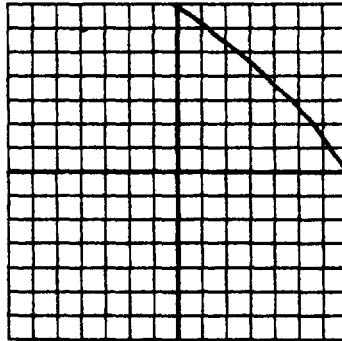


$$\begin{aligned}
 7. \quad 5 + \sqrt{a+7} &= a \\
 (\sqrt{a+7})^2 &= (a-5)^2 \\
 a+7 &= a^2 - 10a + 25 \\
 0 &= a^2 - 11a + 18 \\
 0 &= (a-9)(a-2) \\
 a &= 9, 2
 \end{aligned}$$

Sketch

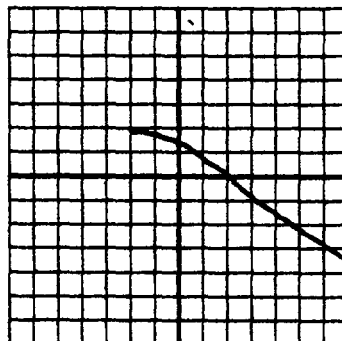


$$7. \quad a = \textcircled{2}, 9$$

$$y_1 = \sqrt{a+7} + 5 - a$$

$$\begin{aligned}
 8. \quad \sqrt{2x+5} - 1 &= x \\
 (\sqrt{2x+5})^2 &= (x+1)^2 \\
 2x+5 &= x^2 + 2x + 1 \\
 0 &= x^2 - 4 \\
 0 &= (x+2)(x-2) \\
 x &= \pm 2
 \end{aligned}$$

Sketch

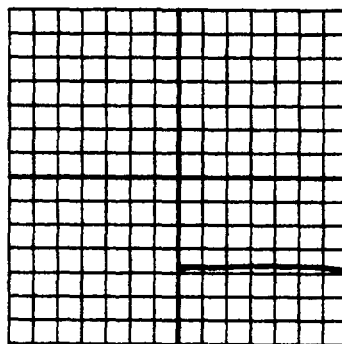


$$8. \quad x = \textcircled{-2}, 2$$

$$y_1 = \sqrt{2x+5} - 1 - x$$

$$\begin{aligned}
 9. \quad \sqrt{5y-1} - \sqrt{7y+9} &= 2 \\
 (\sqrt{5y-1})^2 &= (2 + \sqrt{7y+9})^2 \\
 5y-1 &= 4 + 4\sqrt{7y+9} + 7y+9 \\
 -2y-14 &= 4\sqrt{7y+9} \\
 (-y-7)^2 &= (2\sqrt{7y+9})^2 \\
 y^2 + 14y + 49 &= 28y + 36 \\
 y^2 - 14y + 13 &= 0 \\
 (y-13)(y-1) &= 0 \\
 y &= 13, 1
 \end{aligned}$$

Sketch



$$9. \quad y = \textcircled{13}, \textcircled{1}$$

$$y_1 = \sqrt{5y-1} - \sqrt{7y+9} - 2$$

Range

$$x \text{ Min} = -20$$

$$x \text{ Max} = 20$$

$$x \text{ Scl} = 2$$

$$y \text{ Min} = -20$$

$$y \text{ Max} = 20$$

$$y \text{ Scl} = 2$$

$$10. (\sqrt{x} + \sqrt{3})^2 = (\sqrt{x+3})^2$$

$$x + 2\sqrt{3x} + 3 = x + 3$$

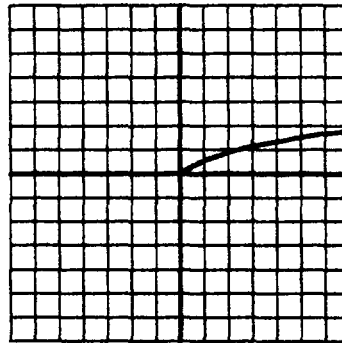
$$2\sqrt{3x} = 0$$

$$\sqrt{3x} = 0$$

$$3x = 0$$

$$x = 0$$

Sketch



$$10. \underline{x=0}$$

$$y_1 = \sqrt{x} + \sqrt{3} - \sqrt{x+3}$$

Range

$$x_{\text{Min}} = -10$$

$$x_{\text{Max}} = 10$$

$$x_{\text{Scl}} = 1$$

$$y_{\text{Min}} = -10$$

$$y_{\text{Max}} = 10$$

$$y_{\text{Scl}} = 1$$

$$11. \sqrt{2n-5} - \sqrt{3n+4} = 2$$

$$\sqrt{2n-5} = 2 + \sqrt{3n+4}$$

$$2n-5 = 4 + 4\sqrt{3n+4} + 3n+4$$

$$2n-5 = 8 + 3n + 4\sqrt{3n+4}$$

$$-n-13 = 4\sqrt{3n+4}$$

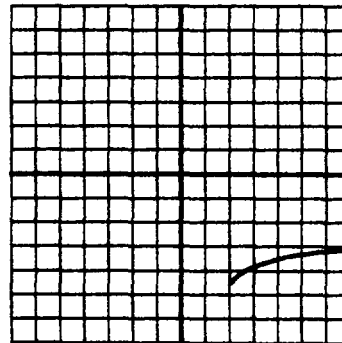
$$n^2 + 26n + 169 = 48n + 64$$

$$n^2 - 22n + 105 = 0$$

$$(n-7)(n-15) = 0$$

$$n = 7, 15$$

Sketch



$$11. \underline{n=7, 15}$$

$$y_1 = \sqrt{2n-5} - \sqrt{3n+4} - 2$$

$$12. \sqrt{x+7} + \sqrt{x} = 7$$

$$(\sqrt{x+7})^2 = (7 - \sqrt{x})^2$$

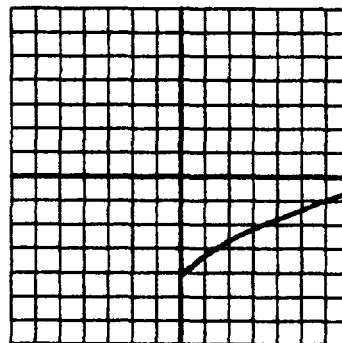
$$x+7 = 49 - 14\sqrt{x} + x$$

$$-42 = -14\sqrt{x}$$

$$(3)^2 = (\sqrt{x})^2$$

$$9 = x$$

Sketch



$$12. \underline{x=9}$$

$$y_1 = \sqrt{x+7} + \sqrt{x} - 7$$

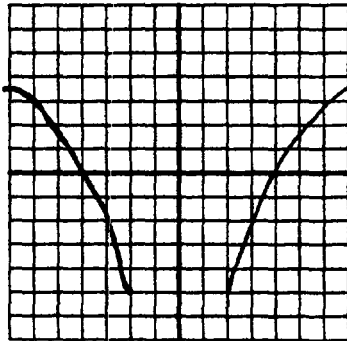
Worksheet 2--An Alternative Approach to Solving Radical Equations

Name: Answer Key Date: _____

Reevaluate problems 3, 4, 6, 7, 10, 11, and 12 from worksheet 1 using the graphing calculator. Sketch the graph below each problem. Write the solutions you found using the graphing calculator in the blank provided.

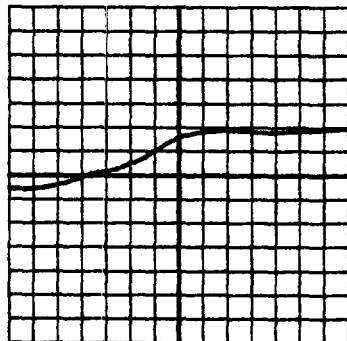
3. $\sqrt{2x^2 - 7} = 5$
Sketch

3. $x = -4, 4$



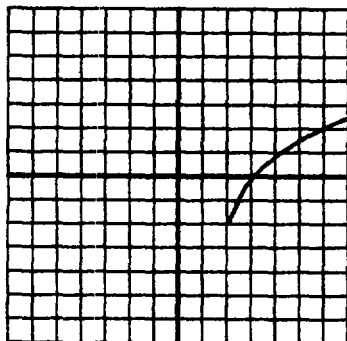
4. $\sqrt[3]{2d} + 5 = 3$
Sketch

4. $d = -4$

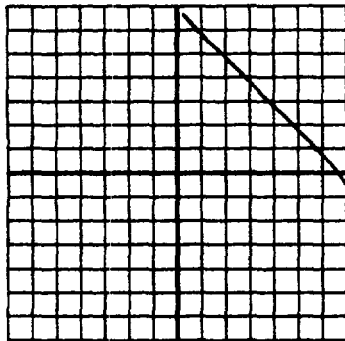


6. $\sqrt{t-2} + t = 4$
Sketch

6. $t = 3$

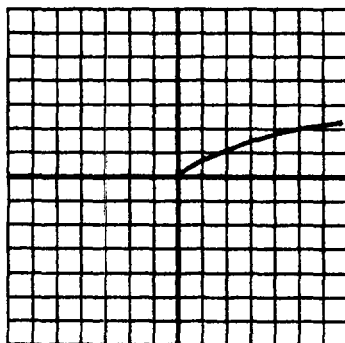


7. $5 + \sqrt{a+7} = a$
Sketch



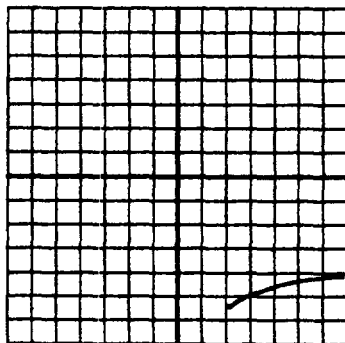
7. $a=9$

10. $\sqrt{x} + \sqrt{3} = \sqrt{x+3}$
Sketch



10. $x=0$

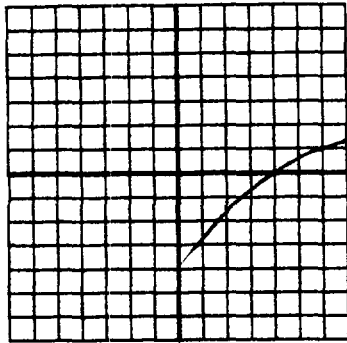
11. $\sqrt{2n-5} - \sqrt{3n+4} = 2$
Sketch



11. no real roots

12. $\sqrt{x+7} + \sqrt{x} = 7$
Sketch

12. $x=9$



Questions

1. After squaring both sides of $2n + 3 = n$ (Exercise 5), you should have gotten $2n + 3 = n^2$. There are three other equations like $2n + 3 = n$ which would yield $2n + 3 = n^2$ when both sides are squared. List these below.

- (1) $\sqrt{2n+3} = n$
- (2) $-\sqrt{2n+3} = n$
- (3) $-\sqrt{2n+3} = n$
- (4) $\sqrt{2n+3} = -n$

2. Do you notice anything about these four equations? Can you group these four equations into two groups of two equations which have something in common?

Group 1
 $\sqrt{2n+3} = n$
 $-\sqrt{2n+3} = -n$

Group 2
 $-\sqrt{2n+3} = n$
 $\sqrt{2n+3} = -n$

3. Why did you group the equations in this manner?

The equations in group 1 are equivalent to one another as are the equations in group 2.

4. Substitute both values you got in the algebraic solution of exercise 5 into all four equations from above. If a true statement results put a "+" in the box; if a false statement results put a "-" in the box.

Equation	n value <u>3</u>	n value <u>-1</u>
$\sqrt{2n+3} = n$	+	-
$-\sqrt{2n+3} = n$	+	-
$-\sqrt{2n+3} = n$	-	+
$\sqrt{2n+3} = -n$	-	+

5. Compare the results from your grouped equations. Are there any similarities within each group of equations? If so, explain. If not, return to question 2, look for a different way to group the equations, and repeat.

The equations in group 1 were true at $n=3$ and false at $n=-1$. The equations in group 2 were true at $n=-1$ and false at $n=3$.

6. Why do you believe these results occurred? (i.e., What do you do in the algebraic solution of radical equations which might cause an extraneous root to result?)

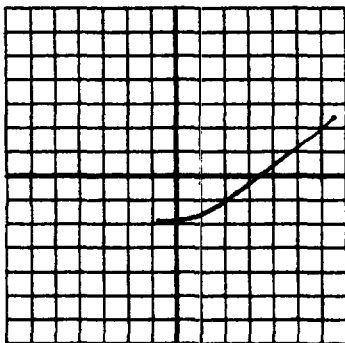
When squaring both sides of the equation you can introduce extraneous roots because there can be more than one possible equation, not necessarily equivalent, that when squared makes the same equation.

7. Graph the four equations on the graphing calculator and record the graphs below.

Group 1

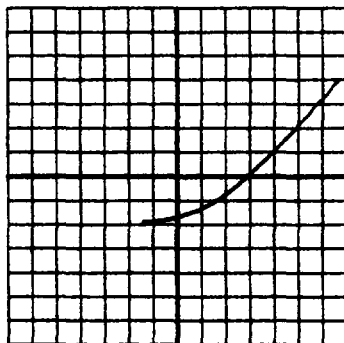
Equation $\sqrt{2n+3} = n$

Sketch



Equation $-\sqrt{2n+3} = -n$

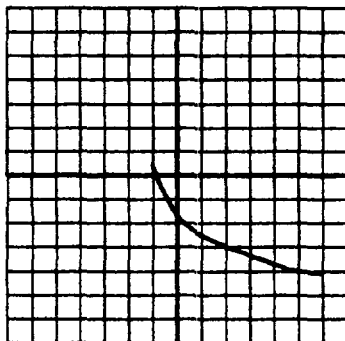
Sketch



Group 2

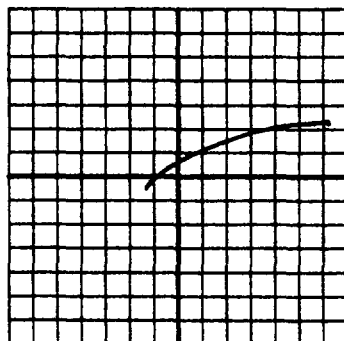
Equation $-\sqrt{2n+3} = n$

Sketch



Equation $\sqrt{2n+3} = -n$

Sketch



8. Do the graphs confirm your reasoning from question 6? How do they or do they not confirm this?

Yes. You can see that the graphs in group 1 have the same roots as do the equations in group 2.

Title: Investigating points of intersection with *Geometer's Sketchpad*

Grade Level: 10 - 12

Time Required: two fifty minute class periods

Objectives:

1. Students will be able to create acute, obtuse, and right triangles using *Geometer's Sketchpad*.
2. Students will be able to draw and label the altitudes, medians, and angle bisectors of each of the three types of triangles.
3. Students will be able to compare the location of the points of intersection of the medians, altitudes, and angle bisectors of the three triangles.
4. Students will be able to prove that the medians of the acute, obtuse, and right triangles are concurrent using Ceva's Theorem.
5. Students will be able to prove that the angle bisectors of acute, obtuse, and right triangles are concurrent using Ceva's Theorem.

Notes to the Teacher:

Computer based discovery lessons are very useful in geometry. The following lesson will greatly assist students in analyzing the points of intersection of angle bisectors, medians, and altitudes. Through the use of this lesson, students will be able to visualize and inspect the locations of the intersections. Using a computer based lesson provides the students with the opportunity to examine many different triangles in a short amount of time. Sample drawings for this activity are included at the end of the lab sheets.

Procedure:

Pass out lab sheet and allow students to work in groups of two or three. Students should be required to print drawings to support their findings.

Acknowledgment:

This lesson and the lab sheets which accompany it were created by Ms. Jane Click (B.S. Ball State University '96).

LAB SHEET #1

Name: _____

Record all observations in the space provided on this lab sheet.
Open a clean page in *Geometer's Sketchpad* and complete the following activities on the computer. You should open additional clean pages as necessary.

STEP ONE:

- a. Draw an acute triangle.
- b. Construct the angle bisectors
- c. Note the location of the points of intersection of the angle bisectors, if one exists.
- d. Repeat steps a through c for two other acute triangles.
- e. Repeat steps a through d for obtuse and right triangles. Be sure to record your observations.

Observations:

Acute triangles:

Obtuse triangles:

Right triangles:

STEP TWO:

- a. Compare the three types of triangles. What do you notice about the points of intersection of the bisectors in each case?

Print out one of each of the three types of triangles which you feel support your conclusions.

b. Using Ceva's Theorem, as previously discussed in class, prove for the first acute triangle that the angle bisectors are concurrent. Can you generalize this for obtuse and right triangles?

STEP THREE:

Repeat step one and step two. However, this time, construct the medians of the triangles instead of the angle bisectors.

Observations:

Acute triangles:

Obtuse triangles:

Right triangles:

Prove concurrence using Ceva's Theorem:

STEP FOUR:

Repeat step one. However, construct the altitudes for each of the triangles.

Observations:

Acute triangles:

Obtuse triangles:

Right triangles:

Compare the three types of triangles. What can you generalize about the location of the intersection in each case?

Title: Investigating diagonals with *Geometer's Sketchpad*

Grade Level: 10 - 12

Time Required: one 55 minute class period

Objectives:

1. Students will be able to create squares, rhombi, parallelograms, and rectangles using *Geometer's Sketchpad*.
2. Students will be able to construct the diagonals of the four quadrilaterals.
3. Students will be able to analyze the length relationship of each of the diagonals.

Notes to the Teacher:

Discovery learning is very effective in the geometry classroom. The following lesson will aid students in forming conjectures about the lengths of the diagonals of various quadrilaterals. The use of the computer will provide students with the opportunity to view and examine various types of quadrilaterals.

Procedure:

Pass out lab sheets and allow students to work in groups of two or three.

Acknowledgment:

This lesson and the lab sheet which accompanies it was created by Ms. Jane Click (B.S. Ball State University '96).

Lab Sheet #2

Name: _____

Record all observations in the space provided on this lab sheet. Open a clean page in *Geometer's Sketchpad* and complete the following activities on the computer. You should open additional clean pages as necessary.

STEP ONE:

- a. Draw a square.
- b. Construct the diagonals of the square.
- c. Note the lengths of the diagonals.
- d. What do you notice about the diagonals? Do they bisect each other?
- e. Repeat steps a through d for two other squares.
- f. Save these sketches and open a new sketch.
- g. Repeat steps a through f for the following quadrilaterals: rectangle, rhombus, and parallelogram.

Observations:

Squares:

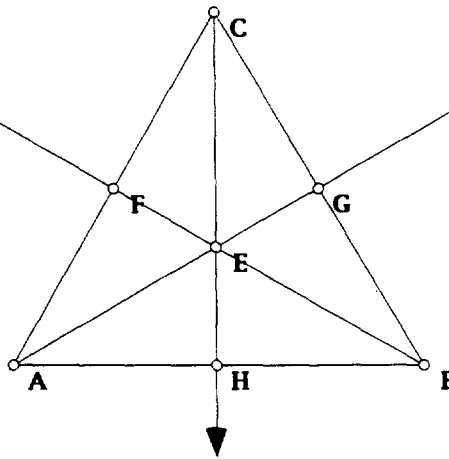
Rectangles:

Rhombus:

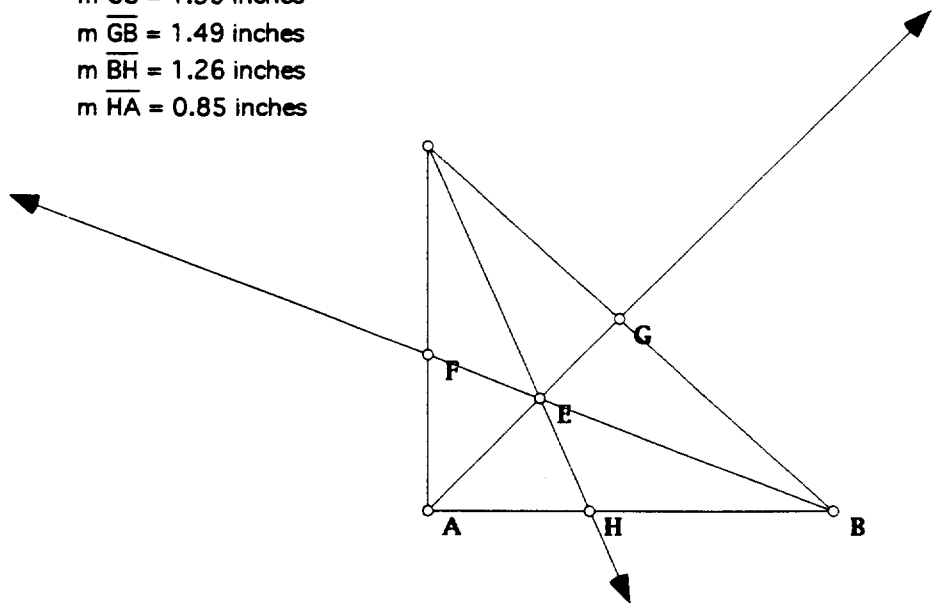
Parallelograms:

Compare the four types of quadrilaterals. What can you generalize about the diagonals in each case? Can you think of any other quadrilaterals that may have similar properties?

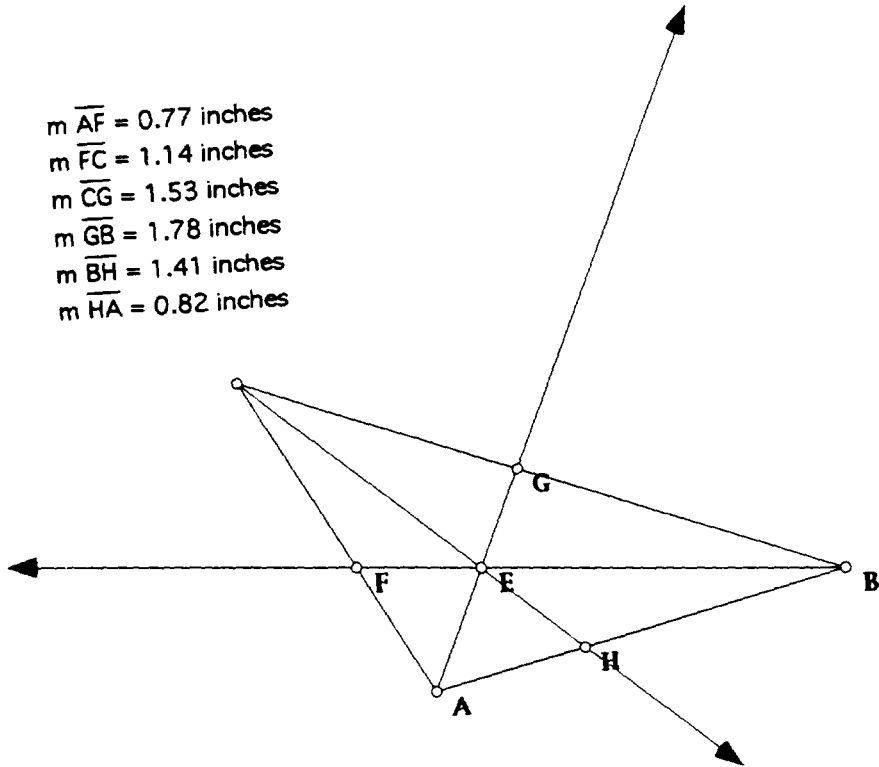
$m \overline{AF} = 1.06$ inches
 $m \overline{FC} = 1.06$ inches
 $m \overline{CG} = 1.06$ inches
 $m \overline{GB} = 1.07$ inches
 $m \overline{BH} = 1.07$ inches
 $m \overline{HA} = 1.07$ inches



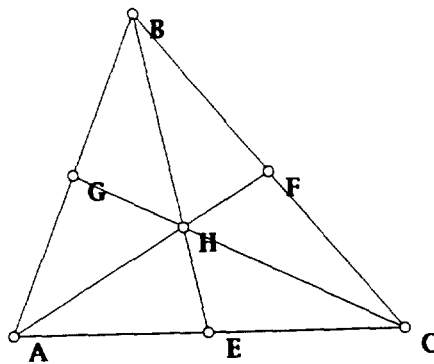
$m \overline{AF} = 0.81$ inches
 $m \overline{FC} = 1.09$ inches
 $m \overline{CG} = 1.35$ inches
 $m \overline{GB} = 1.49$ inches
 $m \overline{BH} = 1.26$ inches
 $m \overline{HA} = 0.85$ inches



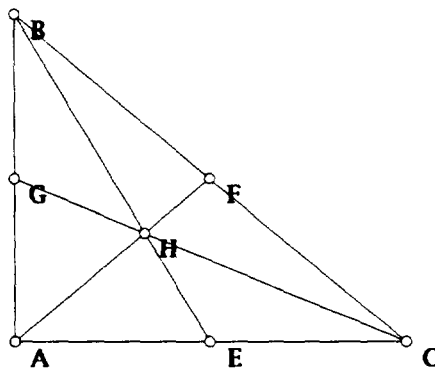
$m \overline{AF} = 0.77$ inches
 $m \overline{FC} = 1.14$ inches
 $m \overline{CG} = 1.53$ inches
 $m \overline{GB} = 1.78$ inches
 $m \overline{BH} = 1.41$ inches
 $m \overline{HA} = 0.82$ inches



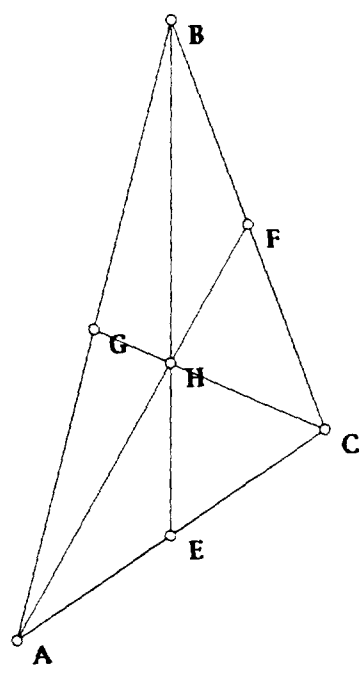
$m \overline{AG} = 0.90$ inches
 $m \overline{GB} = 0.90$ inches
 $m \overline{BF} = 1.08$ inches
 $m \overline{FC} = 1.08$ inches
 $m \overline{CE} = 1.02$ inches
 $m \overline{EA} = 1.02$ inches

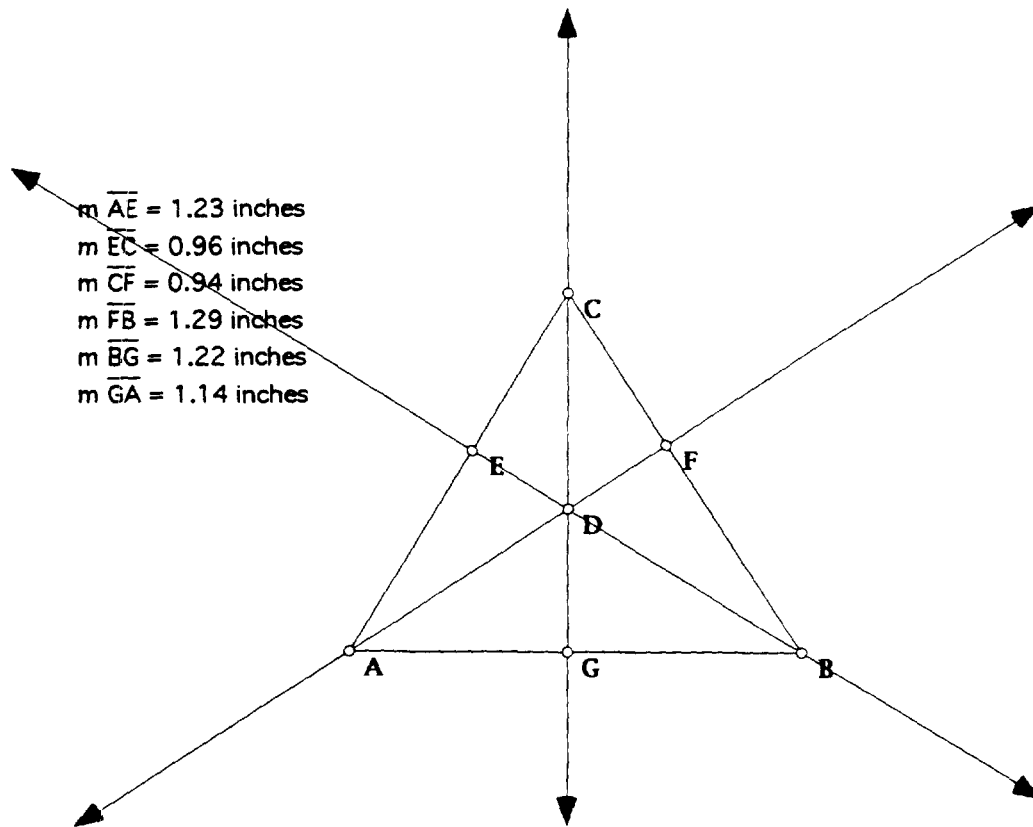


$m \overline{AG} = 0.85$ inches
 $m \overline{GB} = 0.85$ inches
 $m \overline{BF} = 1.33$ inches
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 $m \overline{EA} = 1.02$ inches

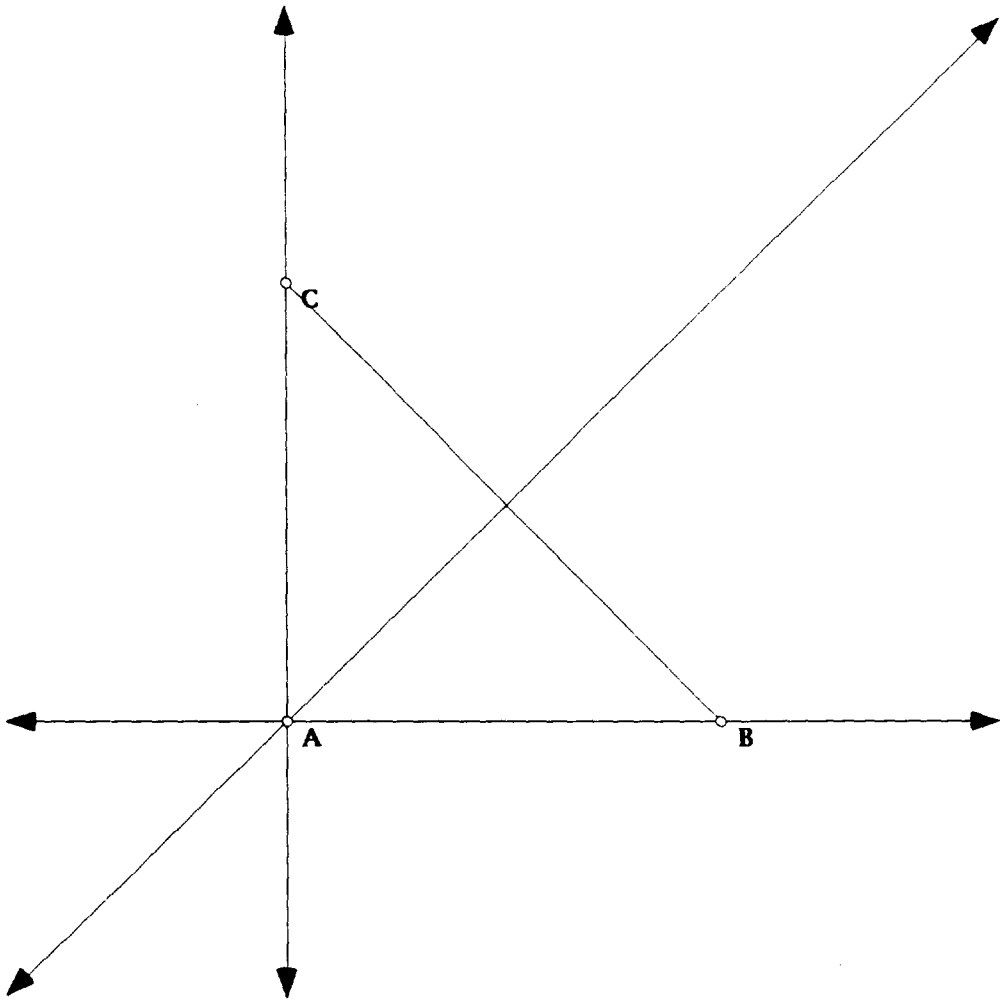


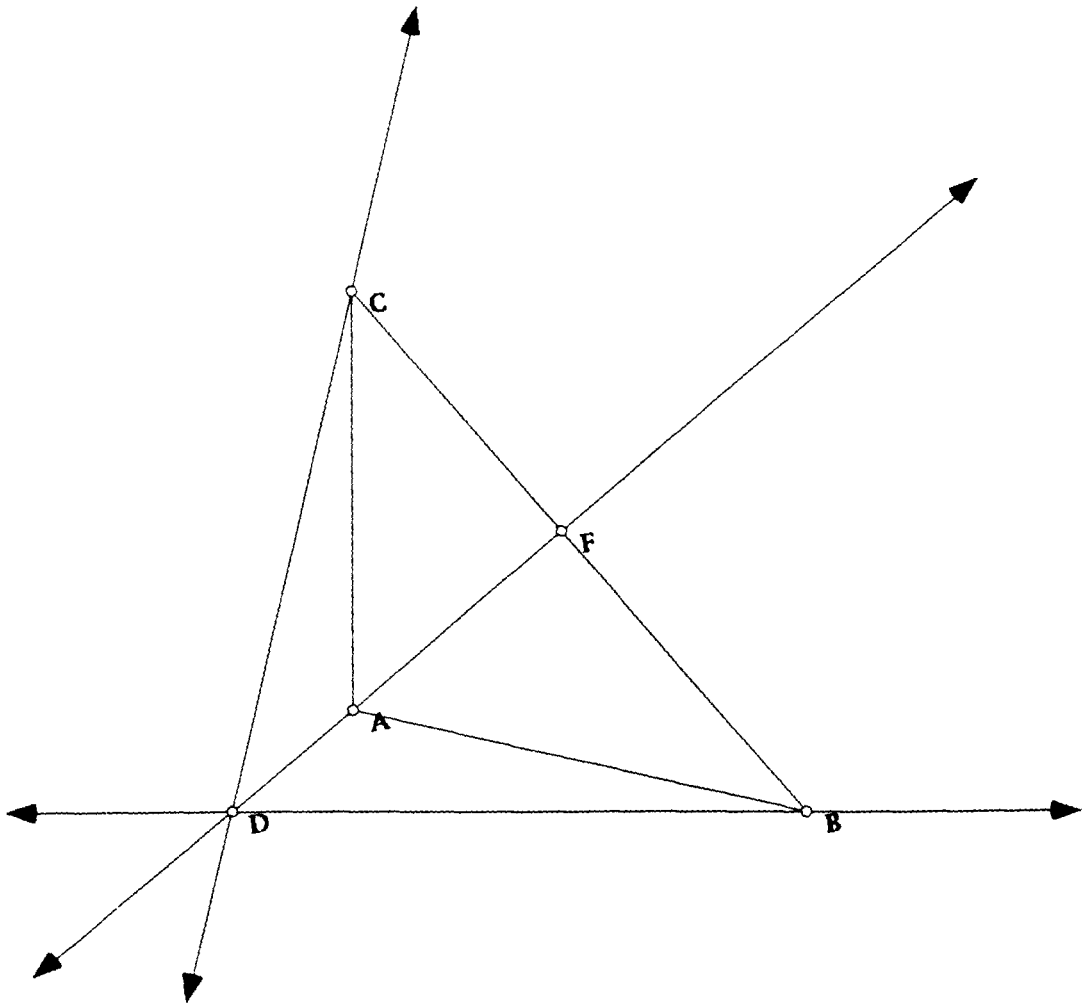
$m \overline{AG} = 1.67$ inches
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 $m \overline{FC} = 1.14$ inches
 $m \overline{CE} = 0.97$ inches
 $m \overline{EA} = 0.97$ inches



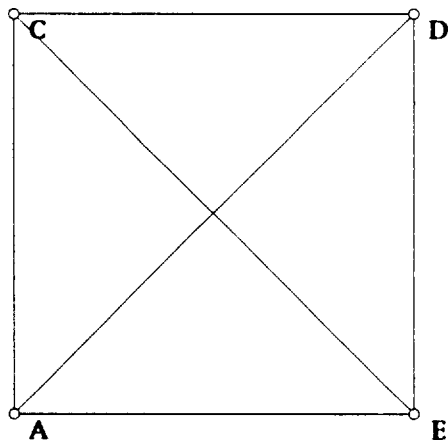


$m \overline{AE} = 1.23$ inches
 $m \overline{EC} = 0.96$ inches
 $m \overline{CF} = 0.94$ inches
 $m \overline{FB} = 1.29$ inches
 $m \overline{BG} = 1.22$ inches
 $m \overline{GA} = 1.14$ inches

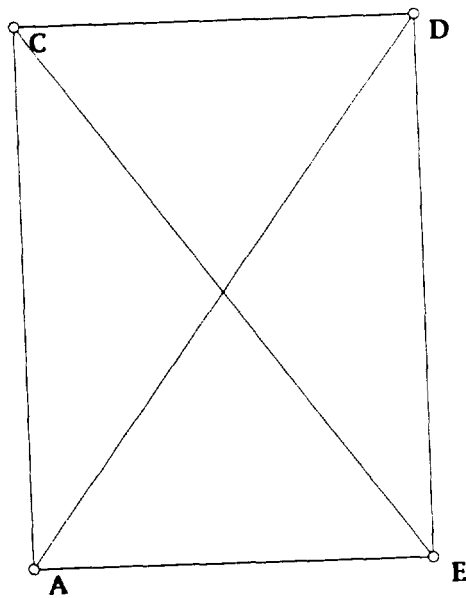




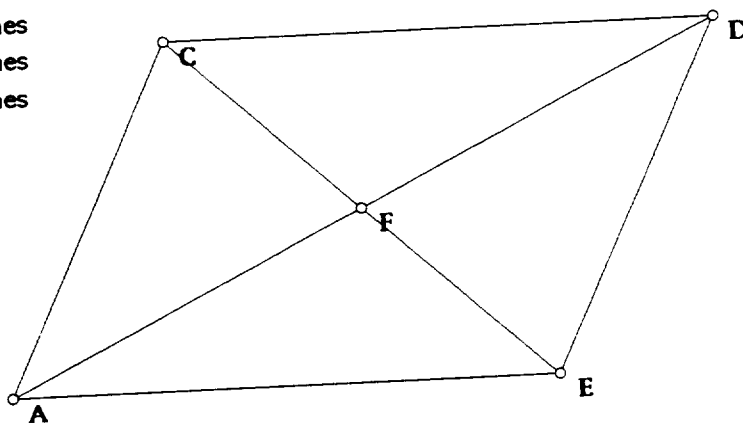
$m \overline{CD} = 2.08$ inches
 $m \overline{DE} = 2.08$ inches
 $m \overline{AD} = 2.95$ inches
 $m \overline{CE} = 2.95$ inches



$m \overline{CD} = 2.08$ inches
 $m \overline{DE} = 2.83$ inches
 $m \overline{AD} = 3.52$ inches
 $m \overline{CE} = 3.52$ inches



$m \overline{CD} = 2.86$ inches
 $m \overline{DE} = 2.02$ inches
 $m \overline{AD} = 4.16$ inches
 $m \overline{CE} = 2.69$ inches
 $m \overline{AC} = 2.02$ inches
 $m \overline{DE} = 2.02$ inches
 $m \overline{CD} = 2.86$ inches
 $m \overline{AE} = 2.86$ inches
 $m \overline{AF} = 2.08$ inches
 $m \overline{FD} = 2.08$ inches
 $m \overline{CF} = 1.35$ inches
 $m \overline{FE} = 1.35$ inches



Title: Spin the Big Wheel

Grade Level: 11 - 12

Time Required: one or two class periods

Objectives:

1. Students will investigate probability through a problem solving situation.
2. Students will simulate an event using dice rolling, spinners, and/or computer simulations.

Materials Needed:

- ___ Video clip of contestants on the game show "The Price is Right" spinning the wheel at the end of a half
- ___ copies of investigation sheet
- ___ "Big Wheel" spinners
- ___ Icosahedral Die
- ___ Computer Program

Notes to the Teacher:

The National Council of Teachers of Mathematics *Curriculum and Evaluation Standards for School Mathematics* states

"In grades 9 - 12, the mathematics curriculum should include the continued study of probability so that all students can --

- use experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty;
- use simulations to estimate probabilities;"

One natural lead in to address these topics is the probability of certain events in television game shows.

This lesson suggests several different simulations for the spin of the big wheel on "The Price is Right". As time allows you may use whichever ones for which you have time. You may wish to have students explore one or more simulation on their own.

Once students use the dice or spinner to simulate the activity they will probably appreciate a computer performing the simulation much quicker than the method they will use. The program provided in Table 1 (written with MICROSOFT BASIC) simulates the situation of player C beating player B if player B stops at 60. The program in Table 2 simulates player B spinning and losing.

Procedure:

Show video clip to students. Discuss whether they think a knowledge of probability could help you win at "The Big Wheel".

Focus class discussion by presenting the following problem:

Player A spins the wheel twice and gets a total of 45.
Player B obtains 60 on the first spin. Obviously she has beaten player A; however she has no way of knowing how well the next player (player C) will do.
Should player B spin the wheel again?

Discuss possible solutions. Have students brainstorm possible ways to answer this question. If time allows have students construct spinners and/or die to use in simulations.

Pass out investigation sheet (and dice or spinners if they were not constructed by the students). Allow students to work in small groups to complete the table in problem 1. Once all groups have completed simulations compile all class data.

Establish the probability that

- (a) player C will beat player B if player B stays at 60; call this P1
- (b) player B will go over 100 if she spins again; call this P2
- (c) player B gets a total between 65 and 95 with her second spin but is still beaten by player C; call this P3.

P1 is the probability of losing by staying at 60. P2 + P3 is the probability of losing by spinning again.

Extension:

Should only be assigned if you go through the theoretical discussion which is further discussed in the article from which this lesson was adapted.

1. For what value of the first spin does player B have an equal chance of going over if she spins again or being beaten by the next player if she doesn't?
2. For what value of the first spin does player B have a 50-50 chance of being beaten by the next player if she doesn't spin again?
3. If player A spins 70 on his first roll, should he spin again?

Adapted From:

Wood, Eric. "Probability, Problem Solving, and 'The Price is Right'."
Mathematics Teacher 85 (February 1992): 103-109.

Investigation of "The Big Wheel"

Name: _____

Group Members: _____

Use the following tables to record your spin or roll in each case for "The Big Wheel" problem.

Simulation of Player C's Spins if Player B Stands Pat

Trial Number	1st Spin	2nd Spin	Total	Beats 60?
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Simulation of Game if Player B Spins Again

Trial Number	Player B's First Spin	Player B's Second Spin	Player C's First Spin (If Needed)	Player C's Second Spin (If Needed)	Win by Player B?
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

The Big Wheel Spinner Pattern

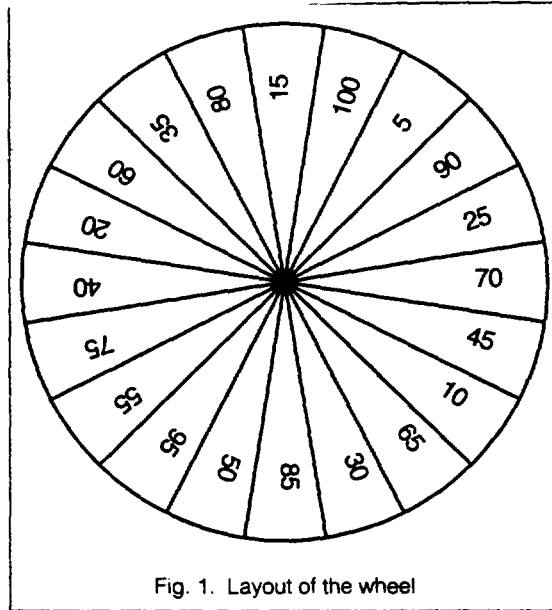
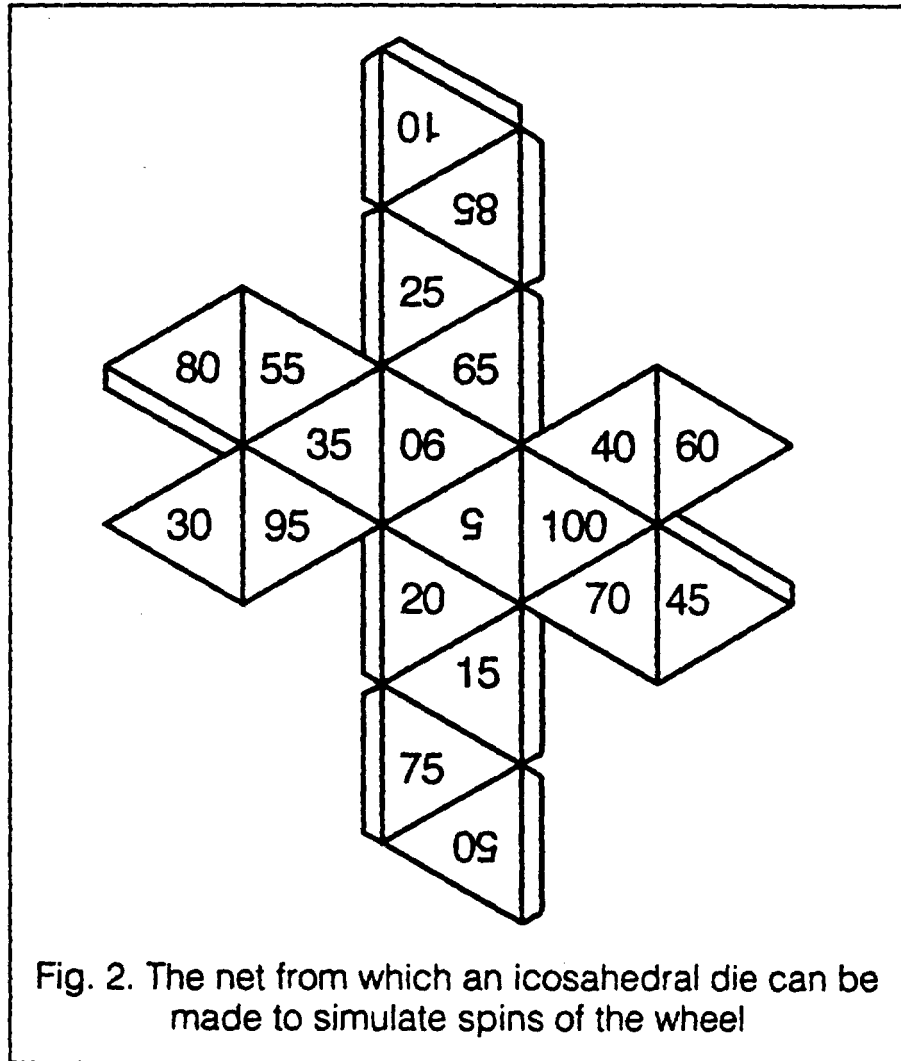


Fig. 1. Layout of the wheel

The Big Wheel
Icosahedral Die Pattern



The Big Wheel

Computer Simulations--Program 1

PROGRAM 1

Simulation of Player C's Spins If Player B Stands Pat

```
REM Set up array for numbers on wheel
CLS
DIM A(20)
REM Put numbers on wheel into array
FOR T=0 TO 19
READ A(T)
NEXT T
DATA 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55,
35, 70
DATA 75, 80, 85, 90, 95, 100
REM Get information about simulation
required
WIN=0:LOSS=0:X=0:Y=0
NPUT "What number must you beat"; B
NPUT "How many trials would you like
simulated"; TR
CLS
REM Start simulation
FOR T=1 TO TR
REM Spin the wheel
X=A(INT(RND*20))
REM If win on first spin don't spin again
IF X>B THEN WIN=WIN+1:Y=0:GOTO 290
REM Otherwise spin a second time
Y=A(INT(RND*20))
SUM=X+Y
REM Check if sum is less than your roll or
over $1
IF SUM>100 OR SUM<B THEN
LOSS=LOSS+1: GOTO 290
REM Otherwise it beats you
WIN=WIN+1
REM Print out the rolls, wins and losses
PRINT X;TAB(10);Y;TAB(20);X + Y;TAB
(30);WIN;TAB(40);LOSS
NEXT T
PRINT:PRINT
REM Print totals, probability etc
PRINT "Wins by player C ="; WIN,"Wins by
player B ="; LOSS
PRINT
PRINT "Probability of being beaten by the
next player"
PRINT "if you stop after a first roll
of";B;"is";WIN/TR
PRINT
REM Check to see if another simulation is
desired
INPUT "Do you wish to do another one or ";Y$
IF LEFT$(Y$,1) = "y" OR LEFT$(Y$,1) = "Y"
THEN GOTO 110
END
```

The Big Wheel

Computer Simulations--Program 2

PROGRAM 2

Simulation of Player B's Second Spin

```

10 REM Set up array for numbers on wheel
20 DIM A(20)
30 REM Put numbers on wheel into array
40 FOR T=0 TO 19
50 READ A(T)
60 NEXT T
70 DATA 5, 10, 15, 20, 25, 30, 35, 40, 45, 50,
55, 55, 60, 65, 70
80 DATA 75, 80, 85, 90, 95, 100
90 REM Get information about simulation
   required
100 WIN=0:Loss=0:TIE=0:BUST=0:X=0
110 CLS
120 INPUT "What was the first roll": R
130 INPUT "How many trials would you like
   simulated": TR
140 CLS
150 REM Start simulation
160 FOR T=1 TO TR
170 X=0: C1=0: C2=0
180 REM Spin the wheel a second time
190 X=A(INT(RND*20))
200 REM If total is over 100 player B loses
210 IF X+R>100 THEN BUST=BUST+1: GOTO
   360
220 REM if not over 100 see what player C would
   get on his first roll
230 C1=A(INT(RND*20))
240 REM if better than player B's total player B
   loses
250 IF C1>X+R THEN LOSS=LOSS+1: GOTO
   360
260 REM If equal to player B's total it is a tie
270 IF C1=X+R THEN TIE=TIE+1:GOTO 360
280 REM If not spin a second time
290 C2=A(INT(RND*20))
300 REM If total is over 100 then player C loses
   and player B wins
310 IF C1+C2>100 THEN WIN=WIN+1: GOTO
   360
320 REM If better than player B's total player B
   loses
330 IF C1+C2>X+R THEN LOSS=LOSS+1:
   GOTO 360
340 REM If equal to player B's total it is a tie
350 IF C1+C2=X+R THEN TIE=TIE+1
360 PRINT TAB(10) R: TAB(20) X: TAB(30) C1:
   TAB(40) C2: TAB(50) LOSS+BUST: TAB (60)
   WIN
370 NEXT T
380 PRINT
390 PRINT"The probability of going over 100 if
   you spin again is": BUST/TR
400 PRINT
410 PRINT "The probability of being beaten by
   player C if you"
420 PRINT
430 PRINT "spin again is": LOSS/TR
440 PRINT
450 PRINT "The probability of losing if you spin
   again is": (BUST+LOSS)/TR
460 REM Check to see if another simulation is
   desired
470 PRINT
480 INPUT "Do you want to do another or ": Y$
490 IF LEFT$(Y$,1)="y" OR LEFT$(Y$,1)="Y"
   THEN GOTO 100
500 END

```

Title: Career Posters

Grade Level: 5 - 12

Time Required: At least 20 minutes to present project to class. Additional class time may be provided for students to work on posters.

Objectives:

1. Students will identify and describe a career in which mathematics is used.
2. Students will create a poster illustrating this career and a typical mathematics problem from this career.

Materials Needed:

- ___ Posterboard and art supplies
- ___ Project handout

Procedure:

Discuss with students some careers in which mathematics is used. Chances are they will only list occupations such as pilots, engineers, etc. The focus of this project should be on careers located within your community.

Pass out project sheet and answer any questions.

Assessment:

Mrs. Susan Canter, mathematics instructor at Ball State University, used the following question on one of her mathematics tests. Of course the correct answer is "none".

Name a career or job which does NOT use mathematics.

Adapted From:

Tibbs, Peggy and Jordan, Jannette. *Sharing Teaching Ideas: Career Posters. Mathematics Teacher*. 87(6): 410-411.

The first two sections of the project sheet were taken directly from figure one in this article. The final section was adapted slightly.

Career Posters

Interview someone who uses mathematics in his or her job. Ask the person to give you an example of a problem used in his or her work. You do not have to understand the problem yourself.

Make a poster. The title of the poster should be the name of the career, such as "Engineer" or "Carpenter." On the poster you should include three things:

1. The mathematics problem given to you by the person you interviewed.
2. A paragraph explaining in general what the problem is about and how it is used.
3. A picture to illustrate the job. It can be a photograph of the person you interviewed, a picture cut from a magazine of a person in that occupation, or a hand-drawn illustration depicting the work done in that career.

On the back of the poster, you must put three things:

1. Your name and class.
2. The name of the person you interviewed and the name of the place she or he works.
3. The daytime telephone number of the person you interviewed. This number will enable me to verify any of the information, if necessary.

The assignment will be evaluated in the following way:

1. **Did you follow instructions?** Make sure you have included all of the required parts and that your poster has been put together according to the instructions. Your picture should be appropriate for the occupation.
2. **Is your work neat and was some thought given to the layout of the poster?** Your paragraph should be typed or written neatly in ink. The title of your poster should be easy to read. Be creative in the layout of the poster. You may add graphics or drawings you feel might help convey the occupation you chose more suitably.
3. **Were all due dates met?** A rough draft of the problem and your paragraph are due on: _____.
The poster is due at the beginning of class on: _____.

Title: Problem Solving Folders

Grade Level: 5 - 12

Objectives:

1. Students will see a need for mathematics in real life situations.
2. Students will create problems which can be answered/solved through mathematical methods.
3. Students will solve problems based on real world situations.

Materials Needed:

___ You may choose to provide file folders for your students. Other materials should be provided by the students.

___ Project sheet

Notes to the Teacher:

In order to improve mathematical communication skills students should be given an opportunity to solve problems AND create problems to be solved. In this project students are given an opportunity to do both. This project also addresses the National Council of Teachers of Mathematics goal for all students to see and appreciate the value of mathematics. While many textbooks are getting better at including realistic examples and problems; these are no substitute for the vast array of problems which are faced every day by every individual. Whether it is in deciding on which brand of cereal to buy based on the unit price or deciding whether or not a music by mail club is truly a good value, there are opportunities for mathematical exploration everywhere.

The evaluation of this project must be based on the ability level of your students.

A suggested rubric for this project follows:

Appropriateness of problems to situation presented	15 pts
Completeness and accuracy of solutions	15 pts
Folder is creatively and appropriately decorated	10 pts
Total	40 pts

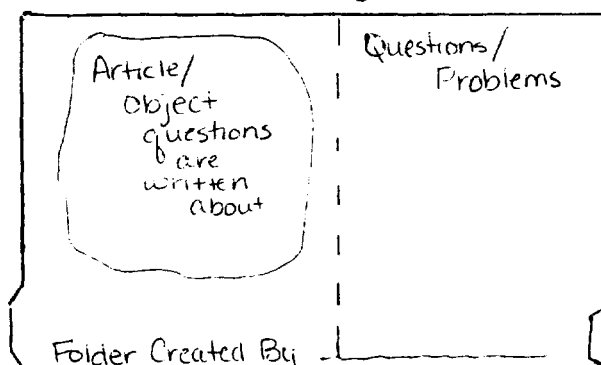
Problem Solving Folders

We have solved problems from various sources this year. It is now your turn to create some problems of your own by creating a problem-solving folder which will be used next semester in a learning center.

So...put on your "math-colored" glasses and look around for a source in the "real world" you can write a few GOOD problems about. You might consider a newspaper or magazine article, a receipt, an advertising flier, a chart, picture, etc. Use this item to create several problems and/or questions.

Once you have written several problems and questions choose three to six of the best ones. Remember best does not always mean hardest or most wordy. Best means problems or questions which require thought to be answered.

Lay out your folder in the following manner.



You should decorate your folder in a tasteful and appropriate manner. Remember your classmates will be using these folders next semester. I would also like to use some of the folders in class next year. The folders will also be available during Parent-Teacher conferences.

Your folder is due on _____. When you turn in your folder you must also turn in a separate sheet of solutions. Your folder will be worth _____ points. You will be graded on mathematical content and accuracy, appropriateness of problems, creativity in problems and design, and neatness.

Adapted From:

Creech, Tricia. *Readers Write: Problem-Solving Folders*. *Mathematics Teaching in the Middle School*. 1(6): 434-435.

Title: Puzzling Project

Grade Level: 5 - 12

Objectives:

1. Students will use problem solving skills to plan and develop a non pencil-and-paper game.
2. Students will develop a set of rules and playing procedures for their game.

Materials Needed:

___ project sheet

Teacher Notes:

There are very few students and teachers who will not be drawn to this project. An activity many students enjoy in class is playing games and so they should also get a hand in creating them.

The requirements made on the documentation which must accompany the finished project will vary greatly depending on the grade level you teach. In some cases you may also want to specify the topic which the game should address (for example in a chapter on radicals, the game could have the requirement that at least half of the questions involve working with radicals). Middle schoolers may only be required to describe the game and how it will be constructed. Older students might be required to submit a construction plan complete with scale drawings. These requirements are left to the discretion of the classroom teacher. The requirement of including complete instructions for play and rules, though, should be made of all students.

The authors of the article which served as inspiration for this lesson (Isaacs et al., 1992) suggest having students present their games to the class with some sort of accompanying advertisements. They also discuss having a game party in which students play each others games and vote on a favorite game.

The following is a suggested rubric for the assessment of the puzzles:

Mathematical accuracy	25 pts
Creativity	15 pts
Rules and playing procedures are complete	10 pts

Procedure:

Pass out project sheet and explain requirements of project. At least twice during time of assignment (two to three weeks is appropriate) do a quick check of progress by having students write briefly about their project ideas and what kind of headway they are making on the project. You may want to give students specific questions to answer or just have them describe their game and where they are in the development process.

Once students have created their games they should be given the choice as to whether they would like to leave their game in the classroom to be enjoyed for the rest of the year or even by future classes.

Just Playing Around

You are to create a non-pencil-and-paper which uses one or more of the following skills:

1. Mathematical computations
2. Mathematical/Technical Problem solving
3. Mathematical Communication

Your game may take any form you wish as long as it is not pencil-and-paper and the theme of the game is appropriate for a mathematics classroom. You must provide complete rules and playing procedures, along with all equipment necessary to playing the game. Rules and playing procedures should be neatly handwritten in blue or black ink or type written.

Your game will be evaluated using the following rubric:

Mathematical accuracy	35 pts
Creativity	25 pts
Rules and playing procedures are complete	20 pts

The game is due at the beginning of class on _____ . On _____ and _____ you will be asked to write a short journal entry describing your game and where you are in the creation process. These will be collected and will count as an additional 10 points each toward the grade for this project.

Title: Fun Reflections on Learning

Grade Level: 5 - 12

Time Required: Time to introduce project assignment. Students should complete the project outside of class. A suggested time limit is two to three weeks for completion of one project.

Objectives:

1. Students will engage in a writing or drawing activity which is based on mathematics.
2. Students will reflect on their mathematics learning while creating an original work.

Materials Needed:

- ___ Project sheet and examples for project you will assign
- ___ Art or writing supplies may need to be supplied for students

Notes to the Teacher:

The idea of connecting mathematics to subjects outside of the mathematics classroom is one of the four key curriculum standards from the National Council of Teachers of Mathematics.

In the project described in this lesson, students or teacher choose a literary or artistic form of expression which allows students to show their more creative side. Rubrics for assessment of each project are included on the individual project sheets along with examples of each type of project.

Procedure:

Choose one of the projects you would like your students to complete. Pass out project sheet to students.

Show students examples of satisfactory examples of the project you have assigned. Once projects have been completed they should be displayed in the classroom or hallway.

Adapted From:

Coffield, Pamela W. "Taking Fun in Earnest." *Mathematics Teacher* 85
(February 1992): 100 - 101.

MATH ACROSTIC

Look through the sections of your book and through the glossary. Choose a word or short phrase from which to make an acrostic poem. Write this word as your title and then write the word vertically down the side of the page. For example, if you chose the word "MATH" you would have:

M A T H
M
A
T
H

Now write your poem. The goal is for each letter in the title to serve as the first letter of one of the words of the poem.

M A T H
Mathematics is
A skill
That requires trying
Hard.

Display your poem on a piece of 8 1/2"x11" paper. The poem will be graded in the following manner:

Proper format	5 pts
Mathematical accuracy	5 pts
Correct grammar	5 pts
Accurate spelling	5 pts
Neatness	5 pts

Up to 5 bonus points will be given for creativity.

Mathematical Cinquain

You are to write a mathematical cinquain. A cinquain is a poem that consists of five lines. The first line is a single mathematical word naming the concept that is the subject of the poem. The second line consists of two words that describe the first line. The third line has three words and details the action of the first line. The fourth line is personal and contains four words telling how the author feels about the first line. The fifth line is a single-word synonym for the first line. An example of a cinquain is

Lines

Never ending
Expressing one's age
Hate waiting in them
Straight

Once you have written and revised your cinquain display it on a piece of 8-1/2"-by-11" paper.

Your cinquain will be graded in the following manner

Mathematical accuracy	10 pts
Proper format	5 pts
Accurate grammar/spelling	5 pts
Neatness/Presentation	5 pts

An additional 5 bonus points can be earned for creativity.

Mathematical Clerihew

We have studied the work of many famous mathematicians this grading period. You should choose one and write a clerihew about him or her. A clerihew is a rhyming verse of four lines with the name of a famous mathematician included in the first line.

For example, a clerihew about Euclid would be:

Euclid was a brain you see,
Being the Father of Geometry.
He wrote *The Elements* in thirteen books,
For which students still give him dirty looks.

Once you have written and revised your poem, display it on an 8-1/2"-by-11" piece of paper. Your poem will be evaluated in the following manner:

Mathematical Accuracy	10 pts
Proper Format	5 pts
Accurate grammar/spelling	5 pts
Neatness/Presentation	5 pts

An additional 5 bonus points can be earned for creativity

Daffynitions

Spend some time looking through your textbook. Choose five mathematical words or phrases about which you would like to write daffynitions.

Some examples of daffynitions are:

Centimeter: price of cloth at a discount store

Minimum: the name of a small chrysanthemum

Percent: A feline one-cent piece

Proof-proof: How a geometry student's dog barks.

Quadrant: The smallest puppy in a litter of four.

Zero: Where the Frenchman told the boy to plant the seeds for his garden

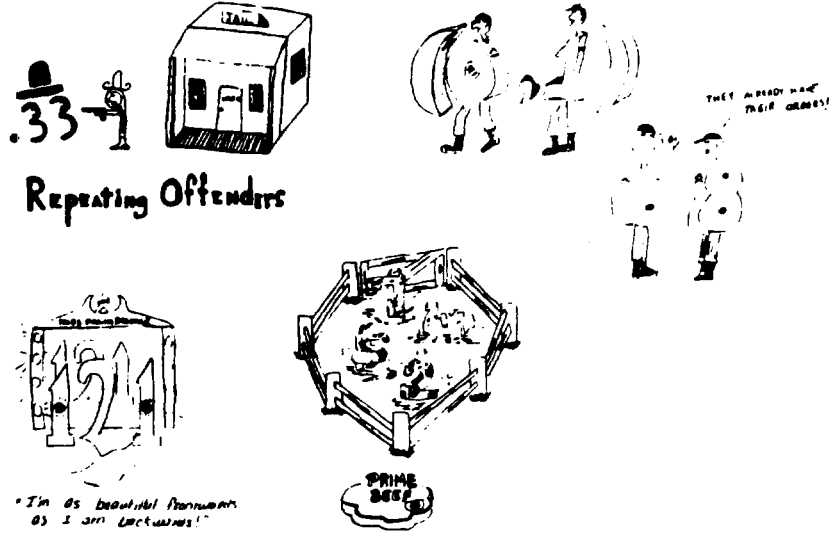
Once you have written and revised your daffynitions display them neatly on a piece of 8-1/2"-by-11" paper.

Your daffynitions will be graded in the following manner:

Creativity	10 pts
Grammar	5 pts
Spelling	5 pts
Neatness/Presentation	5 pts

Quipping Numbers

You are to draw a cartoon depicting another "meaning" for a set of numbers. Some examples of quipping numbers are shown here:



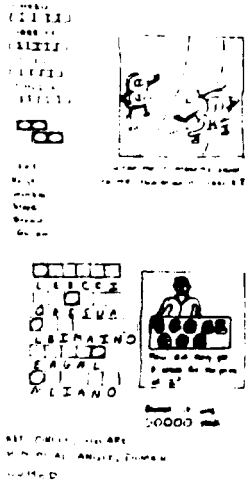
Draw your quip on an 8-1/2"-by-11" piece of paper. Add color to the decoration if you would like.

Your cartoon will be evaluated on creativity, neatness, originality, and evidence of effort.

Jumbles

In a jumble, the letters of four or five mathematical terms are scrambled. A question and a related cartoon also are shown. To solve the puzzle, the letters of the words must be unscrambled to form the answer to the riddle. The jumble also includes a key where all five words have been unscrambled and the answer to the riddle is given.

Make up a jumble of your own which contains these elements.
Some examples of jumbles are shown here:



Draw your jumble on an 8-1/2"-by-11" piece of paper. Add color if you would like.

Your cartoon will be evaluated on creativity, neatness, originality, and evidence of effort.

Rebus Puzzle

The rebus puzzle is a descendant of ancient Egyptian hieroglyphics. In a rebus puzzle, a collection of pictures, letters, and symbols are combined so that, when pronounced in combination, they have the same sound as a mathematical term or statement.

A few rebus puzzles are shown here:



Create a rebus puzzle of your own using a mathematical term, theorem, or statement of your choice. Draw your rebus on an 8-1/2"-by-11" piece of paper.

Your rebus will be evaluated on creativity, neatness, originality, and evidence of effort.

Title: Investigating Numbers and Number Patterns

Grade Level: 8-12

Time Required: Time to introduce project sheet

Objectives:

1. Students will research a number pattern they find interesting and prepare a report about this pattern.
2. Students will investigate and report on real world applications of certain groups of numbers.

Materials Needed:

- ___ Reference materials on number theory, etc.
- ___ Project sheets

Notes to the Teacher:

This project provide students with an opportunity to explore some of the amazing number patterns which have been discovered (or which they might discover) throughout the years.

A rubric for assessment of this project is included to hand out to students with the project sheet. This rubric page should be stapled to the end of the students' paper and used for scoring the project.

Procedure:

Pass out project sheets and proceed through them with students. A few possible topics are listed below. It would be a good idea to have the article from which this lesson was adapted available for students to look at so they have an idea of the types of information they should look for.

Possible Topics:

Triangular Numbers
Square Numbers
Pentagonal Numbers
Hexagonal Numbers
Perfect Numbers
Prime Numbers
Pythagorean Triples
Fibonacci Numbers

Adapted From:

Mahoney, Devin. "The Thinking of Students: "Tri-Square" Numbers."
Mathematics Teaching in the Middle School. 1 (April-May 1995):
408-409.

Investigating Numbers and Number Patterns

We have just concluded a unit on number theory and interesting number patterns. As an extension of this unit I would like you to choose a number pattern or set of numbers you found particularly interesting and prepare a paper on the topic.

While studying your set of numbers you should consider each of the following:

- patterns in the numbers and/or their digits
- geometric representations and their relationships
- related formulas
- highest and/or lowest numbers
- correlations between the set you have chosen and other sets
- real-world applications

Your report should include the following:

- A title page with your name on it.
- A description of patterns and relationships you have considered.
- Any graphic representations which will aid in communicating your ideas.
- A bibliography of sources you have used.

Your paper should be 4 to 6 hand written double spaced pages (excluding illustrations) or 3-1/2 to 5 typed double-spaced pages. In order to help you complete your paper and get the most from this experience we will follow the following timetable for completion:

_____ Research day--look for topics and availability of materials. You must have your topic approved by the end of class.

_____ An outline of your ideas is due at the beginning of class.

_____ A rough draft-including bibliography is due at the beginning of class. These will be read and suggestions made. The papers will be returned on _____.

_____ Final Draft Due

The paper is worth 50 points. It will be scored using the following rubric. This scoring system should be stapled between your title page and the first page of your paper.

Investigating Numbers and Number Patterns

Name: _____ Date: _____ Class: _____

Mathematical Accuracy 20 pts _____

- Patterns are substantiated by proper explorations and experiments.
- Conjectures are supported by references and investigations.
- Diagrams and illustrations support the conjectures you are making or investigations.

Readability 15 pts _____

- Paper flows well through various topics.
- Paper could be understood by someone outside of mathematics.

Bibliography and Use of Sources 7 pts _____

- You must cite at least three sources within the paper and listed on a separate bibliography page.
- Your textbook may not be used as one of the three required sources.

Grammar and Spelling 5 pts _____

- Subject and verb tense agree throughout paper.
- No contractions are used in paper.
- Paper has been proofread so that there are a minimum of misspelled words and grammatical errors.

Neatness 3 pts _____

- This sheet is included between title page and report.
- Paper does not look like it has been run through a grinder.

Title: Express Yourself

Grade Level: 9 - 12

Objectives:

1. Students will reflect on their feelings towards mathematics and/or a particular subject area in mathematics.
2. Students will develop a creative representation of their feelings toward mathematics.

Notes to the Teacher:

In the *Curriculum and Evaluation Standards for School Mathematics* the National Council states "mathematical power involves the development of personal self-confidence." A natural part of developing personal self-confidence towards mathematics is taking time to reflect on what you have learned and where you would like to go with mathematics study.

In this project it is important that students realize that no matter what their feelings towards mathematics, whether negative or positive, they should express themselves honestly without fear of being punished or rewarded for their feelings. This takes a great deal of responsibility and open-mindedness on the part of the teacher to make sure this project is a success.

Express Yourself

Often your feelings toward a topic can seriously affect the amount of success you have with that topic. Whether these feelings are negative or positive, expressing them can provide insight into your amount of success or failure in a subject. I would like you to have a chance to express your feelings about mathematics in a "nontraditional" way.

You are to *construct* an artistic expression of your feelings toward mathematics. This project may take many forms. The most important thing is that you draw on your strengths outside of mathematics in order to complete this project. Some examples of an artistic expression are a sculpture, model, picture/poster, story, poem or poems, etc. Be as creative as possible when planning this project.

In addition to the project you should write a short (3/4 to 1 page, double-spaced) artist's statement. This statement should explain why you chose this form of expression. In addition, it should summarize how your feelings are characterized in your project. Do not try to explain every feeling or emotion expressed in the project, just give a brief overview of the types of feelings you have tried to show.

Projects will be evaluated using the following rubric :

creativity	15 pts
<u>evidence of effort</u>	25 pts
content of the artist's statement	10 pts

Projects and artist statements will be due at the beginning of class on _____.

Title: March Winds are Blowing

Grade Level: 7 - 12 Geometry

Time Required: Several Class Periods

Objectives:

1. Students will research kite flying and kite construction using various reference materials, including the Internet if available.
2. Students will make a scale drawing of their own kite design.
3. Students will build their kite and test to see if it flies.

Materials Needed:

- | | |
|--|---|
| <input type="checkbox"/> Reference tools for research | <input type="checkbox"/> Kite building supplies such as: trash bags, pieces of wood and sticks, glue guns, shoe boxes, construction paper, empty plastic jugs, etc. |
| <input type="checkbox"/> Kite Scavenger Hunt | |
| <input type="checkbox"/> Rulers | |
| <input type="checkbox"/> Blank paper and drawing supplies | |
| <input type="checkbox"/> Calculators | |
| <input type="checkbox"/> Rubric for project completion. | |
| <input type="checkbox"/> This should serve as the assignment sheet for students. | |

Procedure:

Part One

Students should work in pairs to research kite flying and kite making. The scavenger hunt provided with this lesson is designed to be completed using both the Internet and print reference resources available in most school libraries. If you do not have access to the Internet you will need to adapt the scavenger hunt. It is also a good idea to go through the questions and the answer key prior to the activity since resources change on the Internet so often. Using your search engine with the word "kite" should produce a sizable list of resources from which you can adapt the questionnaire to suit your needs.

Part Two

After students have researched the history of kite making and kite flying they are to design a "construction plan" for the kite they will be building. It will be necessary to set some time limits for building prior to making this assignment so that students' designs are not too elaborate or too simple to be completed in the time allotted. The grading scheme used should encourage creativity and originality of design as well as soundness of aerodynamics (see attached rubric). The "construction plan" should include all of the following:

- student's name
- a list of materials needed to construct kite

- ___ a scale drawing or drawings of the kite including a key. It might be necessary to draw a couple of different views of the kite to ensure proper construction.
- ___ a list of special instructions necessary to construct the kite.

As the rubric suggests, completeness of the construction plan is very important to success in this project. As in many jobs, students need to communicate ideas effectively using a blend of text and figures. This project answers that need very well.

Students who choose to work on the extra credit portion of the project will also find that the more detailed their construction plan is the easier it will be to make modifications.

Part Three

Designate a day or two in class for kite construction. You may want to set up stations such as hot gluing or cutting or painting, etc. or you may want to let students work in their own areas. All of this will depend on the design of your individual classroom. An area should be provided for kites to be stored while drying and until a good flying day occurs.

After all kites have been constructed you may wish to have students, other teachers, or visiting parents judge kites in several categories and award prizes to the winners.

Part Four

Pick a good windy day and try out your creations. Some will fly. Some will not. It is important to good participation in this project that only a small portion of the final grade be based on whether or not the kite actual flies. You may also want to have a "professional" kite flyer come into class and demonstrate some tricks to your students.

Part Five

For extra credit allow students to make modifications to their kites to improve their results in part four. You will have to arrange a time, either in class or at some other time, to test out any improvements.

Note: This project is a good "teacher participation" project. You should take the time to make a kite of your own and try it out along with the students. If it flies--great!! If it does not--great!!

Adapted From:

Cole, Renee and Jones, Linda. "Reader Reflections: March winds."
Mathematics Teacher. 87(April 1994): 220.

Flying High--A Kite Scavenger Hunt

Name: _____

Date: _____

Class: _____

Using the printed reference materials in the classroom, in the library, and the Internet answer the following questions about kites and kite flying. While you are researching keep in mind that you will be building a kite of your own.

1. Draw a diagram of a basic kite. Label all important parts.

2. When did kite building and flying first originate?

3. Name some tricks that can be done with stunt kites. Explain how to perform at least one of these tricks and what the kite does as the stunt is performed.

4. Write at least two questions below along with answers to them that you think should be added to this scavenger hunt if this project is done by another class. Please list where you found the answers to your questions.

The following questions are most readily answered using the Internet.

1. Find out about "The Psycho" designed by Andy Preston. From where can you order a mock up of this kite?

2. Find a kite made by Kai Griebenow.
When did Kai start kiting?

Attach a picture of one of Kai's kites that you like.

3. Find Steve's philosophy of kiting. Above all, what does he say kiting should be?

4. What are the designs in the Danger of the Sun Project based on?

5. While visiting kite paradise, write down the process necessary to "tune" your kite.

6. Find at least two other "kite sites" on the web that you visited and thought were interesting. Write down their URL and a short description of the site.

The following questions are most readily answered using the Internet.

1. Find out about "The Psycho" designed by Andy Preston. From where can you order a mock up of this kite?

URL - <http://www.kiteshop.co.uk/>

The Kite Shop

A mock up of The Psycho can be ordered from the European on-line kite shop.

2. Find a kite made by Kai Griebenow.

When did Kai start kiting?

URL--<http://web.mit.edu/griebeno/www/gallery.html>

1991

Attach a picture of one of Kai's kites that you like.

3. Find Steve's philosophy of kiting. Above all, what does he say kiting should be?

URL--<http://server1.admin.gatech.edu/fac/steve/kiting/kiting.html>

FUN

4. What are the designs in the Danger of the Sun Project based on?

URL--<http://web.mit.edu/griebeno/www/danger.html>

Skulls in Native American Indian designs

5. While visiting kite paradise, write down the process necessary to "tune" your kite.

URL--<http://www.herme.de/KITE/KiteHome.html>

Tuning is making small changes in the design of the kite until it flies exactly as you want it to. You should fly the kite after every little change.

Flying High--Kite Construction Project

Over the course of the next few weeks you will be designing and building a kite which we will take outside on a windy day and try to fly. There are several parts to this project. The following description and rubric should serve as your guide to completing your project.

Part One--Research

You and a partner of your choosing will be working on a research scavenger hunt which is located at the end of this packet. The questions should be answered using reference materials available in the classroom, media center, or computer lab.

After completing the scavenger hunt together (one copy of the scavenger hunt should be turned in with both names on it) you should each write up a short report (2-3 paragraphs) of what you found interesting about kites and kite flying. You might include designs you found interesting or some facts about kites you did not know or maybe did not think were possible.

Scoring

The most important part of this component of the project is that you use some research skills to find out about a topic. You will be scored in the following manner:

Scavenger Hunt			
Completion by due date	5 pts		_____
All answers included	5 pts		_____
Short Report			
Report contains more than just basic information	5 pts		_____
Grammar, spelling, punctuation are all accurate	5 pts		_____
Neatness	5 pts		_____
<hr/>			
Total Possible	25 pts	Your Points	_____

Part Two--Construction Plan

Each student is to create a construction plan for the kite they will build.

The construction plan should include all of the following:

- ___ student's name
- ___ a list of materials needed to construct kite
- ___ a scale drawing or drawings of the kite including a key. It might be necessary to draw a couple of different views of the kite to ensure proper construction.
- ___ a list of special instructions necessary to construct the kite.

It is not necessary for the construction plan to be typed, although neatness and accuracy are very important. You should design and assemble your construction plan so that anyone who picked up the construction plan could assemble the kite. This includes details and sketches of any designs you wish to include on the kite and all important construction details.

The construction plan will be scored as follows:

All components included	5 pts	_____
Scale drawing		
Accuracy	10 pts	_____
Key included	5 pts	_____
Neatness	5 pts	_____
All necessary information included for construction of the actual kite.	15 pts	_____
Materials list is complete	5 pts	_____
Special instructions are understandable	10 pts	_____
<hr/>		
Total Points Possible	55 pts	Your Points _____

Part Three--Kite Construction and Flying

Although most of the work for this project will be completed outside of class you will have class time available to construct your kite. You should bring all the materials necessary to construct your kite on _____. Your kite must be ready to fly by _____.

Construction and Flying of your kite will be scored as follows:

Completed kite was constructed according to construction plan.	15 pts	_____
Construction of kite completed by due date	5 pts	_____
Kite Flies!!	10 pts	_____
<hr/>		
Total Points Possible	30 pts	Your Points _____

Important Information: The following are due dates for the various components of this project:

- Scavenger Hunt _____
- Short Report on Research _____
- Construction Plan _____
- Kite Construction Day!! _____
- Kites must be completed by _____

We will take the kites outside to test them on a good windy day. You should keep all of these materials together in your portfolio in the project section. When we fly the kites I would also like to take a picture of you with your kite. I will give you a copy of this picture to keep in your portfolio.

Once we have flown the kites you may earn extra credit by "tuning" your kite and your construction plan. Once you have made all necessary changes to your kite and your construction plan you will need to set up a time with me when I can watch you fly your kite or give me a video tape of you flying your kite so that I may award the extra credit.

Happy Flying!!

Flying High--Kite Construction Project

Scavenger Hunt

Completion by due date	5 pts	_____
All answers included	5 pts	_____

Short Report

Report contains more than just basic information	5 pts	_____
Grammar, spelling, punctuation are all accurate	5 pts	_____
Neatness	5 pts	_____

Total Possible	25 pts	Your Points	_____
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Construction Plan

All components included	5 pts	_____
Scale drawing		
Accuracy	10 pts	_____
Key included	5 pts	_____
Neatness	5 pts	_____
All necessary information included for construction of the actual kite.	15 pts	_____
Materials list is complete	5 pts	_____
Special instructions are understandable	10 pts	_____

Total Points Possible	55 pts	Your Points	_____
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Kite Construction and Flying

Completed kite was constructed according to construction plan.	15 pts	_____
Construction of kite completed by due date	5 pts	_____
Kite Flies!!	10 pts	_____

Total Points Possible	30 pts	Your Points	_____
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Total Points Possible 110 pts	Your Points _____
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Students Name: _____

Teacher Comments:

Title: Getting to Know You

Grade Level: 10 - 12 (see Notes to the Teacher for adaptations for younger students.)

Objectives:

1. Students will become familiar with their calculator.

Notes to the Teacher:

We live in a highly technological society. The computers, calculators, and other highly technical equipment we buy new today are often out of date within one year after that purchase. Keeping up with changes such as these can seem overwhelming for students as well as teachers. However, the more a person is exposed to technology of any sort the more likely they will be to be able to adapt to a new form of technology without difficulty.

It is the position of the National Council of Teachers of Mathematics that all students should have appropriate calculators available to them at all times. However, just making these calculators available does not guarantee that students will learn how to use them efficiently.

In this project students are to spend some time "playing" with their calculator to find out what it can do. The requirements are left quite vague for a reason--so students will not feel limited in their presentations. However, if a teacher wanted to adapt this project to a more specific purpose they might assign each student a particular key on the calculator and have them prepare a short presentation on the power of this key and how it is used in conjunction with other keys.

A rubric for assessment of this project is included on the project sheet. Having students submit their written report with the project sheet as a final page (so grades can be kept more confidential) will provide the teacher with an area to make comments and notes to the student without marking on the written report. If you use portfolio assessment you may also wish to take photographs or videotapes during the students' presentations.

Getting to Know You

As the new year gets under way and we get to know each other, there is someone - or rather something - else I would like you to become better acquainted with - YOUR CALCULATOR.

I have found that many students know how to use calculators but have never really taken the time to learn anything new about their calculators and how they work. Since we will be utilizing calculators and other forms of technology, I would like you to become comfortable with your calculator. Take some time and "play" with your calculator. If you have a manual for your calculator you might want to glance through it to become acquainted with keys with which you are not familiar. Keep playing until something interesting occurs.

Prepare a short report (about 1 page) on what you find. Your report should include a description of the patterns/relationships you found including appropriate examples.

Your report is due on _____. On this day (and if necessary the next day) you will present your findings to the class.

The project is worth 30 points and will be scored according to the following scoring plan:

Written Report

15 pts

Topic presented is not based on a basic function of the calculator.

For example: "Discovering" that entering a fraction by pressing the [a b/c] key and then pressing this key again gives the fraction's decimal equivalent is a basic function of the calculator. Specifically, if you can find out how to do it by simply looking in the user's manual for the calculator, it should be considered a basic function of the calculator.

7 pts _____

Mathematical Accuracy

Topic presented is not based on only one or two examples; sufficient examples have been examined to substantiate claim(s).

5 pts _____

Grammar and Spelling

3 pts _____

Presentation

15 pts

A presentation is not just reading your paper. You will be allowed to use one 4"x6" note card along with the overhead calculator. You may use posters, transparencies, handouts, etc. to aid your presentation. Your presentation will be scored as follows:

Presentation skills

Posture, enunciation, eye contact, use of visuals, etc.

5 pts _____

Presentation involves entire class

You should design your presentation so that your classmates are active participants.

5 pts _____

Average of Peer Evaluations

5 pts _____

Adapted From:

Dirkse, Ron. "Reader Reflections: Calculator Play." *Mathematics Teacher*. 88(December 1995): 728.

Getting to Know You--Peer Evaluation Form

Evaluate your classmates' presentations based on understandability and quality of presentation. A rating of 5 implies the presentation was interesting, involving, and easy to understand. A rating of 1 implies that none of these criteria were met. Make written comments to support your rating in the space provided.

Presenter: _____ Rating: 5 4 3 2 1
Comments:

Presenter: _____ Rating: 5 4 3 2 1
Comments:

Presenter: _____ Rating: 5 4 3 2 1
Comments:

Presenter: _____ Rating: 5 4 3 2 1
Comments:

Presenter: _____ Rating: 5 4 3 2 1
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Presenter: _____ Rating: 5 4 3 2 1
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Presenter: _____ Rating: 5 4 3 2 1
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Presenter: _____ Rating: 5 4 3 2 1
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Presenter: _____ Rating: 5 4 3 2 1
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Presenter: _____ Rating: 5 4 3 2 1
Comments:

Presenter: _____ Rating: 5 4 3 2 1
Comments:

Presenter: _____ Rating: 5 4 3 2 1
Comments:

Presenter: _____ Rating: 5 4 3 2 1
Comments:

Title: Cardioid-Curve Stitching

Grade Level: 11 - 12

Time Required: 75 - 100 minutes (also an excellent project which requires only class time for introduction and explanation)

Objectives:

1. Students will analyze and plan a mathematical pattern which will produce a cardioid when formed with string.
2. Students will measure distances and angles.

Materials Needed:

- ___ Cardboard or Posterboard (white or colored)
- ___ Yarn darning needle
- ___ transparent tape
- ___ crochet yarn in various colors (or embroidery floss)

Notes to the Teacher:

This project allows students to see the connection between the patterns and figures in mathematics and the beauty of art. This project is also good to use at Valentine's Day. If this approach is taken students can write a message on the cardboard before making the cardioid.

The pattern for the cardioid at the end of the procedure section is from *The School Mathematics Project Book D* reproduced in Davenport, Benita. "Reader Reflections: Cardioid Curve Stitching." *Mathematics Teacher* 85 (January 1992): 26.

Procedure:

Students should begin by planning their cardioid on plain paper. The instructions given below will form a cardioid. However, these are provided only for the teacher's convenience. Students should be challenged to design their cardioid on their own. Students can also design lemniscates, limacons, and roses using the same types of materials.

Prior to stitching the cardioid, students should draw the pattern onto the cardboard lightly. All holes should be punched prior to stitching. Tape the end of the string on the back of the posterboard prior to stitching.

Pattern for Cardioid:

On thin cardboard draw a circle of radius 6 centimeters, prick thirty-six holes at equal distance around it at least on fourth to one half inch from the edge of the cardboard. Number the holes from 0 to 35 on the back of the cardboard. Thread

a needle with a long piece of thread and tie a knot in one end (or tape to back of card). Join 1 to 2, 2 to 4, 3 to 6, 4 to 8, 5 to 10, ... 17 to 24, 18 to 0, 19 to 2, 20 to 4, ..., 33 to 30, 34 to 32, 35 to 34, 0 to 35, 1 to 3, 3 to 2.

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