Using the CASIO 9850 G+ Graphing Calculator
With the Algebra Standards of Learning

Worksheets to Accompany the Six
One-hour Video Programs

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Activities available by SOL:

Algebra I:	Algebra II:
A.1	AII.4
A.3	AII.11
A.6	AII.12
A.7	AII.18
A.8	
A.9	
A.12	
A.14	
A.17	
A.18	

SOL A.1

The student will solve linear equations and inequalities in one variable, solve literal equations (formulas) for a given variable and apply these skills to solve practical problems. Graphing calculators will be used to confirm algebraic solutions.

Activity 1: Literally Not Equal

Solving Linear Inequalities
Use the Boolean check feature of the calculator to verify solutions.
Enter:
(Hint: The inequality symbols are found by SHIFT VARS < REL (F3).)

1. $3 < 5$ Boolean Check: 1 indicates a true statement
2. $3 > 5$ Boolean Check: 0 indicates a false statement
3. Graph $x < 6$

> Use paper and pencil to graph first, then verify with the graphing calculator. In the RUN menu, select SHIFT Setup. Change Draw Type to PLOT. At the home screen, press SHIFT SKETCH. Select GRPH, Y=. Press $x < 6$ ENTER. Trace the inequality along the graph. Notice the y-value remains 1 until you trace beyond 6.

4. Solve and graph $.3x - 4 > .7x + .15$

> (You may need to adjust the window to see the graph).)

Questions - Describe what you see. What do you notice about the y-values?
Solve the inequalities algebraically. How does your solution compare with the graph?

Application

Anthony can get a pet pig if he can provide it a rectangular holding pen. His father said he can use no more than 150 feet of chicken wire. If the length of the rectangular pen must be 35 feet, what are the possible widths of the pen?
Solution:

1. Draw a diagram and label the given information.
2. State the formula for the perimeter. Substitute and solve for the width.
    $P = 2(l + w)$.
3. Remember, Anthony can use no more than 150 feet. Rewrite and

solve.

$P \geq 2(l + w)$

$150 \geq 2(35 + w)$ substitution

$150 \geq 70 + 2w$ distributive property

$80 \geq 2w$ additive property of = and additive inverse

$40 \geq w$ multiplicative property of = and
multiplicative inverse

The width of the pen can be no more than 40 feet.
Use the graphing calculator to confirm your solution.

SOL A.2

The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables. Students will choose an appropriate computational technique, such as mental mathematics, calculator, or paper and pencil.

Activity 2: Simply Substitute

1. Define a variable - number of items missed.

2. Identify an algebraic expression to represent the grade.
     Total test = 100 points
     Each item = 5 points

3. Write the expression to represent the grade (100-5x).

Student	Number of Items Missed	Test Score
Patricia	5	
George	2.5	
Latoya	3	
Beth	0	
Cris	1.5	
Alan	8	
any student	x	

What formula or expression can the teacher use to determine each student's grade?

4. Determine each grade using the graphing calculator.

Method 1

To find individual grades: Store the value for x. Enter the expression. EXE.

Determine Patricia's grade: 5 ➔ x, EXE. Press x EXE. The calculator displays 5 as the stored value for x. Enter 100-5x EXE. Explain how the calculator generated Patricia's grade. Repeat for each student.

Method 2

To simulate a spreadsheet: Use the list commands to generate the entire class.

Enter the number of items into List 1. Highlight List 2. Enter 100 –

Select OPTN, List, List, 1, EXE.

The students' grades will appear in List 2.

Exploring a Pattern

Use the graphing calculator to complete the table. Examine the resulting pattern. Describe what is happening.

x	$\frac{1}{4}$	$\frac{1}{2}$	1	10	25	50	100
$\frac{x}{x-1}$							

Solution

Enter data into List 1. Highlight List 2. Select OPTN, List, List, 1. Enter x / (x-1). EXE.

Traditional Textbook Problem

Find all the values of the expression   .75 y + 2.5   if the replacement set of y is (1, 3, 6).

Use the method described above to determine the solution set for the expression.

Application

Mr. Thomas is considering taking a job to sell sports equipment. He would earn $250 a week plus 3% commission on sales. Write an expression to determine the amount of money he will earn if he sells x dollars worth of sports equipment.
(250 + .03 x)

Suppose Mr. Thomas needs at least $350 a week to pay his bills. How much sports equipment will he need to sell in order to earn $350?

Guess and Test   Do you think he
List Sequence   should take the job?
List Calculations

Guess and Test:
Store 100 as x. Calculate 250 + .03x
Store 1000 as x. Calculate 250 + .03x
Narrow your replacement values for x to determine how much equipment Mr. Thomas must sell in order to earn $350.

List Sequence:
Highlight List 1. Select OPTN, SEQ (x, x, 1000, 4000, 500). The values in List 1 begin at 1000 and end at 4000 by increments of 500.
List Calculations:
Highlight List 2. Enter 250 + .03x x OPTN List, List, 1 EXE.

Mr. Thomas will need to sell between $3,000 and $3,500 worth of sports equipment each week to meet his expectations.

SOL A.3
The student will justify steps used in simplifying expressions and solving equations and inequalities. Justifications will include the use of concrete objects, pictorial representations, and the properties of real numbers.

Activity 3: Why Justify?

Which method would you choose to solve the following linear equations?

graphing calculator, mental math, guess-and-test, or by properties

11x - 1 = 98 $\frac{5}{6}$ x + $\frac{1}{3}$ = $\frac{1}{2}$

0.25 x + 3 - 1.5 x + 7   18 = 13 b – 21
Use equation solver. Check solution in run menu.

$$\frac{5}{6}\ x + \frac{1}{3} = \frac{1}{2}$$

Select the EQUA menu. Select Solver. Enter (5/6) x + (1/3) = (1/2).
Select SOLV. The solution is displayed as the value of x.

Solve 0.25 x + 3 - 1.5 x = 7 on the graphing calculator and justify each step.

Solve using the EQUA menu. Store the displayed value of x in the RUN menu. As you show your steps, press EXE. The Boolean value of 1 will indicate appropriate transformations. A Boolean value of 0 indicates that an error has been made.

0.25 x + 3 - 1.5 x = 7	Enter equation	
0.25 x - 1.5 x + 3 = 7	_____	(Commutative)
-1.25 x + 3 = 7	_____	(Combine like terms)
-1.25 x + 3 + ⁻3 = 7 + ⁻3	_____	(Addition Property of = and Additive Inverse)
-1.25 x = 4	_____	(Simplify)
x = _4_	_____	(Multiplicative property of = and Multiplicative Inverse)
⁻1.25		
x = ⁻3.2		Solution

SOL A.6

The student will select, justify, and apply an appropriate technique to graph a linear function in two variables. Techniques will include slope-intercept, x- and y-intercepts, graphing by transformation, and the use of the graphing calculator.

Activity 1: Functional Fun

Make a table of ordered pairs and graph $y = \dfrac{x}{4} + 5$

State the slope, x- and y-intercepts.

Use the Graph Menu. After the graph is drawn, investigate the graph in the integer scale using ZOOM. The calculator will provide the x-and y-intercepts with G-SLV (graph solver); X- and Y- Cal.
Redraw the graph and select SHIFT G~T. This will display a table of values for the graph. Explore the difference between G-CONN and G-PLOT in the Table menu.

Given the x- and y-intercepts, (0, 5) (-20, 0), write the equation of the line and graph.

In the STAT Menu, enter the x values in List 1 and the y values in List 2.

Calculate the slope. Highlight List 3. Select OPTN, List, $\approx 2 / \approx 1$ EXE. The slope value of the two points is displayed in List 3.

You can graph the two points from the STAT menu. Select GRPH. Investigate SEL and SET to prepare the graph. DRAW.

Once the Scatter Plot is displayed, the calculator will generate a regression equation. Follow the directions on the screen.

Application

The amusement park at the shopping mall charges $2 for the House of Horrors and $4 for the Thunder Roller Coaster. You have $40 to spend at the amusement park.

Write an equation that represents the different combinations of attractions.

Graph the equation. Use the graph to complete the table.

x = number of $2 rides $2x + 4y = 40$
y = number of $4 rides   or
                       $y = -1/2\,x + 10$

$2			4	6			12	14		
$4	10	9			6	5			2	1

In the GRAPH menu, enter the equation. You may need to ZOOM out for a better view. Select SHIFT G~T to view the table of values. Set the range to complete the table.

SOL A.7
The student will determine the slope of a line when given an equation of the line, the graph of the line, or two points on the line. Slope will be described as rate of change and will be positive, negative, zero, or undefined. The graphing calculator will be used to investigate the effect of changes in the slope on the graph of the line.

Activity 2: Slope with DYNA

Explore the changes of the coefficient of the variable in the equation
 $y = ax + b$.
(This lesson was developed in cooperation with the Appalachia Educational Laboratory.)

Select the DYNA menu. Choose B-IN to select $y = ax + b$. Set the dynamic value to A. Set the RANG and SPEED. As you observe the display, consider:

What happens as the value of A changed?
Describe the line when A is positive.
Describe the line when A is negative.
Describe the line when A is zero.

Your Turn:
Given $y = -3x + 2$, describe the slope of the line as positive, negative, or zero.
Given $y = 6x + 5$, describe the slope of the line as positive, negative, or zero.
What is the slope of $y = -6$?

SOL A.8
The student will write an equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line.

Activity 3: What's My Line?

Given two points (4,3) and (- 1, 5), write the equation of the line and graph.
Use $y - y_1 = m(x - x_1)$ or $y = m x + b$ to determine the equation.
The graphing calculator will be used to verify your equation.

In this procedure, you will generate the equation of the line through the two given points. You will draw the points on the calculator. Store them as pictures and then graph your equation to see if the line goes through the points.
Select:
1. RUN MENU (1)
2. SHIFT (F3) V-Window
3. STD (F3) EXE
4. SHIFT (F4) Sketch
5. Cls (F1); EXE; ſ (F6); Plot (F1)
6. Pl-On (F2) At cursor, enter coordinates of first point 4,-3 EXE
7. F6 (takes you back to previous screen)
8. Pl-On (F2) At cursor, enter coordinates of second point -1,5 EXE
9. OPTN
10. PICT (F1)
11. STO (F1)
12. PIC1 (F1)
13. MENU GRAPH (5) (delete equations if present using Del (F2) and Yes (F1))
14. Type (F3); Y= (F1)
15. Enter the equation that you found using the point-slope formula and EXE
    Arrow up to highlight Y1= COLR (F4); Choose Orng (F2); EXIT
16. SHIFT MENU (Set up) Arrow down to Background
17. PICT (F2); PIC1 (F1); EXIT
18. DRAW (F6)

If you have determined the correct equation, the line will travel through the two given points.

****Reset the calculator: EXIT; delete graph (F2), (F1); SHIFT MENU (Set up); arrow to Background - None (F1)

SOL A.17
The student will, given a set of data points, write an equation for a line of best fit, using the median fit method, and use the equation to make predictions.

Activity 4: TREND DATA Median Line of Best Fit

Determine the median line of best fit using paper and pencil.

1. Divide data into three groups.
   (1,4) (4,6) (7,8)   (9,6) (12,15) (15,13)   (19,12) (20,19) (26,14)

2. Find the median x-coordinate of each group.
      (4,   )   (12,   )   (20,   )

3. Find the median y-coordinate of each group.
      (,6)   (,13)   (,14)

4. Combine to identify median coordinates
      (4, 6)   (12, 13)   (20, 14)
        A   B   C

5. Calculate the centroid (mean) point.
   $\frac{(4+12+20)}{3}$ $\frac{(6+13+14)}{3}$ = (12,11)

6. Using Points A and C, find slope.
    (4,6) and (20,14) m = 1/2

7. Write the equation of the median line using the mean point
   and m=1/2.

Y = mx + b   or $y - y_1 = m(x - x_1)$

The equation for the median line is y = 1/2 x + 5.

Remember the median line shows overall trend not a specific result.

With the graphing calculator, enter the data in the STAT menu, List 1 and List 2. Graph the points with a scatter plot. The calculator provides a Med regression choice. Verify your solution.

Hours	4	12	8	6	10	8	16
Score	4.25	5.50	4.75	4.75	5.25	4.50	5.50

Application

Mr. Hall recorded the number of hours each student studied for the exam and the score on the exam. Make a scatter plot of the data.

1. Do you think all students who study 16 hours will earn a 5.5?

2. Determine the line of best fit. Explore a Linear Regression and Med-Med Regression.

3. How would the line of best fit be helpful to students?

SOL A.12
The student will factor completely first- and second-degree binomials and trinomials in one or two variables. The graphing calculator will be used as both a primary tool for factoring and for confirming an algebraic factorization.

Activity 1: Balancing Factors

Use the Boolean Check Method to verify each factorization. To refresh your memory, enter $5 = 5$ EXE. The calculator will display 1.000 which indicates a true statement. Enter $3 = 5$ EXE. The calculator will display 0.000 indicating a false statement.

Factor completely first and second degree binomials and trinomials. Verify factorization using the graphing calculator.

$5x^2 - 5x$ $3y^2 + 21y + 36$ $q^2 - 100$

First store any value for x such as 2   x. Be careful of using 0 or 1 because of the identity properties.

Enter $5x^2 - 5x = 5(x-1)$ EXE. (The "=" sign is found by SHIFT .) If you have factored the binomial correctly, the value of 1.000 will be displayed.

Enter $3y^2 + 21y + 36 = 3(y+4)(y+3)$ EXE. What did the calculator display?

Enter $q^2 - 100 = (q-10)(q+10)$ EXE. Is this factored completely and correctly?

SOL A.14
The student will factor completely first- and second-degree binomials and trinomials in one or two variables. The graphing calculator will be used as both a primary tool for factoring and for confirming an algebraic factorization.

Activity 2: Back to Your Roots

Using the Equation Menu (EQUA) solve each quadratic equation.

In the EQUA menu, select Polynomial. You will be prompted to select a second or third degree polynomial. Select 2. Notice the format $ax^2 + bx + c = 0$. You will need to expand each quadratic. Once you have entered the values, select SOLV.

$b(b - 10) = 0$ $(c + 3)(c - 8) = 0$ $3x^2 + 14x = 5$
$x^2 + 4x - 45 = 0$

Solve each equation using the Graph Menu.

How many real roots does each equation have? Enter each equation. Adjust the view window as necessary. To identify the roots, press SHIFT GSLV. Select ROOT and wait. Press the right arrow to identify the right root.

$x^2 - 4x - 2 = 0$ $x^2 - 4x + 4 = 0$ (*use g-solv; min-value)

$x^2 - 4x + 9 = 0$

Solve each equation using the Graph Menu.

1. $m^2 - 6m - 27 = 0$ Enter equation as $y = x^2 - 6x - 27$

2. $g^2 - 4g = 5$ Enter equation as $y = x^2 - 4x - 5$

Follow the method described above to identify the solutions.

SOL AII.4
The student will solve absolute value equations and inequalities graphically and algebraically. Graphing calculators will be used both as a primary method of solution and to verify algebraic solutions.

Activity 3: The "V" Files

Select SHIFT Menu (SetUp). Change Draw Type: PLOT.

| x | ‹ 4   The following steps will display the graph of the solution.

Run Menu	F3 CPLX
Shift F4	F2 Abs
F1 Cls EXE	x
F5 Graph	Shift VARS
F1 Y=	F6 F3 Rel
OPTN	F4 < 4 EXE

Solution   { x| - 4 <x < 4 }

Solve Open Sentences Involving Absolute Value

Following the directions listed below will display the graph of the solution.

Select Shift Menu (SetUp) Draw Type: PLOT in the RUN menu.
Solve | x + 4 | ≥ 3

Run Menu	F3 CPLX
Shift F4	F2 AbS
F1 Cls EXE	(x + 4)
F5 Graph	Shift VARS
F1 Y=	F6 F3 Rel
OPTN	F5 ≥ 3 EXE

Solution: { x| x ≤ -7 or x ≥ - 1 }

Investigate the changes in absolute inequalities using the DYNA menu.

Given y = | A x + B | + C

How do changes in the values for A transform the graph?   for B ?
for C?

Set up the Dynamic Absolute Value Function by selecting:

OPTN, NUM, ABS, (AX + B), + C, EXE.

Select VAR to select the dynamic variable and set the range of values. When investigating the changes of A, set B and C to 0. As the values of A change from –5 to 5, what happens to the graph? What happens when A = 0?

Change the dynamic variable to B and explore. What did you discover? Change the dynamic variable to C and explore. What did you see?

Now, investigate a family of absolute value inequalities.

Using the GRAPH menu, graph each of the following and complete the chart.

	Min. Point	
y = | 2 x + 1 | + 2	(	,	)
y = | 2 x + 2 | + 2	(	,	)
y = | 2 x + 3 | + 2	(	,	)
y = | 2 x + 4 | + 2	(	,	)
y = | Ax + B | + C	(	,	)

Solutions:

	Min. Point	
y = | 2 x + 1 | + 2	(-. 5 ,	2)
y = | 2 x + 2 | + 2	(- 1 ,	2)
y = | 2 x + 3 | + 2	(- 1.5 ,	2)
y = | 2 x + 4 | + 2	(- 2 ,	2)
y = | Ax + B | + C	($\frac{-B}{A}$,	C)

Now sketch the graph of the following.

$$y = | 4 x + 2 | \ -1 \quad \text{Min. Value (} \quad , \quad)$$

$$y = | 3 x + 5 | + 2 \quad \text{Min. Value (} \quad , \quad)$$

Verify your sketches with the graphing calculator.

SOL AII.18
The student will identify conic sections (circle, ellipse, parabola, and hyperbola) from his/her equations. Given the equations in (h, k) form, students will sketch graphs of conic sections, using transformations.

Activity 4: Quadratic Shifts and Slides

Using the DYNA menu, explore the role of A, H, and K in the quadratic function

$$y = A (x - H)^2 + K$$

Enter this equation into Y_1 in the DYNA menu.
Sketch the graph when

      A = - 5   A = - 1   A = 0   A = 2

      H = - 5   H = -1   H = 0   H = 2

      K = -5   K= -1   K = 0   K = 2

Sketch the graph of

$$y = x^2$$

$$y = (x - 1)^2$$

$$y = (x-1)^2 + 1$$

Verify your sketches with the graphing calculator in the GRAPH menu.

Sketch the graph of

$$y = 5\ x^2$$

$$y = 5\ (x + 2)^2$$

$$y = 5\ (x + 2)^2 - 3$$

Verify your sketches with the graphing calculator in the GRAPH menu.

SOL A.18
The student will compare multiple one-variable data sets, using statistical techniques that include measures of central tendency, range, stem-and-leaf plots, and box-and-whisker graphs.

Activity: An Average Grade

Mr. Johnson gave the same test to his first and second period classes. He would like to look at several statistics about the two classes.

The grades in his first period were: 62, 85, 69, 82, 55, 64, 70, 79, 70, 84, 70, 82, 79, 68, 78, 81, 70, 92, 59, 72, 63, 53, and 78.

The grades in his second period were: 62, 85, 69, 82, 85, 64, 70, 79, 70, 84, 70, 82, 79, 68, 78, 88, 81, 70, 90, 92, 59, 72, 63, 93, and 78.

1. Enter the scores from first period in List 1 of your calculator. Sort the list using the sort function.

2. Enter the scores from second period in List 2 of your calculator. Sort the list using the sort function.

3. Without using your calculator, find the minimum, Q1, median, Q3, maximum, and mode for first period. Show all work.

minimum: _____

Q1: _____

median: _____

Q3: _____

maximum: _____

mode: _____

4. Without using your calculator, create a median box-and-whisker graph for first period. Draw your graph on graph paper.

5. Use your calculator to create a median box-and-whisker graph and to verify your values in number 5. If you do not have the same answers, repeat step 5 without using your calculator.

6. Use your calculator to create a median box-and-whisker graph or second Period. Graph both first and second period on one screen. Sketch your result here.
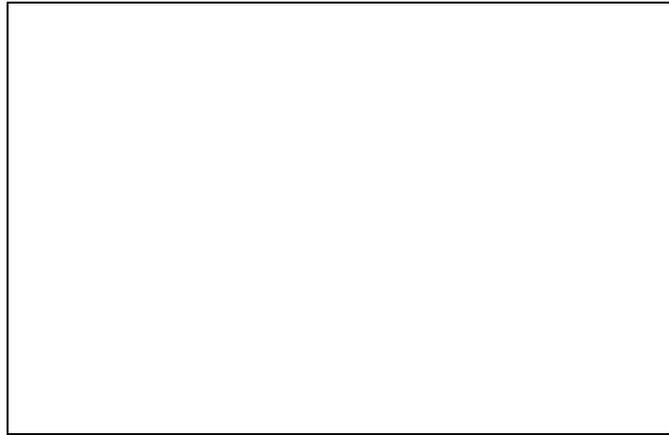
7. Based on what you see on the screen, how did first period do compared to second period? Write your answer in complete sentences.

SOL A.9
The student will solve systems of two linear equations in two variables, both algebraically and graphically, and apply these techniques to solve practical problems. Graphing calculators will be used as both a primary tool of solution and to confirm an algebraic solution.

AII.12
The student will represent problem situations with a system of linear equations and solve the system using the inverse matrix method. Graphing calculators or computer programs with matrix capability will be used to perform computations.

Activity: Geometrically Speaking

In this activity, you will use your knowledge of parallelograms to set up a system of equations. Then, you will solve the system in three ways, using both your algebra skills and your graphing calculator.

Study the diagram below. Assume the figure is a parallelogram.
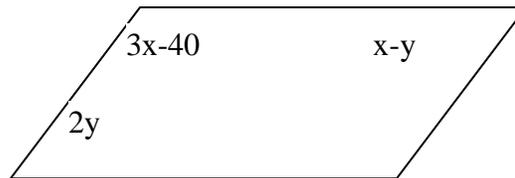
1. Set up a system of equations based on the diagram above. Use your algebra skills to put each equation in standard form.

2. Solve the system algebraically. Show all work clearly.

3. Verify your solution using the EQUA menu on your calculator. Write your solution (in the form given on the calculator) here.

Next, you will solve the same system graphically.

4. Use your algebra skills to solve each equation for y. Show all work.

5.   Solve graphically using the GRAPH menu on your calculator.
     Write down the View Window that you used to see the intersection
     of the lines.

Xmin:
max:
scale:
Ymin:
max:
scale:

6.   Sketch the window after you have found the intersection on your
     calculator.

In this segment, you will solve the same system using the inverse matrix method.

7.   Write the matrix equation which may be used to solve this system.

8.   Use your calculator to solve the system using inverse matrices. Write the expression you typed in the RUN menu to find the answer.

You solved this problem three ways. Explain what your answer represents in relation to the original diagram. Use complete sentences and spell correctly.

SOL AII.11
The student will use matrix multiplication to solve practical problems.
Graphing calculators or computer programs with matrix capabilities will
be used to find the product.

Activity: Personnel Expenses

Food Central is a national supermarket chain. It has three types of
stores: Corner Stores (C), Grocery (G), and Discount (D). Matrix A lists
the number of each store type in the four parts of the country: the
Northeast, the Northwest, the Southeast, and the Southwest.

$$A = \begin{array}{c} \\ NE \\ NW \\ SE \\ SW \end{array} \begin{array}{ccc} C & G & D \\ \begin{bmatrix} 3 & 10 & 5 \\ 10 & 3 & 3 \\ 5 & 9 & 7 \\ 0 & 6 & 2 \end{bmatrix} \end{array}$$

There are three salary levels at all Food Central's stores: maintenance
(M), sales (S), and professional (P). Matrix B lists the number of workers
at each salary level working in each type of store.

$$B = \begin{array}{c} \\ C \\ G \\ D \end{array} \begin{array}{ccc} M & S & P \\ \begin{bmatrix} 1 & 2 & 4 \\ 3 & 8 & 15 \\ 5 & 12 & 25 \end{bmatrix} \end{array}$$

1.   What does the element in row 4, column 2 of Matrix A represent?
        Write your answer in complete sentences.

2.   What does the element in row 2, column 1 of Matrix B represent?
        Write your answer in complete sentences.

3.   Without using your calculator, find the number of maintenance (M)
        workers in the Northeast (NE). Explain in words how you got this
        answer.

4.   Use your calculator to evaluate A*B and store in Matrix D. Write
your answer here. What does Matrix D represent?

Matrix D =

5. The result of B*A does not exist. Explain why this is true and show the mathematical reasoning.

Matrix C lists the monthly salaries in dollars for each salary level at Food Central.

$$
\begin{matrix}
 & \text{Salary} \\
C = \begin{matrix} M \\ S \\ P \end{matrix} & \begin{bmatrix} 1110 \\ 1370 \\ 1930 \end{bmatrix}
\end{matrix}
$$

6. What does the element in row 2, column 1 represent? Write your answer in complete sentences.

7. Multiply Matrix D and Matrix C. In what order must you multiply and why? Write your result matrix here.

Answer Matrix: =

8. Describe the result matrix from step 7. What do the numbers represent?

<u>You will now reach the same result using a different method.</u>

9.   Use your calculator to evaluate Matrix B* Matrix C and store in
      Matrix E. Write your answer here.

      Matrix E =

10.   Describe the information contained in B*C.

11.   Multiply Matrix E and Matrix A. Again, in what order must you multiply and why? Write your result matrix here.

Answer Matrix =

12.   Describe the answer matrix in step 11.

13.   Compare your matrix in step 11 with your matrix in step 7. Do you have the same matrix? Explain why either method yields the correct answer. Write your answer in complete sentences.