Government Spending

I. **UNIT OVERVIEW & PURPOSE:**
This purpose of this lesson is to have students analyze where the government spends our tax dollars and have them make an informed decision about where the money should be allocated. An introductory activity analyzes where the government is actually spending the tax dollars. The first lesson investigates poverty, the second lesson examines educational spending, the third lesson explores defense spending, and the fourth lesson is on social security. A closing activity will ask the students for their opinion on where the tax dollars should be spent.

II. **UNIT AUTHOR:**
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III. **COURSE:**
- Mathematical Modeling: Capstone Course

IV. **CONTENT STRAND:**
- Algebra, Data Analysis and Probability

V. **OBJECTIVES:**
- to create a scatterplot and line of best fit based upon the data on poverty
- to create a survey and examine the results
- to analyze data using percent increase and percent decrease
- to create a scatterplot, make inferences on Social Security, and be able to interpret a Venn diagram

VI. **MATHEMATICS PERFORMANCE EXPECTATION(s):**
- MPE 2: Collect and analyze data, determine the equation of the curve of best fit, make predictions, and solve real-world problems using mathematical models. Mathematical models will include polynomial, exponential, and logarithmic functions.
- MPE 9: Design and conduct an experiment/survey. Key concepts include
  a) sample size;
  b) sampling technique;
  c) controlling sources of bias and experimental error;
  d) data collection; and
  e) data analysis and reporting.

- MPE 12: Transfer between and analyze multiple representations of functions, including algebraic formulas, graphs, tables, and words. Select and use appropriate representations for analysis, interpretation, and prediction.

VII. **CONTENT:**
- The students will take data on poverty and create a scatterplot on the data and create a line of best fit. The students will draw conclusions on the data based on their graph.
- The students will form a survey that will be targeted at teachers at a select high school. The survey will focus on education spending and whether teachers feel that have adequate resources to teach students. The students will graph the results of the survey and draw conclusions based on their results. This data will be presented to the class in a PowerPoint presentation.
- The students will analyze defense spending and calculate the percent of change based on the data given. The students will draw conclusions based on the mathematical calculations they have conducted.
- The students will be given data on Social Security and create a scatterplot based on the data. The students will make inferences on the data. The students will also have to create Venn diagrams and describe what they created.

VIII. **REFERENCE/RESOURCE MATERIALS:**
- Classroom set of calculators
- Computers with Microsoft Excel and Microsoft PowerPoint
- Overhead projector for the computer
- Assessment worksheets for each lesson

IX. **PRIMARY ASSESSMENT STRATEGIES:**
- The assessment for the poverty lesson is a worksheet. The students will have to create a scatterplot and line of best fit based on the data for poverty and answer questions… The students will draw their own conclusions from the data.
- The assessment for the educational spending lesson will be a worksheet. The students will create a survey targeted at teachers that deal with educational spending. The students will create graphs and answer questions on the worksheet based on the survey data. The students will draw their own conclusions from the data.
- The assessment for the percent change lesson is a worksheet. The students will be given data about Department of Defense spending and calculate the percent of change for the data. The students will draw their own conclusions from the data.

X. **EVALUATION CRITERIA:**
- The rubric for grading the unit is attached.
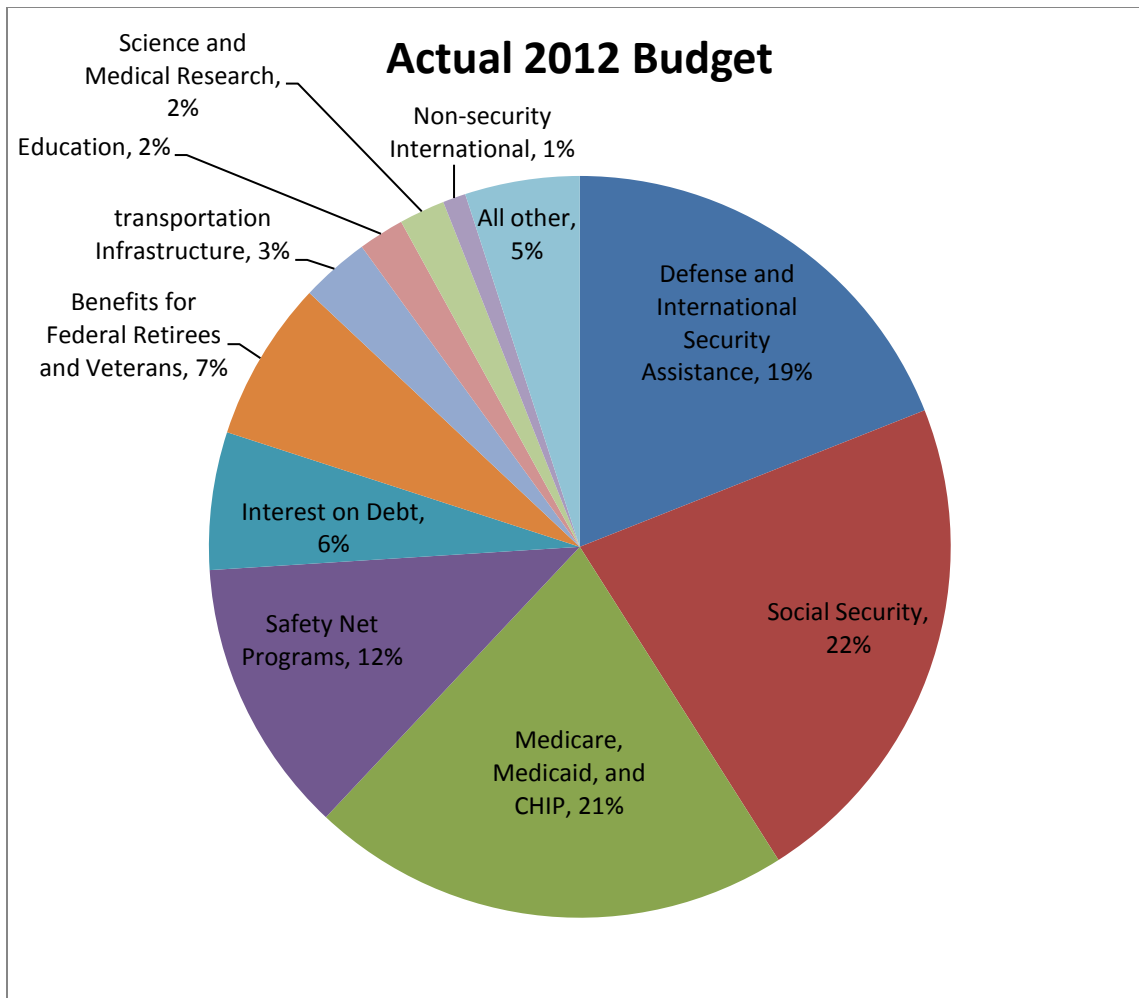
XI. **INSTRUCTIONAL TIME:**
- Six to nine instructional hours (Approximately two weeks)

Introductory Activity

- **The students will be visited by an economics teacher. The teacher will discuss the meaning of the following taxable categories: <u>Defense and International Security Assistance</u>; <u>Social Security</u>; <u>Medicare, Medicaid, and CHIP</u>; <u>Safety Net Programs</u>; <u>Interest on Debt</u>; <u>Benefits for Federal Retirees and Veterans</u>; <u>Transportation Infrastructure</u>; <u>Education</u>; <u>Science and Medical Research</u>; <u>Non-Security International</u>; <u>All Other</u>.**
- **Have the students create a pie chart using 11 categories, to show where they think the Government allocates the Federal Tax Money.**
- **They will open an Excel document and create a column labeled "Categories" and a second column labeled "Where I think the Money Goes". They will enter their guess as percentages. The students will then create a pie chart (under the insert tab). They will right click on the pie chart and select "Add Data Labels"**
- **Here is a sample pie chart:**
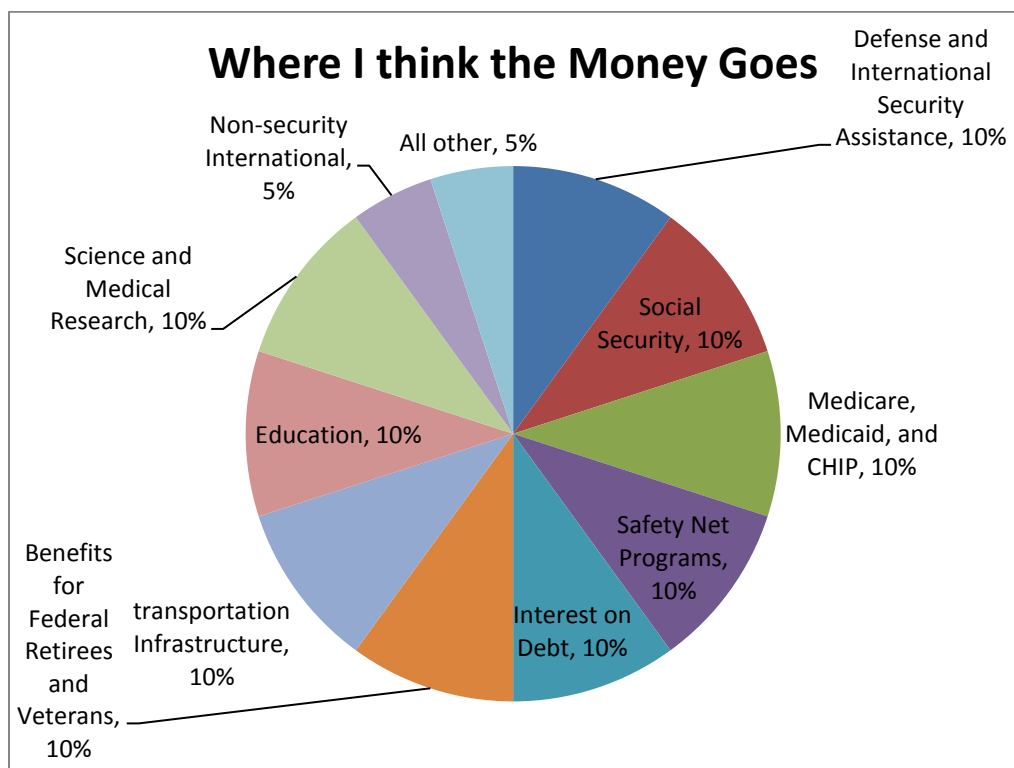
- **Students will share and compare their answers with a partner and then students can volunteer to share their answers with the class.**
- **The teacher will then share the Actual 2012 Budget percentages and pie chart. Students will discuss with a partner how close (or not close) they were.**
- **Actual Numbers:**

Actual 2012 Budget

Science and Medical Research, 2%

Education, 2%

Non-security International, 1%

transportation Infrastructure, 3%

All other, 5%

Benefits for Federal Retirees and Veterans, 7%

Defense and International Security Assistance, 19%

Interest on Debt, 6%

Safety Net Programs, 12%

Social Security, 22%

Medicare, Medicaid, and CHIP, 21%

- **Source:** http://www.cbpp.org/cms/?fa=view&id=1258
- **Given a sample paycheck stub, students will calculate the percentage of income allocated for state, federal, and FICA taxes. Students will have a discussion to determine whether they believe the amount is too much or not enough.**

Poverty

Strand
Algebra, Statistics

Mathematical Objective(s)
The mathematical goal for this lesson is for students to create a scatterplot and line of best fit based upon the data on poverty.

Mathematics Performance Expectation(s)
Collect and analyze data, determine the equation of the curve of best fit, make predictions, and solve real-world problems using mathematical models. Mathematical models will include polynomial, exponential, and logarithmic functions.

Related SOL

- A.11   The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve real-world problems, using mathematical models. Mathematical models will include linear and quadratic functions.

NCTM Standards List all applicable NCTM standards related to each lesson. Example:

- relate and compare different forms of representation for a relationship;
- identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.

Materials/Resources

- Classroom set of graphing calculators
- Computers with Microsoft Excel
- Overhead projector for the computer

Assumption of Prior Knowledge
- Students should have prior knowledge of being able to examine and analyze data.
- Students should be able to create a scatterplot
- Students should be able to identify if the scatterplot has a positive, negative, or no correlation.
- Students should have basic knowledge of linear equations

Introduction: Setting Up the Mathematical Task

- In this lesson, the students will examine the poverty line and how much it has grown over the years.
- The lesson will start off with a discussion of "what is poverty"?
- These questions will be used to facilitate a class discussion on poverty.
    - What do you think are the big factors for poverty?
    - Why is poverty an important topic to examine?
    - What is the minimum wage in the United States?
    - Do you think the minimum wage is too small? Is it a living wage? This topic will be explored further in the closure of the lesson.
- The students will then be broken up into groups of two. If there is an odd number in the class, then one group will have three in it. The students will then be assigned a computer and given the assessment worksheet.

Student Exploration 1:

- The lesson will start off with a review of linear equations, scatterplots, and correlation. The students are asked, "How are they all related into making a prediction about data? Why can we not always make predictions from the scatterplot data?"
- The students will then go to the website http://www.census.gov/hhes/www/poverty/data/historical/people.html and download table 1 to Microsoft Excel.
- The teacher will review how to create a scatterplot for Microsoft Excel. The students will take the data for unrelated individuals of all ages from 1981 to 2011 and create a scatterplot and line of best fit from that data in Excel. The scatterplot should be printed out. This data will be used to answer questions on the assessment worksheet.

Monitoring Student Responses

- The students will work together to create scatterplots and answer the attached questions.
- The teacher will walk around the classroom and offer any assistance as needed.
- In the closure of the lesson after the worksheets have been collected, the teacher will ask the students again about minimum wage. Is it a living wage? Did any of this data surprise you? Why has the poverty line consistently increased? Do you think it will ever decrease?

Assessment

Worksheet on Poverty Line

We will be using data from the website
http://www.census.gov/hhes/www/poverty/data/historical/people.html

Once you are on the Census website, click on Table 1: Weighted Average Poverty Thresholds for Families of Specified Sizes.

Create a scatterplot in Microsoft Excel for unrelated individuals of all ages from 1981-2011 and print out your graph

1. Is the correlation for this data positive or negative?

2. What does the correlation tell you about the data?

3. What is the equation for the line of best fit?

4. Make a prediction on what the poverty line would be in 2017?

5. Make a prediction on what the poverty line would be in 2020?

Create a scatterplot for families of 4 from 1981-2011 and print out your graph

6. Is the correlation positive or negative?

7. What does the correlation tell you about the data?

8. What is the equation for the line of best fit?

9. Make a prediction on what the poverty line would be in 2015?

10. Make a prediction on what the poverty line would be in 2018?

Create a scatterplot for families of 6 from 1981-2011 and print out your graph

11. What is the correlation for this data?

12. What does the correlation tell you about the data?

13. What is the equation for the line of best fit?

14. Make a prediction on what the poverty line would be in 2014?

15. Make a prediction on what the poverty line would be in 2019?

Create a scatterplot for families of 9 or more from 1981-2011 and print out your graph

16. What is the correlation for this data?

17. What does the correlation tell you about the data?

18. What is the equation for the line of best fit?

19. Make a prediction on what the poverty line would be in 2016?

20. Make a prediction on what the poverty line would be in 2022?

21. What is the current minimum wage in the United States?

For questions 22- You work 40 hours a week and 52 weeks a year.

22. How much would you make in a year?

23. If you were a single person working and continued to make the current minimum wage, what year would you be considered in poverty?

24. What wage would you have to make per hour if you work 40 hours a week, 52 weeks a year to not be in poverty in 2030?

25. If you have two children and make $8.50 an hour and your wife makes $7.70 an hour, how much do you make in a year (both parents working 40 hours a week and 52 weeks a year)?

26. If you and your wife continued to make the same wage, what year would your family be considered to be in poverty?

Extensions and Connections (for all students)

- Student can go to the website http://www.census.gov/hhes/www/poverty/data/historical/people.html and look at other tables and examine other aspects of poverty in society

Strategies for Differentiation

- The teacher reserves the right to pair up students so that a student that understands that materials can work with other student that is struggling.
- The teacher can give students that are struggling individual instruction as he/she is walking around the room.
- Students can be presented with a hard copy of the notes

Answers to the poverty lesson:

1. positive
2. Tells us that it is consistently increasing and behaving somewhat like a linear equation
3. In Excel, students will highlight the data, click on Insert, click on Scatter, and then click on Scatter with only Markers. Then click on line of best fit in chart layout (the third choice). Right click on the graphed line and go to Format Trendline. Click on Display Equation on chart. $f(x)=227.83x+4318.7$ $x=1$ represents 1981
4. That means x=37, and f(37)=12748.41
5. That means x=40, and f(40)=13431.9
6. Positive
7. Tells us that it is consistently increasing and behaving somewhat like a linear equation
8. In Excel, students will highlight the data, click on Insert, click on Scatter, and then click on Scatter with only Markers. Then click on line of best fit in chart layout (the third choice). Right click on the graphed line and go to Format Trendline. Click on Display Equation on chart. $f(x)=454.7x+8693.9$ $x=1$ represents 1981
9. That means x=35, and f(35)=24,608.40
10. That means x=38, and f(38)=25972.5
11. Positive
12. Tells us that it is consistently increasing and behaving somewhat like a linear equation.
13. In Excel, students will highlight the data, click on Insert, click on Scatter, and then click on Scatter with only Markers. Then click on line of best fit in chart layout (the third choice). Right click on the graphed line and go to Format Trendline. Click on Display Equation on chart. $f(x)=608.34x+11612$ $x=1$ represents 1981
14. That means x=34, and f(34)=32,395.56
15. That means x=39, and f(39)=35,337.26
16. Positive
17. Tells us that it is consistently increasing and behaving somewhat like a linear equation
18. In Excel, students will highlight the data, click on Insert, click on Scatter, and then click on Scatter with only Markers. Then click on line of best fit in chart layout (the third choice). Right click on the graphed line and go to Format Trendline. Click on Display Equation on chart. $f(x)=925.23x+17271$ $x=1$ represents 1981
19. That means x=36, and f(39)=50,579.28
20. That means x=42, and f(42)=56,130.66
21. $7.25
22. $15,080
23. Using the equation found in number 3, $f(x)=227.83x+4318.7$, set $f(x)=15,080$ $227.83x+4318.7=15,080$, so x=48 which is year 2028.
24. Using $f(x)=227.83x+4318.7$, when x=50, then f(50)=15710.2, to find the wage, divide $f(50)/(52 * 40) \approx 7.55$. You need to make more than $7.55.
25. $33,696
26. Using the equation found in number 8, $f(x)=454.7x+8693.9$, set $f(x)=33,696$ $33696=454.7x+8693.9$, so x=55 which is in year 2035.

Education Spending

Strand
Algebra, Statistics

Mathematical Objective(s)
- The mathematical goal for this lesson is for students to create a survey and examine the results.

Mathematics Performance Expectation(s)
- Design and conduct an experiment/survey. Key concepts include
a) sample size;
b) sampling technique;
c) controlling sources of bias and experimental error;
d) data collection; and
e) data analysis and reporting.

Related SOL

- PS. 8 The student will describe the methods of data collection in a census, sample survey, experiment, and observational study and identify an appropriate method of solution for a given problem setting.

NCTM Standards

- understand the differences among various kinds of studies and which types of inferences can legitimately be drawn from each;
- know the characteristics of well-designed studies, including the role of randomization in surveys and experiments
- select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots

Materials/Resources
- Classroom set of graphing calculators
- Computers with Microsoft Excel and Microsoft PowerPoint
- Overhead projector for the computer

Assumption of Prior Knowledge
- Students should have prior knowledge of being able to look and analyze data.
- Students should be able to create graphical representations of data

Introduction: Setting Up the Mathematical Task

- In this lesson, the students will take survey data and display the results in graphical form that is easy for people to understand. The students will come to their own conclusions based on the data.
- The focus group for this survey is teachers.
- The topic of the survey is personal views on the availability of resources so that teachers can adequately do their job.
- The students will collect data from the teachers at a random high school. The teacher can determine the areas of where the high schools can be chosen.
- The lesson will start off with a discussion on education and how much tax money is spent on education.
- These questions will be used to facilitate a class discussion on education spending.
  - How much do you think should be spent on education?
  - Should we increase education spending? What would be the advantages and what consequences would that cause?
  - Do you feel that every school has equal resources to adequately educate their children?
- The students will then be broken up into groups of four. The teacher reserves the right to modify the number of people in the group as needed. The students will then be assigned a computer and given the attached questions.
- The teacher will review how to create graphs in Microsoft Excel and how to create a presentation in Microsoft PowerPoint with the class.

Student Exploration 1:

- The lesson will start off with a lesson on surveys and different sampling techniques. The students will learn how surveys are formed and how to control for bias. The participants in this survey will be completely anonymous. The different sampling techniques (Random, Stratified, Cluster, Systematic, and Convenience) will be discussed. This survey will use a cluster approach.
- The teacher will also review bar and pie graphs with the students.
- The teacher will then guide the students in creating their survey. The students will be given the assessment worksheet that they will use to help guide them in creating the survey. The survey will be a 12 multiple choice questions. An online survey creator is highly recommended. A great website to use is www.surveymonkey.com. The teacher will look over the surveys and recommend any changes that may need to be made.
- The students will then choose a school out of a hat and the teacher will be responsible in ensuring the groups receive the proper approval in order to give the survey.

Monitoring Student Responses

- The students (with the teacher's help) will send out the survey and give the teachers a week deadline.
- The students will then check the results and put the data into Microsoft Excel.
- The students will then answer the questions on the assessment worksheet and create a PowerPoint presentation for their data that will be presented to the class.
- The teacher will come around as the students are working on their data and offer any assistance as needed.
- In the closure of the lesson after the PowerPoint presentations have been completed, the teacher will summarize what was learned from the surveys. The teacher can ask the following questions to encourage classroom discussion. "Why was an anonymous survey used? Do you think survey participants will be more truthful if they are anonymous or if they have to put their name on the survey? Do you feel like the data you received was helpful? Was your sample size big enough?"

Assessment

Worksheet on Surveys

This survey will go out to all teachers at a random high school. The purpose of this survey is to see how teachers feel about education spending and if they have adequate resources to adequately educate students.

Creating the survey

Question 1

What is your gender?

Male

Female

Question 2

What is your age range?

20-30

30-40

40-50

50 & over

Question 3

How many years of teaching experience do you have?

1-10 years

10-20 years

20-30 years

30 or more years

Question 4-Question 12

Create eight multiple choice questions based on how teachers feel about educational spending and if they have adequate resources to fully educate students. Your teacher will offer any assistance as needed and look over your questions before the survey goes out.

Reflection

1.   How many responses did you get back? Were you disappointed with how many responses you received back?

2.   Put your data into Microsoft Excel and create bar graphs for six questions and create pie graphs for six questions. What is the advantage of using graphs to display data? Why are we using bar graphs and pie graphs? Are there any other graph types we could use?

3.   What conclusions can you draw by looking at your data?

4.   Was there anything in the data that was surprising to you? Why was it surprising to you?

5.   In what ways could this survey be improved for future study? Should we have included other types of questions? Elaborate.

Create a PowerPoint presentation based upon your data. Include your questions and your graphs in the presentation. In the final five slides, include the answers to the reflection questions. You will present your PowerPoint to your classmates.

Extensions and Connections (for all students)

- Student can go to the website http://www.heritage.org/issues/education/education-spending and analyze research that has been completed on education spending.

Strategies for Differentiation

- The teacher reserves the right to pair up students so that a student that understands can work with other students that are struggling.
- The teacher can give students that are struggling individual instruction as he/she is walking around the room.
- Students can be presented with a hard copy of the notes

Department of Defense

Strand
Understanding and Applying Functions

Mathematical Objective(s)
Students will be able to analyze data using percent increase and percent decrease.

Mathematics Performance Expectation(s)
Transfer between and analyze multiple representations of functions, including algebraic formulas, graphs, tables, and words. Select and use appropriate representations for analysis, interpretation, and prediction.

Related SOL

- 8.3   The student will a) solve practical problems involving rational numbers, percents, ratios, and proportions; and b) determine the percent increase or decrease for a given situation.

Materials/Resources
Describe the materials and resources (including instructional technology) you plan to use in each lesson.

- Classroom set of graphing calculators
- Handouts (attached)

Assumption of Prior Knowledge

- Students should have a basic knowledge of reading tables and charts.
- Students should know how to convert decimals to fractions and percents and vice versa.
- Students should have a basic understanding of the Federal Budget as it pertains to distribution of funds.

Introduction: Setting Up the Mathematical Task

- In this lesson students will be dissecting tables and graphs using percent increase and decrease to compare relativity.
- Show the students a brief commercial advertising one of the Armed Forces.
- Ask the students the following questions, "Do you think it's important to have a strong National Defense? Why or why not?" or, "Do you think we spend too much on National Security? Why or why not?"

Student Exploration 1:

- Remind/Instruct the students on how to find percent change. Namely, $\% \, change = \frac{Change}{Original}$. Give them a few examples to practice. For example: You have 20 pieces of gum, you chew 1 piece and give 4 other pieces of gum to friends. What is the percent decrease of how much gum you have? (ANS. 25%)

- After a discussion on the importance of national security and its role in the Federal budget, show the students the information on the attachment "Total Budget Trends". Let the students analyze the graph and questions in a "Think, Pair, Share" format.

- The next form: "The Department of Defense Budget by Departments" is then given to the students to practice determining percent change and making educated conclusions based on percent change.

- The final form: "Budget Cuts" can be used as an assessment or extension to the lesson. Allow them the freedom to explore the difficult decisions that have to be made.

Monitoring Student Responses

- The students will work in pairs to complete tables and calculate percent change.
- The teacher will walk around the classroom and offer any assistance as needed.
- Closure: Discuss the possible reasons law makers have such a hard time making budget cuts. Then discuss how finding the percent of change helps put things into a relative perspective.

Extensions

- The links below the tables will take them to a government website that contains many charts and graphs about the Department of Defense's budget. Have the students research updated information on financial cuts for various departments. Have the students talk about the impact of these cuts on the Department of Defense.

The Department of Defense Budget through the Ages

Total Budget Trends
(Including supplemental and OCO funding)
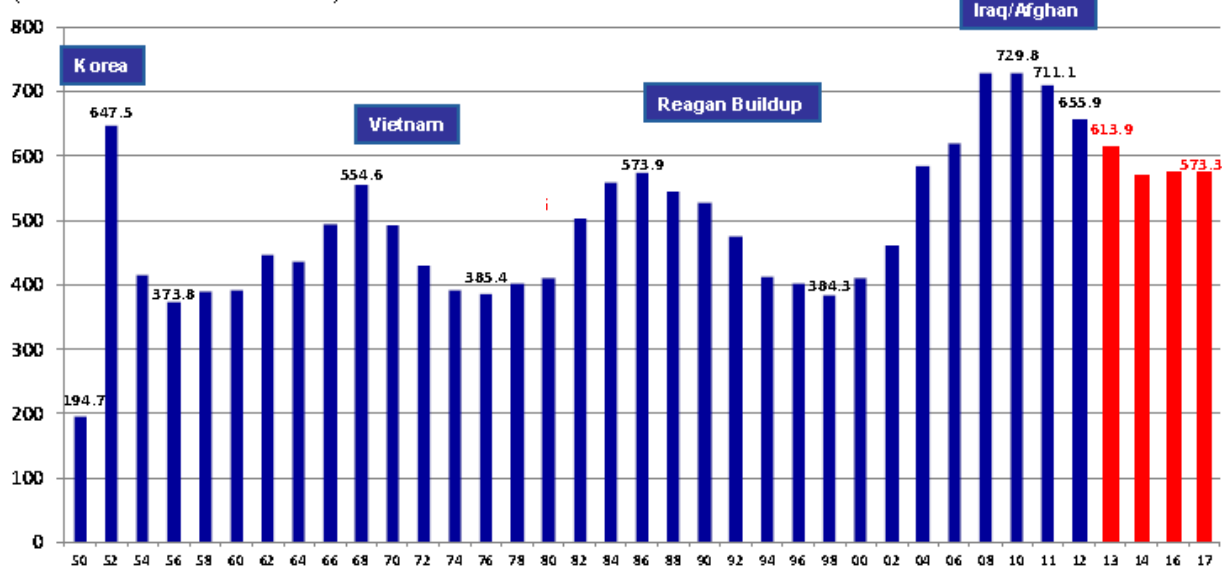
The following graph represents the fiscal budget of the Department of Defense. Use this graph to answer the questions below.

1. From 1950 to 1952, what was the percent increase? Why do you think there was such a big jump in the budget?

2. Wars have a significant impact on the Department of Defense's budget. From 1956 to 2012, which war (peak) did we have the highest percent increase from a time of peace (valley)? What was the percent of increase in the budget?

3. Why do you think the budget jumped so high in question 2 as opposed to other wars the U.S. has been involved in?

4. Is the cost of war worth fighting in some of these conflicts? Why or why not?

The Department of Defense Budget by Department

FY 2013 DEPARTMENT OF DEFENSE BUDGET
FY 2011 Actual Base and OCO, FY 2012 Appropriated Base and OCO, FY 2013 Base Request
TOTAL OBLIGATIONAL AUTHORITY, BUDGET AUTHORITY, AND OUTLAYS
(Millions of Dollars)

FUNCTIONAL CLASSIFICATION	DIRECT BUDGET PLAN (TOA)		
	FY 2011	FY 2012	FY 2013
(1)	(2)	(3)	(4)
RECAP BY COMPONENT			
DEPARTMENT OF THE ARMY	237,295	201,313	133,135
DEPARTMENT OF THE NAVY	176,814	173,014	155,902
DEPARTMENT OF THE AIR FORCE	167,293	162,520	140,064
DEFENSE-WIDE	107,688	113,255	97,104

http://comptroller.defense.gov/defbudget/fy2013/FY2013_Financial_Summary_Tables.pdf Page 9

Answer the following questions based on the table above.

1. Why do you think some departments get more money than others?

2. What percent of the Defense budget did each department get in 2011?

3. In an effort to cut costs, each department has reduced the amount in their budget. Fill out the table that shows the percent increase or decrease in each department budget for 2012 and 2013 using 2011 as the base data.

Department	2011 Budget	2012 Budget	Difference	2012 % Change	2013 Budget	Difference	2013 % Change
Army							
Navy							
Air Force							
D. – Wide							

4. Which department had the highest percentage of their budget cut in 2012?

5. Which department has the highest percentage of their budget cut in 2013?

6. Do you think there are any reasons why some department budgets are cut more than others?

Answers to "The Department of Defense Budget through the Ages":

1. 233% increase; answers will vary
2. 1998-2010 ; 90% increase
3. Answers will vary
4. Answers will vary
5. Answers will vary

Answers to "The Department of Defense Budget by Department":

1. Answers will vary
2. Army: 34.4% ; Navy: 25.7% ; Air Force: 24.3% ; Division-Wide: 15.6%
3. See table below

Department	2011 Budget	2012 Budget	Difference	2012 % Change	2013 Budget	Difference	2013 % Change
Army	237,295	212,313	24,982	-10.5%	133,135	104,160	-43.9%
Navy	176,814	173,014	3,800	-2.1%	155,902	20,912	-11.8%
Air Force	167,293	162,520	4,773	-2.9%	140,064	27,229	-16.3%
D. – Wide	107,688	113,255	5,567	+5.2%	97,104	10,584	-9.8%

4. Army
5. Army
6. Answers will vary

Budget Cuts

Below is a summary of how the money in the Department of the Army was spent in 2011. (in Millions) In 2012 the Department of the Army had to cut 35,982,000,000 from their budget. Fill out the chart below where you think it would be most appropriate to cut. Then calculate the percent change and explain your reasons for cutting the programs you did. Be prepared to give your reasons in class.

DEPARTMENT OF THE ARMY		Cuts/Additions	% Change
MILITARY PERSONNEL			
ACTIVE FORCES	55,027		
RESERVE FORCES	15,090		
TOTAL MILITARY PERSONNEL	70,116		
OPERATION AND MAINTENANCE	114,927		
PROCUREMENT	34,680		
RESEARCH, DEV, TEST & EVAL	9,760		
MILITARY CONSTRUCTION	7,129		
FAMILY HOUSING	627		
REVOLVING AND MGMT FUNDS	55		
DEDUCT FOR OFFSETTING RCPTS	-		
TRUST FUNDS	-		
TOTAL DEPARTMENT OF THE ARMY	237,295	35,982	

http://comptroller.defense.gov/defbudget/fy2013/FY2013_Financial_Summary_Tables.pdf

Reasons:

_____
_____
_____
_____
_____
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_____

Social Security

Strand
Understanding and Applying Functions

Mathematical Objective(s)
Students will be able to analyze data using percent increase and percent decrease.

Mathematics Performance Expectation(s)
Transfer between and analyze multiple representations of functions, including algebraic formulas, graphs, tables, and words. Select and use appropriate representations for analysis, interpretation, and prediction.

Related SOL

- 8.13   The student will a) make comparisons, predictions, and inferences, using information displayed in graphs; and b) construct and analyze scatterplots.

- 8.14   The student will make connections between any two representations (tables, graphs, words, and rules) of a given relationship.

Materials/Resources
- Classroom set of graphing calculators
- Handouts (attached)

Assumption of Prior Knowledge
- Students should have a basic knowledge of reading tables and charts.
- Students should know how to create a scatter plot from a table.
- Students should have a basic understanding of the Federal Budget as it pertains to distribution of funds. (1ˢᵗ Lesson in Unit)

Introduction: Setting Up the Mathematical Task

- In this lesson, students will compare and contrast two graphs from the same table of data.
- Ask the students if they have a Social Security Number and discuss (broadly) what social security is. Find out what they know and supplement the hook with possible videos that can be found online concerning social security.
- Remind/Instruct the students what a correlation is on a scatter plot and also recognition of the basic functions (logarithmic, exponential, linear, sinusoidal, etc.)

Student Exploration 1:

- The students should then be given the data entitled, "Social Security Reciepts, Expenditures, and Assets." Allow the students to review the information, particularly the various categories that are present on the table. Make sure the students understand the key terms: expenditures, assets, and fiscal year. Also the units they see on the table and the units they'll use to plot on the graph. (the units are millions and plotting will be done in hundred thousandths)

- Tell the students that they need to decide if they will invest in Social Security. To do so they need to look at the trends and decide if it's a good investment.

- The next two forms (pages 4 and 5) are then given to the students to work in pairs.

Monitoring Student Responses

- The teacher will allow time for the students to discuss as a small group and as a class, their answers to both pages work sheets.
- The teacher will walk around the classroom and offer any assistance as needed.
- Closure: Allow the students to compare the similarities and differences between the two graphs and what they represent. Show them how the same set of data can convey two different views.

Extensions

- Have the students find research on a controversial topic online. Have them find information, tables, charts, etc. for both pros and cons of the topic. Then have them report their findings.

Social Security Reciepts, Expenditures, and Assets

Old-Age, Survivors, and Disability Insurance Trust Funds, Fiscal Years 1977-2012
[In millions]

Fiscal year	Total receipts	Total expenditures	Assets	
			Net increase during year [1]	Amount at end of year
1977	$81,170	$85,068	-$3,898	$39,615
1978	89,595	93,861	-4,265	35,350
1979	102,090	104,073	-1,983	33,367
1980	117,428	118,548	-1,121	32,246
1981	134,565	139,585	-5,019	27,226
1982	148,028	155,964	-7,936	19,290
1983	170,280	170,058	12,660	31,950
1984	178,461	178,199	262	32,212
1985	197,865	188,504	7,538	39,750
1986	215,461	198,730	6,117	45,867
1987	226,893	207,323	19,570	65,437
1988	258,090	219,290	38,800	104,237
1989	284,936	232,491	52,445	156,682
1990	306,822	248,605	58,217	214,900
1991	322,611	269,096	53,515	268,415
1992	338,270	287,524	50,746	319,161
1993	351,354	304,566	46,788	365,949
1994	376,307	319,551	56,757	422,706
1995	396,276	335,830	60,446	483,152
1996	416,064	349,654	66,410	549,562
1997	446,553	365,238	81,316	630,878
1998	478,608	379,291	99,318	730,195
1999	514,731	390,019	124,712	854,908
2000	561,251	409,404	151,847	1,006,754
2001	595,913	432,926	162,987	1,169,741
2002	614,977	455,910	159,067	1,328,808
2003	630,253	474,721	155,532	1,484,340
2004	646,628	495,525	151,103	1,635,443
2005	696,757	523,279	173,478	1,808,922
2006	733,728	548,492	185,237	1,994,158
2007	771,772	585,311	186,461	2,180,619
2008	802,689	617,017	185,672	2,366,291
2009	807,007	669,686	137,321	2,503,612
2010	787,961	706,250	81,710	2,585,323
2011	798,735	730,721	68,014	2,653,336
2012	837,827	773,247	64,580	2,717,916

Developed by Dr. Agida Manizade & Dr. Laura Jacobsen, Radford University MSP project
in collaboration with
Mr. Michael Bolling, Virginia Department of Education

Today we'd like to change the data to see if we can interpret what it all means. Plot the Amount at the End of the Year vs. Time. 1980 is plotted for you.
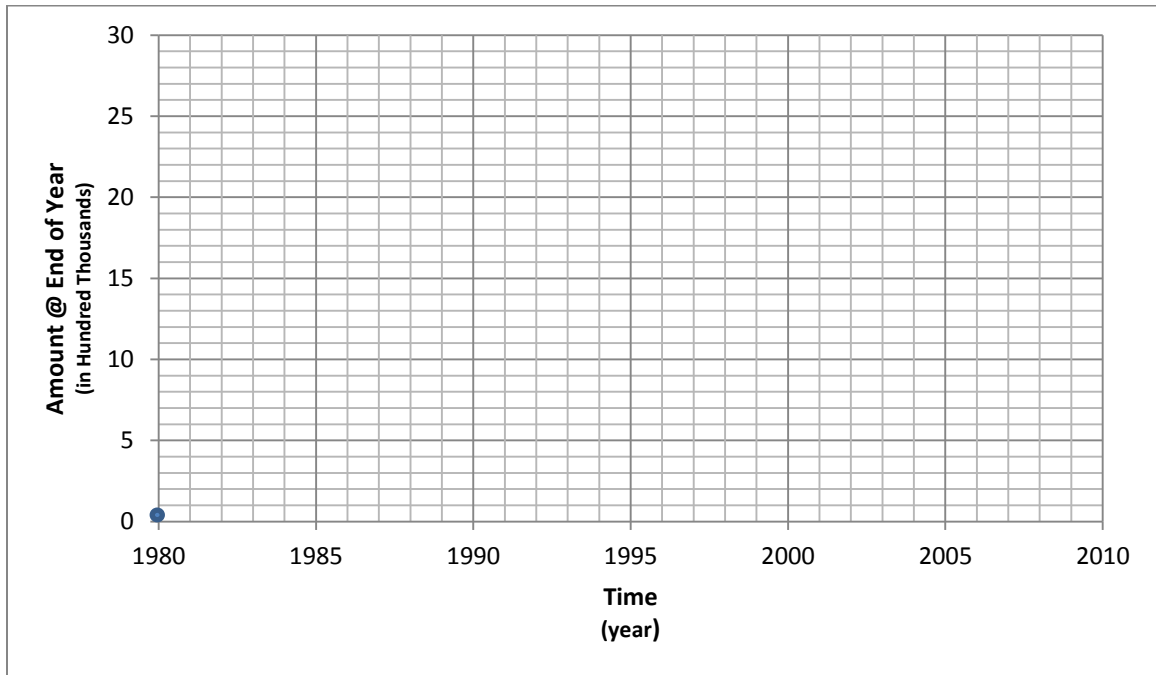
1. Is there a correlation between assets over time? If so, what kind of correlation?

2. What other observations do you notice? Does the graph look like any functions you know of?

3. Based on your observations, what events in our country do you think lead to the graph changing in each decade?
    a. 80's:
    b. 90's
    c. 00's:

4. Based on the graph, what do you think will happen to the Social Security Budget in the next 5 years? 10 years? Or 30-35 years (when you retire)?

5. Based on the information presented in the graph, is there a reason people should be concerned with Social Security? Why or why not?

Now let's look at the data in a different way. Graph the Net Increase over Time. 1980 is graphed for you.
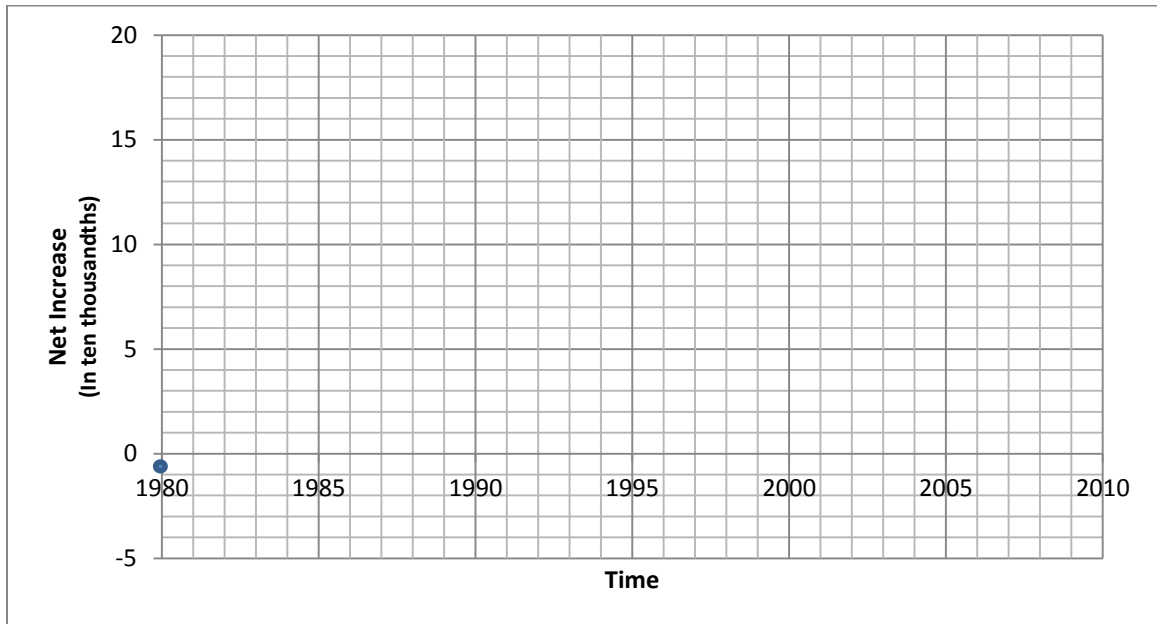
6. Is there a correlation between Net Increase and time? If so, what kind of correlation?

7. What other observations do you notice? Does the graph look like any functions you know of?

8. Based on your observations, what events in our country do you think lead to the graph changing in each decade? Especially 2005-2010.
    a. 80's:
    b. 90's
    c. 00's:

9. Based on the graph, what do you think will happen to the Social Security Budget in the next 5 years? 10 years? Or 30-35 years (when you retire)?

10. Based on the information presented in the graph, is there a reason people should be concerned with Social Security? Why or why not?

If you had to present this data to the general public (those who invest in social security) which form would you use and why? Compare and Contrast the two graphs and the data using a Venn diagram. Then summarize these similarities and differences in paragraph form.

Amount vs. Time   Net Increase vs. Time

Data Given

_____

_____

_____

_____

_____

_____
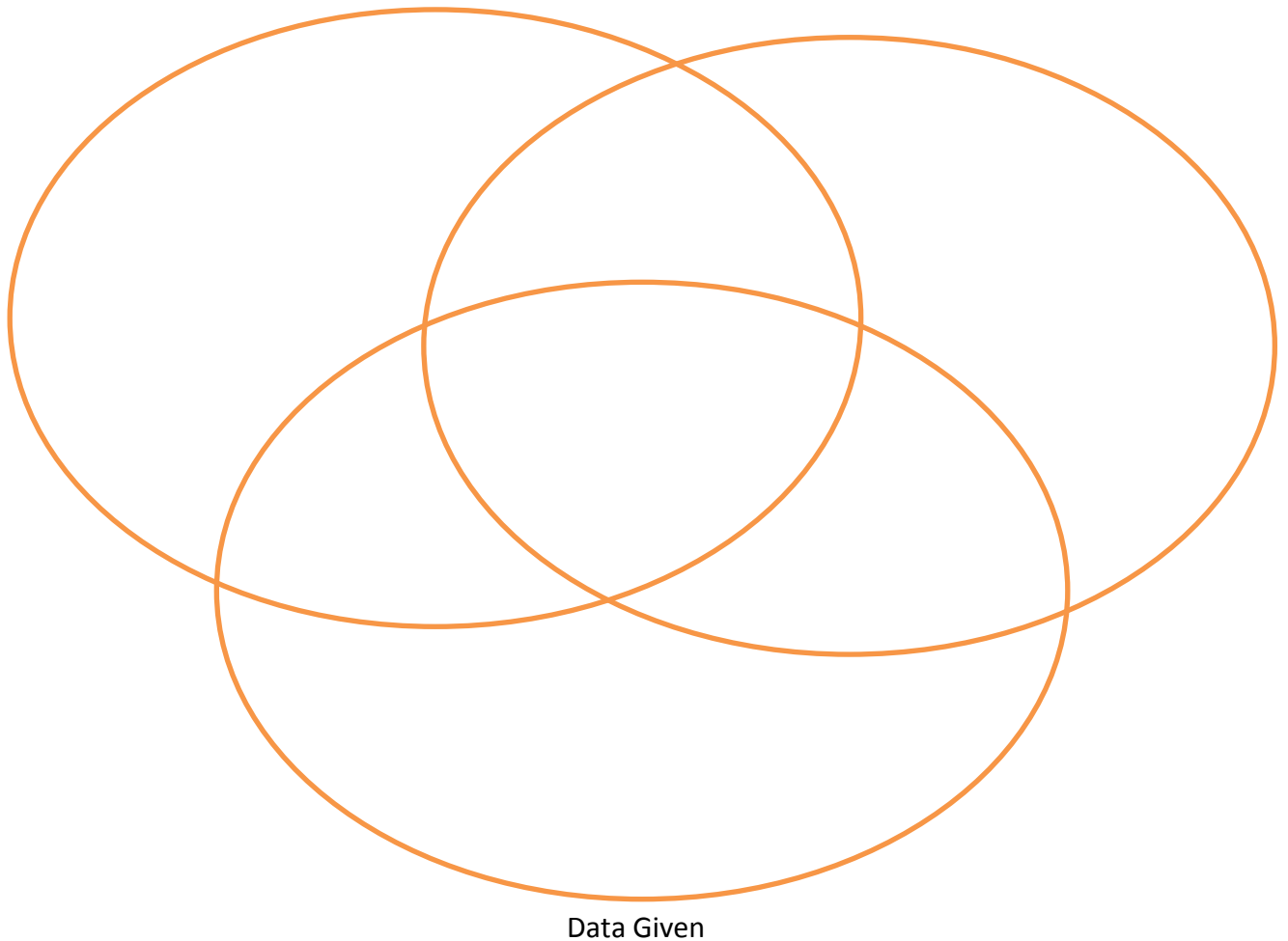
Answers to the Social Security Lesson:

1. Yes, strong - positive correlation
2. Answers will vary Ex: upside down Parabola
3. Answers will vary Ex:
    a. Economy grows, people get better jobs
    b. Desert Storm, fewer people part of S. S., political shifts
    c. Seniors retire, housing market collapse, political shifts, Iraq/Afghanistan
4. Answers will vary
5. Answers will vary
6. Yes, weak - positive correlation
7. Answers will vary depending on opinion
8. Answers will vary (encourage the students to do research on those decades)
9. Answers will vary
10. Answers will vary

*Note to teacher: The first graph minimalizes the fact that the S.S. budget is going down while the second graph accentuates the sharp decrease in S.S. increases. The goal is to help the students see how one set of data can give two different perspectives.

Closure Activity

- **Have the students create a pie chart using 11 categories to show where they think the Government <u>SHOULD</u> allocates the Federal Tax Money. The eleven categories are: <u>Defense and International Security Assistance</u>; <u>Social Security</u>; <u>Medicare, Medicaid, and CHIP</u>; <u>Safety Net Programs</u>; <u>Interest on Debt</u>; <u>Benefits for Federal Retirees and Veterans</u>; <u>Transportation Infrastructure</u>; <u>Education</u>; <u>Science and Medical Research</u>; <u>Non-Security International</u>; <u>All other</u>**
- **They will open an Excel document and create a column labeled "Categories" and a second column labeled "Where the Money SHOULD GO". They will enter their answer as percentages. Then the students will create a pie chart. They will right click on the pie chart and select "Add Data Labels"**
- **Here is a sample pie chart:**
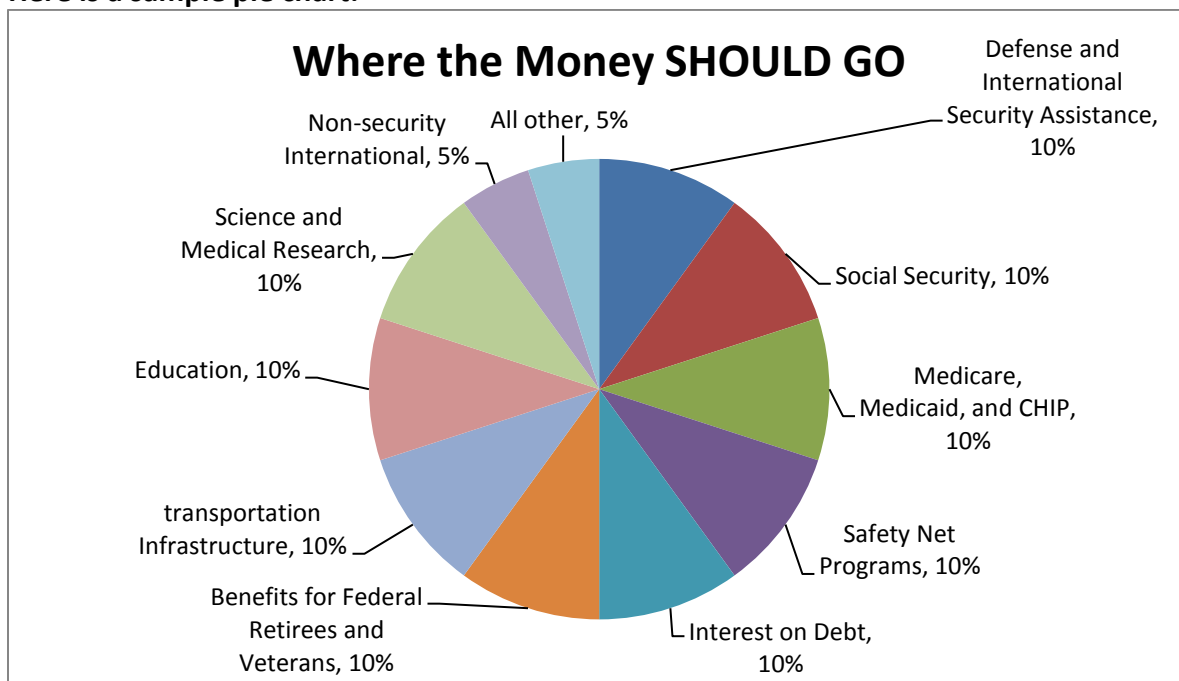
- **Have the students present their recommendations with reasons to the class.**
    - **They should create a poster with their pie charts (that they can print out).**
    - **They will need to explain why they changed the percentages from what the government actually spends (using the information to compare their pie chart to the "Actual 2012 Budget" pie chart given to them in the opening activity).**
    - **Students will decide whether federal tax money should be increased, decreased, or stay the same.**
    - **Name three things that they learned from the Government Spending Unit.**

Rubric for Government Spending Unit

	Excellent	**Needs improvement**	**Unacceptable**
Worksheet 30 points	Answers 90% or more of the right or wrong questions correctly 15 points Gives logical answers to the discussion questions with thorough explanations. 15 point	Answers between 60-90% of the right or wrong questions correctly.8points Gives logical answers to the discussion questions with not much explaination8points	Answers less than 60% of the right or wrong questions correctly 0 points Either gives answers that does not make sense or does not attempt the discussion questions 0 points
Presentations 30 points	Survey presentation is well planned and material is clearly explained. 15 points The unit presentation is well planned and material is clearly explained. 15 points	Survey presentation needs more planning and is slightly confusing 8 points The unit presentation needs more planning and is slightly confusing 8points	Survey presentation is poorly planned and explanations are confusing 0 points The unit presentation is poorly planned and explanations are confusing. 0 points
Participation 30 points	Participates in all activities, completes all tasks, and works well during group work. 30 points	Participants in most activities, completes most tasks and works in a satisfactory manner during group work. 10points	Does not participate in most activities, does not complete most tasks, and does not work well during group work. 0 points
Peer Review 10 points	Excellent Work 10points	Needs improvement 5 points	Unacceptable 0 points

Rubric guidelines:

Score: _____/100

Name of student:_____