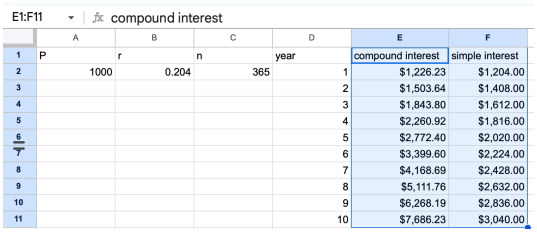
   (a) Make a new spreadsheet with spaces for P, r, n, and t (which we will label "years"). Make columns for compound interest and simple interest. I am showing you the formula for compound interest in the screenshot; you will need to modify it to enter simple interest.



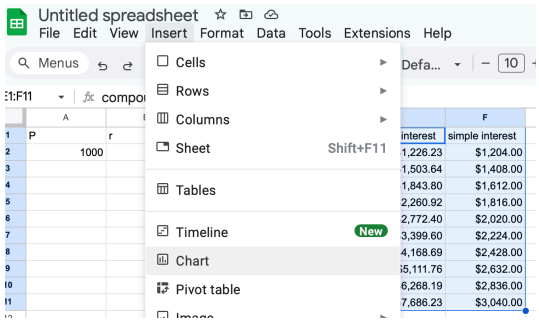
	A	B	C	D	E	F
1	P	r	n	year	compound interest	simple interest
2	1000	0.204	365	1	1226.228272	1204

   (b) Fill down the "year" column by typing in 1 and 2, selecting both, and filling down until you reach 10 years. Then fill down the compound interest and simple interest columns.

   (c) Select the entries in the Compound Interest and Simple Interest columns, go to the `Insert` column, select `Chart`.



	A	B	C	D	E	F
1	P	r	n	year	compound interest	simple interest
2	1000	0.204	365	1	$1,226.23	$1,204.00
3				2	$1,503.64	$1,408.00
4				3	$1,843.80	$1,612.00
5				4	$2,260.92	$1,816.00
6				5	$2,772.40	$2,020.00
7				6	$3,399.60	$2,224.00
8				7	$4,168.69	$2,428.00
9				8	$5,111.76	$2,632.00
10				9	$6,268.19	$2,836.00
11				10	$7,686.23	$3,040.00



   (d) Move the chart so that you can see the chart and the data, and experiment with what happens to the chart if you change the number of compounding periods, or the interest rate. What do you notice?

   (e) How much do you owe in interest at the end of 10 years?

   Simple interest: _____

   Compound interest: _____

7. Modify the previous question to make a chart that shows the difference in interest if you compound \$1000 daily versus annually at 6% annual interest rate for 100 years, looking at values every 10 years. You will need to have two different values for n and two different compound interest columns.

   What do you notice?

8. Use a spreadsheet to answer the following question:

   Alice deposited \$2498 into an account paying 7.05% APR, compounded quarterly. Bob deposited \$2994 into an account paying 5.19% APR, compounded monthly. How many years will it take for their balances to (nearly) match?

9. Which is better: an account that earns 7.25% compounded quarterly, or an account that earns 7.15% compounded daily? Give the effective rate (that is, the effective annual interest rate) for each account, and explain your answer