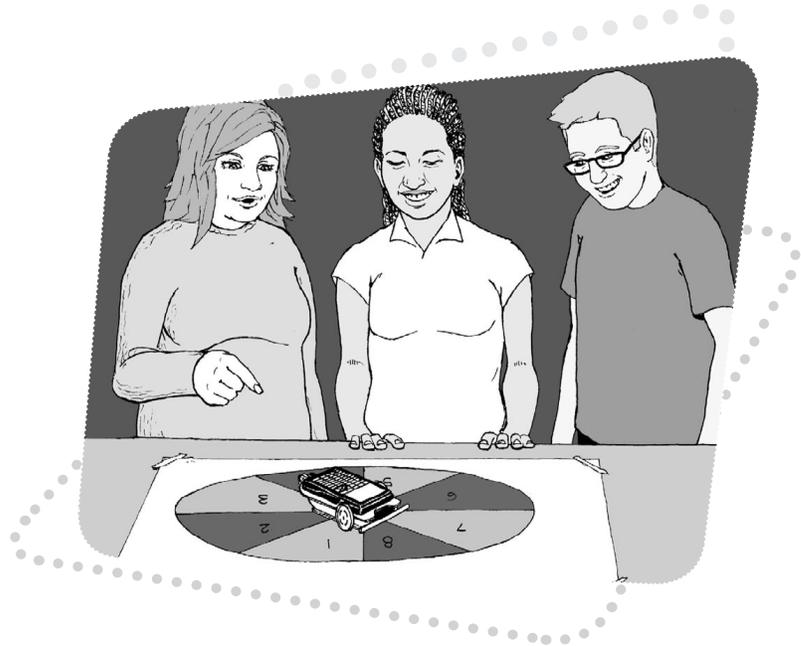


Name:		Date:
MISSION	5	Game Spinner
		Materials
What are the chances that you can write your own program on a graphing calculator that instructs your robot to spin and randomly land on numbers 1 to 8? If the probability of that is low, can you write the program on the next page without looking at the detailed programming instructions? Try.		

You need:

- 1 Norland Calculator Robot
- 1 Graphing Calculator
- 1 Robot Circle from Mission 4
- Markers and Colored Pencils



Name:		Date:
MISSION	5	Game Spinner
		<i>Instructions</i>

Instructions:

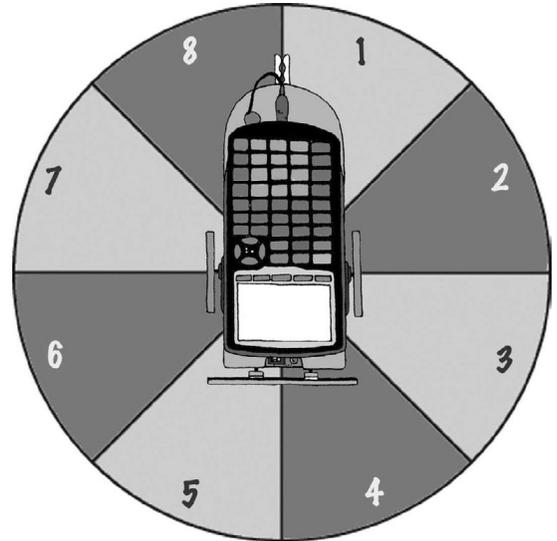
Use a robot drawn 32 to 40 cm circle from mission 4. With a marker, divide the circle into eight equal pieces and number 1 to 8 clockwise. Color odd numbered spaces red and the even numbered spaces black. Use your graphing calculator to write the program **SPINNER** (see PROGRAMMING INSTRUCTIONS if needed):

PROGRAM:SPINNER

```

:randInt(1,8)->X
:Disp X
:If X=1
:Then
:X+209->T
:Disp T
:Send({120,T})
:Get(R)
:Else
:210+(X-1)25->T
:Disp T
:Send({120,T})
:Get(R)

```



This program will randomly pick a number from 1 to 8, display that number, and instruct the robot to spin in one full circle, then stop at that number. The clothes peg attached at the back of the robot from the previous exercise makes a good pointer or you can make a cardboard pointer.

The program is designed for the robot to be placed at the center of the spinner with its pivot point (located half way between the two large wheels) directly over the intersection of the four lines used to divide the spinner. The robot's pointer should be set on the line between the 1 and the 8. You may need to adjust the duration of spin times in the program depending on your robot's turn speed or the size of your spinner board.

Name:			Date:
MISSION	5	Game Spinner	Challenge

The Largest Sum Wins!

Odd or red numbers are negative. Even or black numbers are positive. What are your chances of spinning a negative number? Test it out.

Use your “robot spinner” to randomly select four numbers. Remember red numbers are negative. Record your numbers and find their sum. You have three trials. Circle your largest sum and write it on the board with your initials. If it’s over 10 you get 1 point, if it’s over 20 you get 2, over 30 is 3. What are your chances of getting a sum over 30?

Table 1

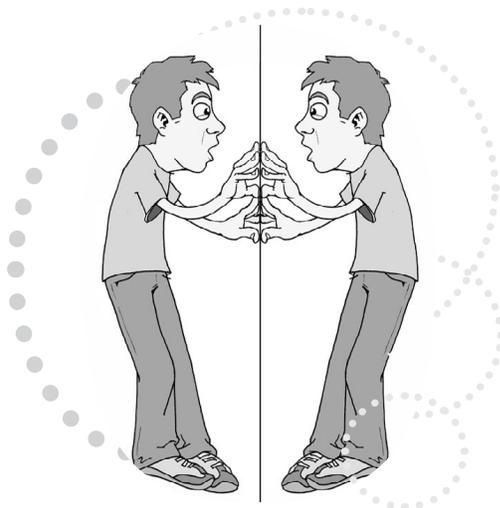
Spins	Number Value	Spins	Number Value	Spins	Number Value
1		1		1	
2		2		2	
3		3		3	
4		4		4	
Total					

What’s Missing?

For Table 2, use your “robot spinner” to randomly select three numbers. Record the numbers, (red, negative and black, positive) and then determine what the fourth number would have to be to arrive at the total given. Again, there are three trials. Have your teacher check your answers. If they are all correct, put +1 by your initials on the board.

Table 2

Spins	Number Value	Spins	Number Value	Spins	Number Value
1		1		1	
2		2		2	
3		3		3	
X=		X=		X=	
Total					



Chance and the Parallel Universe

Scientists theorize that there are only so many ways matter can be arranged in our observable universe (between 2 to 10^{118} arrangements) before things must repeat. They view space as infinite and that probability dictates that you have an exact twin somewhere 10 meters to 10^{28} meters away from where you are standing right now and that between 10 meters to 10^{118} meters away is a totally identical parallel universe.

Name:			Date:
MISSION	5	Game Spinner	Challenge & Results

Challenge:

Spin a random number and record it across from Spin 1 in Table 3 below. How many more spins would you predict will be required before the number is repeated? Given enough spins, will the number always repeat itself? Test it out and record the randomly selected numbers until your initial number is repeated. Show your teacher your results and the answers to the adjacent questions and he/she will award points accordingly.

Table 3

Spins	Number	Spins	Number	Spins	Number
1		6		11	
2		7		12	
3		8		13	
4		9		14	
5		10		15	

Results:

1. What is the theoretical probability of the robot pointing to an even number and then an odd number?

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.....

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2. What are the chances of the robot pointer landing on a prime number?

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.....

.....

.....

3. In space if you exhaust all possible arrangements of matter, what would happen after that? (Your opinion)

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.....

.....

.....

.....

4. Do you have an identical twin in another universe? Why or why not?

.....

.....

.....

.....

Name:		Date:
MISSION	5	Game Spinner
		<i>Extension</i>

Somebody Give Me a Number

Randomly pick five numbers with the robot spinner and, using the basic operations (add, subtract, multiply, or divide), make the largest number possible. You have to use all five numbers, but only once, and each operation may only be used once.

Table 4

Spins	Number	Calculations
1		
2		
3		
4		
5		
Largest Number:		

Spins	Number	Calculations
1		
2		
3		
4		
5		
Largest Number:		

Name:		Date:	
MISSION	5	Game Spinner	Programming Instructions

Turn on your graphing calculator. Press the **PRGM** and arrow to highlight **NEW**. Press **ENTER**, then spell out [SPINNER] by pressing the appropriate keys. Press **ENTER** and you're ready to enter the first command for the program.

Line 1: Press **MATH**, then use arrow to highlight **PRB**. Use the arrow to scroll down to **5: randInt (**. Press **ENTER**. Type in **1**, **8** and close the parentheses by pressing **)**. Press **STO►**. Press **X,T,θ,n** and **ENTER**. The first line should appear as:
:randInt(1,8)->X

Line 2: Press **PRGM**, then use the arrow key to highlight **I/O**. Arrow down to **3: Disp**, and press **ENTER**. Press **X,T,θ,n** and **ENTER**. The second line should appear as:
:Disp X

Line 3: Press **PRGM** and **CTL** will be highlighted as well as **1: If**. Press **ENTER**. Press **X,T,θ,n**. Press **2nd** and **MATH** and **TEST** will be highlighted as well as **1: =**. Press **ENTER** and then type the number **1** followed by **ENTER** again. The third line should appear as:
:If X=1

Line 4: Press **PRGM** and **CTL** will be highlighted. Arrow down to **2: Then**. Press **ENTER** twice. The fourth line should appear as:
:Then

Line 5: Press **X,T,θ,n**. Press **+** and then type in **2009**. Press **STO►**. Press **ALPHA** [T]. Press **ENTER**. The fifth line should appear as:
:X+209->T

Line 6: Press **PRGM**, then use the arrow key to highlight **I/O**. Arrow down to **3: Disp**, and press **ENTER**. Press **ALPHA** T. Press **ENTER**. The sixth line should appear as:
:Disp T

Line 7: Press **PRGM**, then use the arrow key to highlight **I/O**. Arrow down to **B: Send (** and press **ENTER**. Press **2nd** and **[t]**. Type in **120,** (including the comma). Press **ALPHA** [T]. Close the braces and parentheses by

pressing **2nd** [**]**, and then **)**. Press **ENTER**. The seventh line should appear as:
:Send({120,T})

Line 8: Press **PRGM**, then arrow to highlight **I/O**. Arrow down to **A: Get (**. Press **ENTER**. Press **ALPHA** [R], press **)** then **ENTER**. The eighth line should appear as:
:Get(R)

Line 9: Press **PRGM** and **CTL** will be highlighted. Arrow down to **3: Else**. Press **ENTER** twice. The ninth line should appear as:
:Else

Line 10: Type in the number **210** then press **+**. Press **(**, then press **X,T,θ,n**. Press **-**, then type **1**. Press **)** and then type **25**. Press **STO►**. Press **ALPHA** [T]. Press **ENTER**. The tenth line should appear as:
:210+(X-1)25->T

For lines 11 through 13, repeat lines 6 to 8, that is:
:Disp T
:Send({120,T})
:Get(R)

Line 14: Press **PRGM** and **CTL** will be highlighted. Arrow down to **F: Stop**. Press **ENTER**. The fourth line should appear as:
:Stop

Press **2nd**, then **[QUIT]**.

The parallel universe information is based on the article “Parallel Universes” by Max Tegmark in the May 2003 *Scientific American* magazine, page 40.

Award points as you see fit for the Table 3 activity. At the end of the activity, one way to reward the top individuals or teams with the highest total is allow them to pick a prize box. Three mystery prize boxes can be made ahead of time, one with 2-3 pencils, one with one pencil, and a dud prize. Similar to the game show *Let's Make a Deal*, the teacher can offer to “buy” a box back after it has been chosen. Probability can be discussed as each box is chosen.

For **questions 1** and **2** treat the numbers on the spinner board as being all positives. The answer to number one is $1/4$ and the answer to number two is $1/2$. Many other types of probability questions can be asked such as, asking for the probability of landing on a multiple of 2 or 3, a perfect square, etc.