EXPLORATIONS ™

Activity 6

Off to the Races

Introduction

You are about to take a look into the world of thoroughbred racing. Three races, the Kentucky Derby, Preakness Stakes, and Belmont Stakes, make up the World Series of horseracing, referred to as the Triple Crown. Only a handful of horses (11 to be exact, from 1875 to 2003) have won all three of these races in a given year.

The Kentucky Derby, the first of the three races, takes place the first Saturday in May at Churchill Downs in Louisville, Kentucky. The course length is $1\frac{1}{4}$ miles. Two weeks later is the Preakness Stakes, a $1\frac{3}{16}$-mile race that takes place at Pimlico Race Course in Baltimore, Maryland. The third, and oldest of the races, is the Belmont Stakes, a $1\frac{1}{2}$-mile race at Belmont Park in Elmont, New York. The Belmont takes place three weeks after the Preakness Stakes.

The last time a horse won the Triple Crown was in 1978 when a three-year-old named Affirmed won all three races. In 2003, Funny Cide won both the Kentucky Derby and the Preakness Stakes, but lost to Empire Maker in the Belmont Stakes.

Many factors affect the outcome of a horse race. In this activity, you consider three: the horse's earning history, the jockey, and the post position of the horse in the race.

Working in groups of three, keep track of the following information: post position, earning history of the horse, and jockey information. (Each student in the group tracks one type of information.)

Problem

Six horses have qualified to run in the race of the best: Funny Cide, Empire Maker, Ten Most Wanted, Midway Road, Peace Rules, and Scrimshaw. Can you predict who will win the race?

Exploration

Weigh the Information

Your group's first task is to give each horse a weight setting based on its earning history for the year in the three Triple Crown races. Look at the Earning of Money Winners 2003 table on page page 103 to calculate the cumulative earnings for each horse and total cumulative earnings for the six horses that have qualified to run in the race of the best. Determine the percent that each horse's cumulative earnings represents. Use this decimal amount for the weight setting for each horse.

Respond to # 1 – 2 on the Student Worksheet.

1. Determine the weight setting for each jockey. In thoroughbred racing, a jockey usually rides the same horse in all three Triple Crown races, but for this simulation, you will randomly assign jockeys to horses. Look at the Jockey's Placing table and use your best judgment to determine weight settings for each jockey. In your group, discuss the merits of the jockeys and come to an agreement on their weighting. You may want to consider how well each jockey placed in the three races. (Of course part of the jockey's success may be due to the horse he was riding rather than his skill as a jockey.)

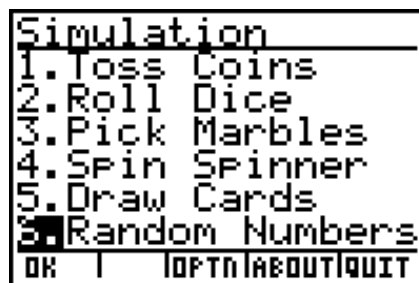Respond to # 3 on the Student Worksheet.

2. Provide weights to post positions—where on the track the horse starts. Post position one is closest to the inside of the track and post position six is farthest from it. Because only six horses are running in the Race for the Best, you will need only six post positions. The Wins by Post Position table shows the number of wins for the first six post positions at Churchill Downs over a 100-year period. (There are up to 16 post positions at Churchill Downs.) Use that information to determine the weight setting for each post position. (You can calculate post position weights by following the same procedure as in step **1** of this Exploration.)

Respond to # 4 on the Student Worksheet.

Assign the Jockeys and Post Positions

1. Open the Probability Simulation application and select **Random Numbers**.

```
Simulation
1.Toss Coins
2.Roll Dice
3.Pick Marbles
4.Spin Spinner
5.Draw Cards
6.Random Numbers
 OK    |OPTN|ABOUT|QUIT
```

2. Select **SET**, and then set the settings as shown.

3. Select **DRAW**. Six numbers are displayed in random order. Use these numbers to assign jockeys to each of the six horses.

```
Settings
Numbers:12345█
Range:    1 -6
Repeat:    Yes █

ESC                    OK
```

Complete the Jockey column in the table in # **5** on the Student Worksheet.

4. Select **DRAW** again to get another set of six random numbers. These numbers represent the post position for each horse.

Complete the Post Position column in the table in # **5** on the Student Worksheet.

Enter the Starting Gate

Label the graphing calculators in your group with one of the following categories: Horse, Jockey, or Post Position. Follow the general instructions and the instructions for your category below.

1. On each graphing calculator, open the Probability Simulation application and select **Roll Dice** from the **Simulation** menu.

2. Select **SET**, and then enter the settings as shown.

```
Settings
Trial Set:  1
Dice:   █ 2 3
Sides: █8 10 12 20
Graph: █Freq Prob
StoTbl:No All █
ClearTbl: Yes █
ESC ADV          OK ▼
```

3. For Horse, select **ADV**, and then enter the weight settings for each horse as shown on the table in # **2** on the Student Worksheet.

```
Side  Wght  Prob
1     53    .53
2     26    .26
3     7     .07
4     7     .07
5     4     .04
6     3     .03
ESC              OK
```

4. For Jockey, select **ADV**, and then enter the weight settings for each jockey as shown on the table in # 3 on the Student Worksheet.

5. For Post Position, select **ADV**, and enter the weight settings for each horse as shown on the table in # 4 on the Student Worksheet. Change Trial Set to **40** on the **Settings** screen.
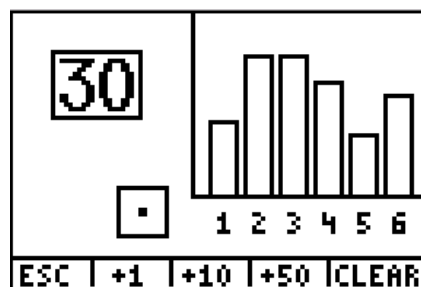
Respond to # 6 on the Student Worksheet.

And They're Off!

This race will be run one quarter at a time. For the first quarter, post position is more important than earning history or jockey. Therefore, change Trial Set to **30** for Horse and Jockey.

1. On each of the graphing calculators, select **ROLL**.

2. View the frequency for each side (horse).

Complete the Quarter 1 column of the table in # 7 on the Student Worksheet.

3. For the next quarter of the race, the ability of the horse and jockey are more important than the post position. To show this, for Horse and Jockey, change Trial Set to **40**. For Post Position, change Trial Set to **20**. Clear the table. Select **ROLL**.

Complete the Quarter 2 column of the table in # 7 on the Student Worksheet. Add the scores from the first and second quarters to see which horse is in the lead.

4. In the third quarter of the race, the ability of the horse and jockey are still more important, so leave the settings the same as they were for the second quarter. Clear the table. Select **ROLL** again.

Complete the Quarter 3 column of the table in # 7 on the Student Worksheet. Add the scores from the first, second, and third quarters to see which horse is in the lead.

5. The horses are now in the home stretch, the last quarter of the race. The jockey must now urge the horse to run even faster. For Jockey, change Trial Set to **50**; change Trial Set to **10** for Post Position. Clear the table. Select **ROLL**.

Complete the Quarter 4 column of the table in # 7 on the Student Worksheet. Add the scores from all of the quarters to see which horse won the race.

Respond to # 8 – 12 on the Student Worksheet.

Entries for 2003 Races

Placing	KENTUCKY DERBY Horse	PREAKNESS STAKES Horse	BELMONT STAKES Horse
1*	Funny Cide	Funny Cide	Empire Maker
2*	Empire Maker	Midway Road	Ten Most Wanted
3*	Peace Rules	Scrimshaw	Funny Cide
4*	Atswhatimtalknbout	Peace Rules	Dynever
5	Eye of the Tiger	Senor Swinger	Supervisor
6	Buddy Gill	New York Hero	Scrimshaw
7	Outta Here	Foufa's Warrior	
8	Ten Cents a Shine	Cherokee's Boy	
9	Ten Most Wanted	Ten Cents a Shine	
10	Domestic Dispute	Kissin Saint	
11	Scrimshaw		
12	Offlee Wild		
13	Supah Blitz		
14	Indian Express		
15	Lone Star Sky		
16	Brancusi		

*Indicates money winner

Earnings of Money Winners 2003

THE KENTUCKY DERBY		PREAKNESS STAKES		BELMONT STAKES	
Horse	Earnings	Horse	Earnings	Horse	Earnings
Funny Cide	$800,000	Funny Cide	$650,000	Empire Maker	$600,000
Empire Maker	$170,000	Midway Road	$200,000	Ten Most Wanted	$200,000
Peace Rules	$85,000	Scrimshaw	$100,000	Funny Cide	$110,000
Atswatimtalknbout	$45,000	Peace Rules	$50,000	Dynever	$60,000
				Supervisor	$30,000

Jockey's Placing

Jockey	KENTUCKY DERBY	PREAKNESS STAKES	BELMONT STAKES
Santos	1	1	3
Prado	3	4	4
Bailey	2	9	2
Stevens	6	3	6
Day	9	X	2
Albarado	12	2	X

X indicates did not ride

Wins by Post Position*

Position	Wins
1	13
2	9
3	8
4	9
5	11
6	6

*Total wins of the last 100 years of the Kentucky Derby

Student Worksheet

Name _____

Date _____

Off to the Races

1. Using the Earnings of Money Winners 2003 table, determine the cumulative earnings for each horse, and what percent of the overall total for the six horses that amount represents. Record your findings in the table below.

Horse	Cumulative Earnings for 2003	Percent of Overall Total

2. Based on your findings recorded in the table above, determine the weight you will assign each horse for the simulation. Be sure that the sum of the weights of the horses equals 100.

Horse	Weight

3. Use the Jockey's Placing table to determine the weight setting to give to each jockey. Be sure that the weight settings sum to 100.

Jockey	Weight

4. Determine the weight of each of the post positions based on the information given to you in the Post Position table. Be sure that the weight settings sum to 100.

Post Position	Weight

5. List the horses in the column labeled Horse. Record the randomly selected jockey and post position for each horse in the correct columns.

Horse	Jockey	Post Position

6. Predict the outcomes of the Race of the Best.

   1st

   2nd

   3rd

7. Record the results of each quarter of the race in the table below.

Horse	Quarter 1			Quarter 2			Quarter 3			Quarter 4			
	H	J	PP	H	J	PP	H	J	PP	H	J	PP	Total

8. What was the final outcome of the race?

9. Throughout this simulation, you have made decisions for weights based on statistics you were given for three variables: post position, horse's earning history, and jockey. These are not the only factors that can affect the outcome of a horse race. What are some other factors? Explain how they would affect the outcome of a race.

10. What if you used a fair die instead of a weighted die in this simulation? Would the results be any different? Did the weights change the outcome of the race? Explain. Would the results be different if the horse and jockey combinations were different? Did post position play an important role?

11. Was your prediction about which horse would win the race correct? On what did you base your prediction? Did you take into account the weights when making your prediction?

12. Reassign the jockey and post position to each horse and run the race again. Keep the weight settings the same as the first race. Which horse won the race the second time? How do the results differ from the first race? Can you determine which of the three factors has the greatest impact on the outcome of the race? Explain.

Teacher Notes

Objective

- Make decisions based on the results of experiments and simulations

Materials

- TI-84 Plus/TI-83 Plus

Teaching Time

- 60 minutes

Off to the Races

Preparation

Determining weights for different factors used in the Probability Simulation App is a main concept of this activity. Each of the three factors used in this activity are weighted differently, not only in the number of trials used, but also the advanced settings weight. Students see how these weights affect the probability of a particular outcome.

In addition to setting a weight for the three factors for each of the six horses, the three factors are weighted in different parts of the race. In the first part of the race, the post position is more influential, while at the end of the race, the jockey's skills become more important. The changes in **Trial Sets** represent the varying influence of these factors.

As students set up their tables and handhelds, remind them to keep track of the weights they are giving to each horse regarding the three factors so that their graphing calculators and their tables contain the same information.

Answers to Student Worksheet

1.

Horse	Cumulative Earnings for 2003	Percent of Overall Total
Funny Cide	$1,560,000	52.6%
Empire Maker	$770,000	26.0%
Ten Most Wanted	$200,000	6.7%
Midway Road	$200,000	6.7%
Peace Rules	$135,000	4.6%
Scrimshaw	$100,000	3.4%

2.

Horse	Weight
Funny Cide	53
Empire Maker	26
Ten Most Wanted	7
Midway Road	7
Peace Rules	4
Scrimshaw	3

3. Answers will vary.

4.

Post Position	Weight
1	23
2	16
3	14
4	16
5	20
6	11

5. Answers will vary.

6. Answers will vary.

7. Answers will vary.

8. Answers will vary.

9. Answers will vary, but may include: size or lineage of the horse, trainer or owner of the horse, number of entries in the race, track length or weather conditions. Explanations will vary.

10. If weights were not used, each horse would have an equal chance of winning the race. Each would have an equal opportunity to earn points for each leg of the race. Neither horse and jockey combinations nor post positions would impact the results.

11. Answers will vary.

12. Answers will vary.