

Chapter 4 Group Activity - SOLUTIONS

4B: Simple and Compound Interest

Group Activity

Use a spreadsheet on a Chromebook, smartphone, laptop or tablet to work on these problems. Write down the spreadsheet syntax to show your work.

For example: =FV(.05/12, 2*12, 0, 1000).

Answer each question in a complete sentence.

1. Your uncle is giving you a **simple interest** loan of \$500 for one year at 4% interest. What is the total amount you will owe him?

$$= 500 + 500 * 0.04 * 1 = \$520$$

I would owe my uncle \$520 after one year.

2. You borrowed \$1500 from another relative. She charged you 5% APR, **compounded monthly**. If you paid her back 2 years later, how much money did you give her?

$$=FV(0.05/12, 12*2, 0, 1500)$$

$$=\$1,657.41$$

I would owe my relative \$1,657.41 after 2 years.

3. 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?

Since they just turned 2, we have 16 more years.

$$=FV(0.0975/4, 16*4, 0, 7500)$$

$$=\$35,029.62$$

I would have \$35,029.62 when my child turns 18.

4. Calculate how much you would have in problem 3 above if it was **compounded continuously** instead of quarterly.

$$=7500*EXP(.0975*16)$$

$$=\$35,691.16$$

I would have \$35,691.16 when my child turns 18 if the interest was compounded continuously.

5. If you are considering a credit card with an APR of 27.49%, compounded daily, what annual rate are you **effectively paying**?

$$=EFFECT(.2749, 365)$$

$$\approx 0.316262829$$

$$\approx 31.63\%$$

If I am using a credit card with an APR of 27.49%, compounded daily, I am effectively paying 31.63% per year.

6. 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?

$$=PV(0.10/365, 50*365, 0, 1000000)$$

$$=\$6,742.56$$

If I could deposit \$6,742.56 in an account with 10% interest compounded daily, I would have one million dollars in 50 years.

4C: Savings Plans and Investments - SOLUTIONS

Use your Excel Financial Calculator Spreadsheet to work on these problems. Write down the Excel syntax to show your work. Answer each question in a complete sentence.

7. Janelle is 34 years old. She would like to have one million dollars in her retirement account when she is 65 years old.

- a. How much would she need to deposit every month into an account with an APR of 7.25%, compounded monthly, to achieve her goal?

$$=PMT(0.0725/12, (65-34)*12, 0, 1000000)$$

$$= \$719.22$$

She would need to deposit \$719.22 each month to have a million dollars when she retires.

- b. If Janelle had started the account at age 21 (same APR), how much would she need to deposit every month to achieve her goal?

$$=PMT(0.0725/12, (65-21)*12, 0, 1000000)$$

$$= \$262.04$$

She would need to deposit \$262.04 each month to have a million dollars when she retires.

- c. If Janelle had started the account at age 21 (same APR) and deposited the amount calculated in part (a) every month, what would the balance be when she retired at age 65?

$$=FV(0.0725/12, (65-21)*12, -719.22)$$

$$= \$2,744,713.35$$

She would have over \$2.7 million dollars when she retired.

8. Kimmy has a student loan of \$30,000 at a fixed APR of 4.45%. If they want to pay it off in 15 years,

- a. How much would they pay per month?

$$=PMT(0.0445/12, 15*12, 0, 30000)$$

$$= \$228.73$$

They would need to pay \$228.73 per month for 15 years.

- b. How much would they pay in total?

$$= \$228.73 * 15 * 12$$

$$= \$41,171.40$$

She would need to deposit \$262.04 each month to have a million dollars when she retires.

- c. What percentage of the total was paid toward the loan amount of \$30,000 and what percentage was paid toward interest?

Percentage toward the principal:

$$= \$30,000 / 41,171.40$$

$$\approx 73\%$$

About 73% of the total was paid toward the principal. That means about 27% was paid in interest.

9. You want to buy a \$350,000 home. You plan to put 10% down and take out a 30-year fixed mortgage on the rest.

- a. What will the loan amount be?

$$\text{Amount of down payment: } 0.10(350,000) = \$35,000$$

$$\text{Loan amount} = \$350,000 - \$35,000 = \$315,000$$

The loan amount is \$315,000.

- b. What will your monthly payment be if the interest rate is 4.5%?

$$= \text{PMT}(0.045/12, 30*12, 315000, 0)$$

$$= \$1,596.06$$

My monthly mortgage payment would be \$1,596.06.

- c. If you make all the payments for 30 years, how much would you have paid for the house in total?

$$= \$1,596.06 * 30 * 12$$

$$= \$574,581.14$$

If I owned the house for 30 years I would pay \$574,581.14.

d. In part b above, what number would you get if you switch the 0 and the 315,000? Why are the answers so different? Explain the difference between these two scenarios.

$$\begin{aligned} &= \text{PMT}(0.045/12, 30*12, 0, 315000) \\ &= \$414.81 \end{aligned}$$

These numbers are very different! In part b, we are making loan payments that include interest in addition to the principal of \$315,000. The present value is \$315,000 and the future value is \$0.

Part d is different because we switched the present value to \$0 and the future value to \$315,000. In this case we would be depositing \$414.81 per month to save up to \$315,000. Interest is working with us instead of against us.

4E: Federal Income Taxes

10. Separate the tax table page and calculate the values for each household and determine the amount they owe or will be refunded.

2018 Tax Year	Dakota and Avery (no children)	Letitia (2 children)
Filing Status	Married Filing Jointly	Single (Single means she is not claiming her kids on her return, another parent is)
Adjusted Gross Income	\$93,700	\$42,600
Itemized Deductions	\$17,200	\$5,700
Standard Deduction	\$24,000	\$12,000
Taxable Income	$\begin{array}{r} \$93,700 \\ -24,000 \\ \hline = \$69,700 \end{array}$	$\begin{array}{r} \$42,600 \\ -12,000 \\ \hline = \$30,600 \end{array}$
Tax from Table	$\$1,905 + .12(69,700 - 19,050) = \$7,983$	$\$952.50 + .12(30,600 - 9,525) = \$3,481.50$
Tax Credits	\$0	\$426
Tax Amount after Credits	\$7,983	\$3,481.50 - 426 = \$3,055.50
Federal Taxes Withheld	\$14,570	\$4,230
Federal Tax Owed or Refund	$\begin{array}{r} \text{Refund} \\ \$14,570 \\ -\$7,983 \\ \hline = 6,587 \end{array}$	$\begin{array}{r} \text{Refund} \\ \$4,230.00 \\ -\$3,055.50 \\ \hline = \$1,174.50 \end{array}$
Effective Rate (Tax amount after credits ÷ taxable income)	\$7,983/69,700 = 11.5%	\$3,055.50/30,600 = 10%

2018 Tax Year	Joshua (3 children)	Karalene (no children)
Filing Status	Head of Household	Married Filing Separately
Adjusted Gross Income	\$38,200	\$125,400
Itemized Deductions	\$7,800	\$8,500
Standard Deduction	\$18,000	\$12,000
Taxable Income	$\begin{array}{r} \$38,200 \\ -18,000 \\ \hline = \$20,200 \end{array}$	$\begin{array}{r} \$125,400 \\ -12,000 \\ \hline = \$113,400 \end{array}$
Tax from Table	$\$1360 + .12(20,200-13,600) \\ = \$2,152$	$\$14,089.50 + .24(113,400-82,500) \\ = \$21,505.50$
Tax Credits	\$2,049	\$0
Tax Amount after Credits	\$2,152 - 2,049 = \$103	\$21,505.50
Federal Taxes Withheld	\$3,850	\$23,490
Federal Tax Owed or Refund	$\begin{array}{r} \text{Refund} \\ \$3,850 \\ -103 \\ \hline = \$3,747 \end{array}$	$\begin{array}{r} \text{Owe} \\ \$21,505.50 \\ -\$23,490.00 \\ \hline = \$1,984.50 \end{array}$
Effective Rate (Tax amount after credits ÷ taxable income)	\$103/20,200 = 0.5%	\$21,505.50/113,400 = 19%

11. Below is a portion of the 2017 tax year tax schedule from the form 1040 booklet.

a. Find the tax amount for a single person with a taxable income of \$39,890.

The taxes from the table would be \$5,708.

b. Find the tax amount for a married couple filing jointly with a taxable income of \$45,350.

The taxes from the table would be \$5,874.

c. Find the tax amount for a single dad filing as head of household with a taxable income of \$42,102.

The taxes from the table would be \$5,651.









2017 Tax Table — Continued

If line 43 (taxable income) is—		And you are—				If line 43 (taxable income) is—		And you are—				If line 43 (taxable income) is—		And you are—			
		Single	Married filing jointly *	Married filing separately	Head of a household			Single	Married filing jointly *	Married filing separately	Head of a household			Single	Married filing jointly *	Married filing separately	Head of a household
At least	But less than	Your tax is—				At least	But less than	Your tax is—				At least	But less than	Your tax is—			
39,000						42,000						45,000					
39,000	39,050	5,495	4,921	5,495	5,186	42,000	42,050	6,245	5,371	6,245	5,636	45,000	45,050	6,995	5,821	6,995	6,086
39,050	39,100	5,508	4,929	5,508	5,194	42,050	42,100	6,258	5,379	6,258	5,644	45,050	45,100	7,008	5,829	7,008	6,094
39,100	39,150	5,520	4,936	5,520	5,201	42,100	42,150	6,270	5,386	6,270	5,651	45,100	45,150	7,020	5,836	7,020	6,101
39,150	39,200	5,533	4,944	5,533	5,209	42,150	42,200	6,283	5,394	6,283	5,659	45,150	45,200	7,033	5,844	7,033	6,109
39,200	39,250	5,545	4,951	5,545	5,216	42,200	42,250	6,295	5,401	6,295	5,666	45,200	45,250	7,045	5,851	7,045	6,116
39,250	39,300	5,558	4,959	5,558	5,224	42,250	42,300	6,308	5,409	6,308	5,674	45,250	45,300	7,058	5,859	7,058	6,124
39,300	39,350	5,570	4,966	5,570	5,231	42,300	42,350	6,320	5,416	6,320	5,681	45,300	45,350	7,070	5,866	7,070	6,131
39,350	39,400	5,583	4,974	5,583	5,239	42,350	42,400	6,333	5,424	6,333	5,689	45,350	45,400	7,083	5,874	7,083	6,139
39,400	39,450	5,595	4,981	5,595	5,246	42,400	42,450	6,345	5,431	6,345	5,696	45,400	45,450	7,095	5,881	7,095	6,146
39,450	39,500	5,608	4,989	5,608	5,254	42,450	42,500	6,358	5,439	6,358	5,704	45,450	45,500	7,108	5,889	7,108	6,154
39,500	39,550	5,620	4,996	5,620	5,261	42,500	42,550	6,370	5,446	6,370	5,711	45,500	45,550	7,120	5,896	7,120	6,161
39,550	39,600	5,633	5,004	5,633	5,269	42,550	42,600	6,383	5,454	6,383	5,719	45,550	45,600	7,133	5,904	7,133	6,169
39,600	39,650	5,645	5,011	5,645	5,276	42,600	42,650	6,395	5,461	6,395	5,726	45,600	45,650	7,145	5,911	7,145	6,176
39,650	39,700	5,658	5,019	5,658	5,284	42,650	42,700	6,408	5,469	6,408	5,734	45,650	45,700	7,158	5,919	7,158	6,184
39,700	39,750	5,670	5,026	5,670	5,291	42,700	42,750	6,420	5,476	6,420	5,741	45,700	45,750	7,170	5,926	7,170	6,191
39,750	39,800	5,683	5,034	5,683	5,299	42,750	42,800	6,433	5,484	6,433	5,749	45,750	45,800	7,183	5,934	7,183	6,199
39,800	39,850	5,695	5,041	5,695	5,306	42,800	42,850	6,445	5,491	6,445	5,756	45,800	45,850	7,195	5,941	7,195	6,206
39,850	39,900	5,708	5,049	5,708	5,314	42,850	42,900	6,458	5,499	6,458	5,764	45,850	45,900	7,208	5,949	7,208	6,214
39,900	39,950	5,720	5,056	5,720	5,321	42,900	42,950	6,470	5,506	6,470	5,771	45,900	45,950	7,220	5,956	7,220	6,221
39,950	40,000	5,733	5,064	5,733	5,329	42,950	43,000	6,483	5,514	6,483	5,779	45,950	46,000	7,233	5,964	7,233	6,229
40,000						43,000						46,000					
40,000	40,050	5,745	5,071	5,745	5,336	43,000	43,050	6,495	5,521	6,495	5,786	46,000	46,050	7,245	5,971	7,245	6,236

12. Here are some scenarios that compare 2017 taxes (labeled “Current Law” below), with the new tax law that takes effect in the 2018 tax year (labeled “Proposed” below).

<https://taxfoundation.org/final-tax-cuts-and-jobs-act-taxpayer-impacts/>

Impacts of the Tax Cuts and Jobs Act

								
	James	Jason	Amber	Kavya and Nick	Sophie and Chad	Soren and Linnea	Laura and Seth	Joe and Ethan
Ordinary Income	\$30,000	\$52,000	\$75,000	\$85,000	\$165,000	\$325,000	\$2,000,000	\$48,000
Marital Status	Single	Single	Single	Married	Married	Married	Married	Married
Earners	1 earner	1 earner	1 earner	1 earner	2 earners	2 earners	1 earner	Retired
Children	No kids	2 kids	No kids	2 kids	2 kids	3 kids	2 kids	n/a
Tax-Deferred Retirement Contributions	\$2,600	\$4,000	\$5,500	\$5,500	\$20,000	\$37,000	\$18,500	\$0
Itemization	Std. Ded.	Std. Ded.	Std. Ded.	Std. Ded.	Itemizing	Itemizing	Itemizing	Std. Ded.
Current Law	\$4,331	\$5,198	\$16,104	\$11,035	\$29,345	\$71,629	\$713,234	\$3,497
Proposed	\$3,953	\$3,306	\$14,327	\$8,782	\$27,122	\$62,012	\$694,330	\$3,227
Tax Liability Change	-\$379	-\$1,892	-\$1,777	-\$2,254	-\$2,224	-\$9,617	-\$18,904	-\$270
% Tax Liability Change	-9%	-36%	-11%	-20%	-8%	-13%	-3%	-8%
% Change in After Tax Earnings	1.26%	3.64%	2.37%	2.65%	1.35%	2.96%	0.95%	0.56%

Note: Tax burden figures do not include employer-side payroll taxes. These results are for 2018, and do not reflect the expiration of many individual provisions.
Source: Tax Foundation calculations.

a. Look at the “Tax Liability Change” row. Who saves the most money under the new plan? Who saves the least?

Laura and Seth save the most money and they make \$2 million. Then Soren and Linnea. The people who save the least are the retired couple.

b. Look at the “% Tax Liability Change” row. Who saves the largest percentage on their taxes? Who saves the smallest percentage?

Jason, with 2 kids saves the largest percentage, then Kavya and Nick, then Soren and Linnea. Laura and Seth save the smallest percentage.

Challenge Problem

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

Write a spreadsheet formula for each person, using a cell reference for the year. Then you can copy the formula down using the fill-down feature.

With cell references:

Year	Sage	Dionne
1	<code>=FV(0.0705/4, A2*4, 0, 2498)</code>	<code>=FV(0.0519/12, A2*12, 0, 2994)</code>
2	<code>=FV(0.0705/4, A3*4, 0, 2498)</code>	<code>=FV(0.0519/12, A3*12, 0, 2994)</code>
3	<code>=FV(0.0705/4, A4*4, 0, 2498)</code>	<code>=FV(0.0519/12, A4*12, 0, 2994)</code>

Full Table:

Year	Sage	Dionne
1	\$2,678.82	\$3,153.14
2	\$2,872.73	\$3,320.74
3	\$3,080.67	\$3,497.24
4	\$3,303.67	\$3,683.13
5	\$3,542.81	\$3,878.90
6	\$3,799.26	\$4,085.07
7	\$4,074.27	\$4,302.20
8	\$4,369.19	\$4,530.87
9	\$4,685.46	\$4,771.70
10	\$5,024.62	\$5,025.33
11	\$5,388.33	\$5,292.44
12	\$5,778.37	\$5,573.75
13	\$6,196.64	\$5,870.00
14	\$6,645.19	\$6,182.01
15	\$7,126.21	\$6,510.60

Their balances are about the same after 10 years. Dionne starts out with a higher deposit but after 10 years, Sage passes her due to the higher interest rate.

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Round-Robin Problems. Choose two people from your group to travel together and two to stay. Use the space below to write your formula for each problem.

1. You deposit \$2000 in an account earning 3% interest compounded monthly.
 - a. How much will you have in the account in 20 years?
 - b. How much interest will you earn?

2. Which is better? An account that earns 7.25% compounded quarterly or an account that earns 7.15% compounded daily? Give the effective rate for each account.

3. How much would you need to deposit in an account now in order to have \$6,000 in the account in 8 years? Assume the account earns 6% interest compounded monthly.

4. You deposit \$4,500 in an account that earns 3.5% interest compounded continuously. How much will you have in 15 years?

5. A friend lends you \$200 for a week, which you agree to repay with 5% one-time interest. How much will you have to repay?

Round-Robin Problems. Choose two people from your group to travel together and two to stay. Use the space below to write your formula for each problem.

1. You deposit \$2000 in an account earning 3% interest compounded monthly.
 c. How much will you have in the account in 20 years?
 d. How much interest will you earn?

$$\mathbf{a. =FV(0.03/12, 20*12, 0, 2000) = \$3,641.51}$$

$$\mathbf{b. =\$3,641.51 - \$2,000 = \$1,641.51}$$

2. Which is better? An account that earns 7.25% compounded quarterly or an account that earns 7.15% compounded daily? Give the effective rate for each account.

$$\mathbf{=Effect(.0725, 4)}$$

$$\approx 0.074495$$

$$\approx 7.45\%$$

$$\mathbf{=Effect(.0715, 365)}$$

$$\approx 0.07411$$

$$\approx 7.41\%$$

3. How much would you need to deposit in an account now in order to have \$6,000 in the account in 8 years? Assume the account earns 6% interest compounded monthly.

$$\mathbf{=PV(0.06/12, 8*12, 0, 6000) =\$3,714.14}$$

4. You deposit \$4,500 in an account that earns 3.5% interest compounded continuously. How much will you have in 15 years?

$$\mathbf{=FV(0.0975/4, 16*4, 0, 7500) =\$35,029.62}$$

5. A friend lends you \$200 for a week, which you agree to repay with 5% one-time interest. How much will you have to repay?

$$= 200 + 200 * 0.05 = \$210$$

More Practice

1. Use the **2018 tax tables** to answer the questions and show your steps. The tables will be given to you with any test. Write your answers in complete sentences.

a. Mariana is single and has \$11,402 in itemized deductions. What is her standard deduction and should she claim the itemized deductions or the standard deduction?

b. Vy has a gross income of \$129,500 and he filed as the head of household with 2 kids. He had \$6,500 in itemized deductions. Determine his deduction and calculate his taxable income.

c. Alex and Jesse are married, filing jointly. Their taxable income is \$96,210. Calculate the amount of tax they owe using the appropriate table.

d. Tim had \$8,420 deducted from his paychecks in withholdings. He calculated his taxes owed to be \$7,952. Does he get a refund or owe money and what is the amount?