FEPPP
Financial Education
Public-Private Partnership
Setting the Washington Agenda for Financial Education

This task was developed by secondary mathematics and CTE teachers across Washington State from urban and rural areas. These teachers have incorporated financial literacy in their classroom and have received training on the Common Core State Standards and the Jump$tart Financial Literacy standards. The task was validated by content experts in the Common Core State Standards in mathematics. The purpose of this task is to demonstrate how financial literacy standards can be incorporated within mathematics classrooms that are implementing the Common Core State Standards.

TASK: What is the True Cost of Purchasing an Automobile?

TARGET COMMON CORE STATE STANDARD(S) IN MATHEMATICS:
A-CED.A: Create equations that describe numbers or relationships
A-CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
A-REI.D: Represent and solve equations and inequalities graphically
A-REI.D.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
F-IF.B: Interpret functions that arise in applications in terms of the context
F-IF.B.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
F-IF.C: Analyze functions using different representations
F-IF.C.7e: Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
F-LE.A: Construct and compare linear, quadratic, and exponential models and solve problems
F-LE.A.2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
F-LE.B: Interpret expressions of functions in terms of the situation they model
F-LE.B.5: Interpret the parameters in a linear or exponential function in terms of a context.
TARGET STANDARDS FOR MATHEMATICAL PRACTICES:
MP3: Construct viable arguments and critique the reasoning of others.
MP4: Model with mathematics.
MP6: Attend to precision.
MP7: Look for and make use of structure.
TARGET FINANCIAL LITERACY STANDARDS:
Financial Responsibility and Decision Making **Standard 2: Find and evaluate financial information from a variety of sources.** **Standard 4: Make financial decisions by systematically considering alternatives and consequences.** **Planning and Money Management** **Standard 4: Apply consumer skills to purchase decisions.** **Credit and Debt** **Standard 1: Identify the costs and benefits of various types of credit.**

RECOMMENDED COURSE(S):
Personal Finance, Algebra 1
ADDITIONAL INSTRUCTIONS:
This task should be completed in multiple class periods.
ADDITIONAL INSTRUCTIONS:
Graphing calculator or online calculator, spreadsheet program, Internet Example of Online Amortization Calculator: http://bretwhissel.net/cgi-bin/amortize

About the Common Core State Standards in Mathematics

The Common Core State Standards (CCSS) is a state developed set of standards that represent a coherent progression of learning expectations in English language arts and mathematics. These standards are designed to establish a set of shared goals and expectations for what students should understand and be able to do in grades K–12 in order to be prepared for success in college and the workplace. Forty-six states have now adopted these shared standards. The CCSS for mathematics highlight three major shifts around Focus, Coherence and Rigor. For more information:
http://www.k12.wa.us/CoreStandards/Mathematics/default.aspx

About the Jump$tart Financial Literacy Standards

The National Standards in K–12 Personal Finance Education, created and maintained by the Jump$tart Coalition® for Personal Financial Literacy, delineate the personal finance knowledge and skills that K–12 students should possess. The Jump$tart Coalition intends the National Standards in K–12 Personal Finance Education to serve as a model. As such, the National Standards represent the framework of an ideal personal finance curriculum, portions of which might not be appropriate for individual instructors and students. The Coalition leaves it up to various stakeholders to decide how to address the topics in the National Standards. http://jumpstart.org/national-standards.html

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The Task – What is the True Cost of Purchasing an Automobile?

As a young adult one of your most expensive purchases will be an automobile. You need to consider your needs and how you are going to finance your purchase when making your choice. For this task you will choose a vehicle and compare the costs associated with financing the purchase using two different loan options.

1. Make a list of needs for your vehicle and research the types of vehicles that would meet these needs.

2. Choose a vehicle that meets your needs and use Internet resources to find a price. (Craigslist, Edmonds.com, AutoTrader.com or other sites can be used to find this information)
   Cost of vehicle: _____

3. Calculate the monthly payment using the following formula and both options:

   A. Down payment of 10% and 60 month financing at 4.68%
   Monthly Payment: _____

   B. Down payment of 30% and 36 month financing at 4.68%
   Monthly Payment: _____

Monthly Payment: The formula has a principal, P, annual interest rate, r (as a decimal), and the total number of monthly payments, m.

$$\frac{P\,\frac{r}{12}}{1-\left(1+\frac{r}{12}\right)^{-m}}$$

4. Calculate the **total amount you pay for your car:** (Cost of the car + interest paid)

   Option A: _____
   Option B: _____

5. Calculate the **total amount of interest you pay** for each option:

   Option A: _____
   Option B: _____

6. For loan options A & B, use an online amortization calculator to complete the tables below for the given months.

Loan Option A

Month #	Principal	Interest	Monthly Payment	Principal Balance
0				
6				
12				
18				
24				
30				
36				
42				
48				
54				
60				

Loan Option B

Month #	Principal	Interest	Monthly Payment	Principal Balance
0				
4				
8				
12				
16				
20				
24				
28				
32				
36				

6. On a sheet of graph paper or with a spreadsheet, plot the relationship between the number of months and the principal balance for each loan option.

7. a. Identify the domain and range for both the loan options.
b. Identify what values would be reasonable in this situation. Explain why.

8. Using a graphing calculator or spreadsheet, determine the equation that best models this data.

Loan A: _____
Loan B: _____

9. Use the data from your table or the amortization schedule to explain why the equations from question #8 bests fit the data.

10. Use this equation to compute the outstanding loan balance at 25 months for each loan option.

Loan A: _____
Loan B: _____

11. Compare your answer from question #10 for Loan A and Loan B, with their respective amortization schedules at month 25. How do the two answers compare? If there are differences in the answers, explain why that might be.

12. Make a decision about which loan option you would choose. Justify your reasoning using your mathematical calculations, data from the table/spreadsheet and consideration of costs such as down payment and monthly payments. Provide a compelling argument that you can defend to a classmate.

Possible Solutions

2. Choose a vehicle that meets your needs and use Internet resources to find a price. (Craigslist, Edmonds.com, AutoTrader.com or other sites can be used to find this information)
Cost of vehicle:____$7000_____

3. Calculate the monthly payment using the following formulae and both options:

   A. Down payment of 10% and 60 month financing at 4.68%
   Monthly Payment:____$117.97 calculated on $6300 at 4.68%

   B. Down payment of 30% and 36 month financing at 4.68%
   Monthly Payment:___$146.15 calculated on $4900

Monthly Payment: The formula has a principal, P, interest rate, r (as a decimal), and the total number of monthly payments, m.

$$\frac{P\frac{r}{12}}{1-\left(1+\frac{r}{12}\right)^{-m}}$$

4. Calculate the **total amount you pay for your car:** (Cost of the car + interest paid)

   Option A:_____$7778.20

   Option B:_____$7361.40

5. Calculate the **total amount of interest you paid** for each option:

   Option A:_____$778.20

   Option B:_____$361.40

6. For loan options A & B, use an online amortization calculator to complete the tables below for the given months.

Loan Option A

Month #	Principal	Interest	Monthly Payment	Principal Balance
0				6300
6	95.23	22.73	117.96	5829.36
12	97.48	20.48	117.96	5154.88
18	99.79	18.18	117.96	4561.94
24	102.14	15.82	117.96	3954.99
30	104.56	13.41	117.96	3333.71
36	107.03	10.94	117.96	2697.74
42	109.56	8.41	117.96	2046.74
48	112.15	5.82	117.96	1380.37
54	114.80	3.17	117.96	698.24
60	117.51	0.46	117.96	0.00

Loan Option B

Month #	Principal	Interest	Monthly Payment	Principal Balance
0				4900
4	128.54	17.62	146.15	4388.84
8	130.55	15.60	146.15	3869.66
12	132.60	13.55	146.15	3342.34
16	134.68	11.47	146.15	2806.74
20	136.80	9.36	146.15	2262.73
24	138.94	7.21	146.15	1710.19
28	141.12	5.03	146.15	1148.98
32	143.34	2.82	146.15	578.96
36	145.59	0.57	146.15	0

7. On a sheet of graph paper or with a spreadsheet, plot the relationship between the number of months and the principal balance for each loan option.

8. a. Identify what values would be reasonable in this situation. Explain why.

Positive values less than or equal to the value of the loan and length of the loan. You cannot have negative months or a negative principal.

b. Identify the domain and range for both the loan options.

Loan A Domain: $0 \le X \le 60$ Range: $0 \le X \le 6300$
Loan B Domain: $0 \le X \le 36$ Range: $0 \le X \le 4900$

9. Using a graphing calculator or spreadsheet, determine the equation that best models this data.

Loan A: _____y = 6408.27 – 104.93x Loan B: _____y = 4949.80 – 136.083x

10. Use the data from your table or the amortization schedule to explain why the equations from question #8 bests fits the data?

Students should talk about what patterns they see in the data.

11. Use this equation to compute the outstanding loan balance at 25 months for each loan option.

Loan A: _____$3785.02 Loan B: _____$1547.73

12. Compare your answer from question #10 for Loan A and Loan B, with their respective amortization schedules at month 25. How do the two answers compare? If there are differences in the answers, explain why that might be.

Student answers may vary.

13. Make a decision about which loan option you would choose. Justify your reasoning using your mathematical calculations, data from the table/spreadsheet and consideration of costs such as down payment and monthly payments. Provide a compelling argument that you can defend to a classmate.

Student answers may vary.

Possible Extensions

The extensions below represent potential ways in which mathematics and personal finance can build on the task above.

1. What impact does increasing or decreasing the down payment have on the monthly payments and overall cost of the loan. How would changing the down payment affect your discretionary income? What life style changes would you have to make if your monthly payment increased?

2. Do some research either with an insurance agent or on the Internet to determine the cost of full-coverage insurance on your vehicle (you have to have full coverage if you have a loan).

3. What is the suggested maintenance schedule for the vehicle you chose? How much should you budget monthly to cover this cost (oil change, lube, tires, brakes, etc.)?

4. Research the repair record for this type of vehicle and calculate the amount you should budget in anticipation of any major repairs indicated by this report.

5. Assuming that you will not incur any penalties for early repayment of the loan, at what month could you repay the total loan if your great aunt Bertha promised to give you $1500 to pay off the vehicle when your outstanding balance reached $1500?

6. Have students use a spreadsheet program to enter the formulae to calculate the difference made by making a higher monthly payment and compare to original calculations.