



MAGIC SPRINGS

EDUCATION IN MOTION

WORKBOOK

Prepared in part by faculty from
the Arkansas School for Mathematics, Sciences, and the Arts.



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Magic Math (Elementary School)

Solve the following story problems.

*Teacher's note: numbers may be changed to increase or decrease the complexity of the problems.

1. There were 8 schools in line to buy tickets for Education in Motion. Each school purchased 45 tickets. How many tickets were purchased altogether?
2. Carla counted 32 fish and 9 turtles in the pond at Magic Springs. Pam counted 24 fish and 13 turtles in the pond. How many fish did they count all together? How many turtles?
3. There are 30 animals and 2 sleighs that seat 4 people each on the Carousel. 18 People total get on the ride and 2 people sit down in the sleighs. How many more people can still ride on the carousel?
4. Justine and Logan get in line for the Arkansas Twister. There are 87 people waiting in line ahead of them. The Arkansas Twister has 24 seats and goes around three times before Justine and Logan get on the ride. There are 13 people on the ride with Justine and Logan, and there were 22 people on the ride before them. If the ride was full the first time around, how many people rode the second time?
5. There are 80 boys, girls, and teachers swimming in the Crystal Cove wave pool. There are 48 boys and half as many girls. How many girls are in the pool? There are three times as many girls as there are teachers. How many teachers are in the pool?

6. The Goodie Gallery baked 80 soft pretzels to sell. They sold some of them, they now have 58 left. How many pretzels did the Goodie Gallery sell?

7. Kyle purchased 4 boxes of fudge. There are 12 pieces of fudge in each box. How many pieces of fudge does Kyle have all together? If Kyle shares his fudge equally with Jessica and Aaron, how many pieces will each of them have?

8. The foods team cooked 250 hot dogs and 250 hamburgers at the picnic pavilions. At the end of the day, they had 23 hot dogs and 38 hamburgers left. How many hot dogs did they serve? How many hamburgers did they serve?

Lunch Time! (Middle School)

*No purchase is necessary to complete this activity.

1. It is lunchtime, and you are hungry. Your best friend, Maria, is craving a 1/4-pound cheeseburger, French fries, and a bottled water. She could order each item individually or as a combo.
 - a. Calculate how much each item would cost if she ordered them individually.

	Cost
1/4 Ib. Cheeseburger	
French Fries	
Bottled Water	
Subtotal	
Sales Tax (12.5%)	
Total	

- b. Calculate how much her meal would cost if she ordered the combo instead.

	Cost
1/4 Ib. Cheeseburger Combo	
Bottled Water	
Subtotal	
Sales Tax (12.5%)	
Total	

- c. How much money would she save by buying the combo meal?
 - d. Maria only has \$15.00 left to spend on lunch, does she have enough money to order this meal?

2. While calculating your food cost, you run into another friend, Jack. Jack suggests pizza. After a little investigation, Maria narrows her pizza options down to two choices: a personal pizza and bottled water or ordering a 16" pizza (to split between Jack, Maria, and you) and a bottled water. Let us calculate how much it would cost Maria to eat Pizza.
- a. Calculate how much it would cost to order a personal pizza and a bottle of water.

	Cost
Personal Pizza	
Bottled Water	
Subtotal	
Sales Tax (12.5%)	
Total	

- b. Calculate how much it would cost to share a 16" pizza with Maria, Jack, and you if you all decide to order water to drink.

	Cost
16" Pizza	
3 Bottle Waters	
Subtotal	
Sales Tax (12.5%)	
Total	
Cost per Person	

- c. Does Maria have enough money to eat pizza? Explain.

3. Go to two restaurants or food stands in the park. Let us plan out what food you could get. Try to get the most food for your money.
- a. Looking at the first eater's menu and find one meal that you can eat for \$15.00 and complete the table below for this meal.

	Food for \$15.00	Price
Main Dish		
Side Dish		
Dessert		
Drink		
Subtotal		
Sales Tax (12.5%)		
Total		

Including sales tax, does this meal cost over \$15.00? If the cost of your meal is over \$15.00, what changes could you make so you could afford to eat a \$15.00 meal at this restaurant?

- b. Looking at the second eater's menu and find one meal that you can eat for \$25.00 and complete the table below for this meal.

	Food for \$25.00	Price
Main Dish		
Side Dish		
Dessert		
Drink		
Subtotal		
Sales Tax (12.5%)		
Total		

Including sales tax, does this meal cost over \$25.00? If the cost of your meal is over \$25.00, what changes could you make so you could afford to eat a \$25.00 meal at this restaurant?

Roller Coaster Fun (Middle School)

Roller coasters are a lot of fun and are extremely popular rides. How long a ride takes and how many passengers it holds plays a big part in the rider's experience. For this exercise, assume every seat has a passenger in it (that is, every ride is at maximum capacity).

- Determine the number of seats per ride for each of the following Roller Coasters:

	X-Coaster	The Gauntlet	Arkansas Twister	Big Bad John
# of Seats Per Ride:				

- Use the information above and the attendance for four random days to determine how many times each train would have to go around the track to get EVERY guest in the park to ride each roller coaster one time. Round to the nearest tenth.

Attendance	X-Coaster	The Gauntlet	Arkansas Twister	Big Bad John
12,924				
7,532				
3,965				
1,023				

- Time the ride of each of the Roller Coasters from beginning to end four times.

	X-Coaster	The Gauntlet	Arkansas Twister	Big Bad John
1st				
2nd				
3rd				
4th				
Average Length of the Ride				

- Do the times for each coaster vary? Why or why not?

5. Below is the attendance for 4 different days at Magic Springs, assume that every guest rides each roller coaster one time. Also, assume that each roller coaster runs non-stop from the park opening at 10:00 am to closing time at 8:00 pm. How long would it take for EVERY guest to ride each coaster exactly once?

Attendance	X-Coaster	The Gauntlet	Arkansas Twister	Big Bad John
12,924				
7,532				
3,965				
1,023				

Build Your Own Sextant

Sextant should be constructed before going to the park.

Materials:

Drinking Straw

Protractor

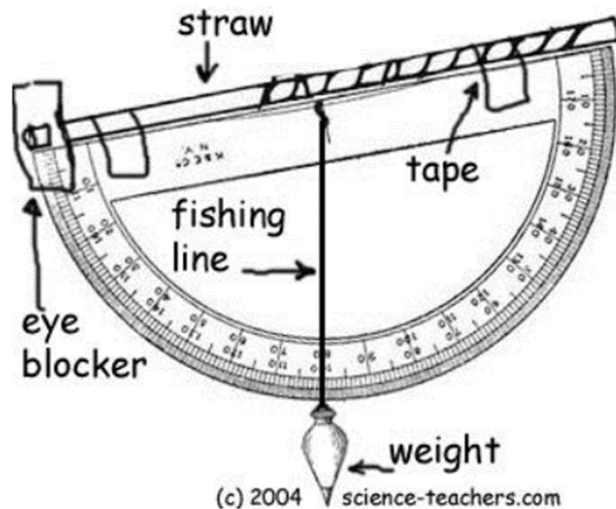
String

Steel washer or small weight

Tape

Instructions:

1. Tape the drinking straw to the bottom of the protractor.
2. Tie the washer (or small weight) to one end of the string. Tie the other end of the string of the string to the protractor and hang it from the hole of the protractor (above the mark).



How To Use the Sextant

1. Sight through the tube at a distance object and record the angle.
2. Subtract this angle from 90 degrees to obtain the angle of elevation. In the example below, the angle read is 80 degrees, so the angle of elevation is 10 degrees.

Suggestions: Reproduce the table below to fit onto the back of the Sextant for easy reference. You can cut and paste this onto your sextant, or you can copy them onto card stock, cut them apart, and tape onto the back of the finished Sextant.

If you have access to a laminating machine, you might want to laminate the Sextant/Tangent Table BEFORE you attach the straw or the string so that it will hold up better during use.

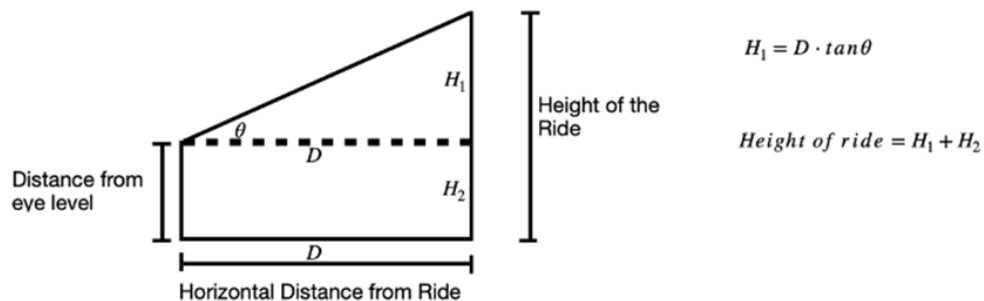
Table of Tangents

Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.
1	.02	17	.31	33	.65	49	1.15	65	2.14
2	.03	18	.32	34	.67	50	1.19	66	2.25
3	.05	19	.34	35	.70	51	1.23	67	2.36
4	.07	20	.36	36	.73	52	1.28	68	2.48
5	.09	21	.38	37	.75	53	1.33	69	2.61
6	.11	22	.40	38	.78	54	1.38	70	2.75
7	.12	23	.42	39	.81	55	1.43	71	2.90
8	.14	24	.45	40	.84	56	1.48	72	3.08
9	.16	25	.47	41	.87	57	1.54	73	3.27
10	.18	26	.49	42	.90	58	1.60	74	3.49
11	.19	27	.51	43	.93	59	1.66	75	3.73
12	.21	28	.53	44	.97	60	1.73	76	4.01
13	.23	29	.55	45	1.00	61	1.80	77	4.33
14	.25	30	.58	46	1.04	62	1.88	78	4.70
15	.27	31	.60	47	1.07	63	1.96	79	5.14
16	.29	32	.62	48	1.11	64	2.05	80	5.67

Making Distance Measurements

Since you cannot interfere with the normal operations of the rides, you will not directly be able to measure distances. Using the following methods, most of the distances can be measured remotely to give you a reasonable estimate. Try to keep consistent units (for example, meters, centimeters, etc.) to make calculations easier.

1. Pacing: Before arriving at the park, determine the length of your stride. Walk at your normal rate over a measured distance. Divide the distance by the number of steps to get an average distance per step. Knowing this, you can pace off horizontal distances.
2. Using a Sextant: This is known as Triangulation. When you want to determine the height of an object that you cannot physically measure, apply a little trigonometry.



Brain Drain (High School)

Before the Ride

1. Move to the Sextant Measuring Marker (located across the walkway from the Brain Drain Ride. This marker is 78 feet from the Brain Drain Ride. Use your sextant to calculate how high riders climb before they are dropped during the Brain Drain Ride.
 - a. Record the angle measure on the Sextant: _____
 - b. Find the angle of elevation: _____
 - c. Calculate the height of the Brain Drain Riders: _____
 - d. The height of every story in a building is based on ceiling height, floor thickness, and building materials. The average height of one story in a building is approximately 12 feet. Approximate how many stories a rider will climb for the Brian Drian ride: _____

2. Repeat this process to estimate the height the ride is from the ground when the brakes are applied (height of riders at the end of the free fall). You might need to watch a few rides to get a good estimate of this height.
 - a. Record the angle measure on the Sextant: _____
 - b. Find the angle of elevation: _____
 - c. Calculate the height at the end of the free fall Brain Drain Riders: _____
 - d. How many stories does a rider drop: _____

As You Ride

3. Estimate how many seconds the climb up on the lift lasted.

4. As the ride stops or immediately after it ends, estimate how many seconds free fall lasted.

After You Ride

5. Look back at the ride and use a stopwatch to time how long it takes to climb to the top of the ride.

6. Compare your answers to problem 3 and 5. If there is a significant difference, can you suggest a reason?

7. Calculate the distance the rider traveled during free fall.

8. The time spent in free fall can be estimated using the formula $\sqrt{\frac{d}{4}}$, where (d) is the distance traveled during free fall. Estimate the time spent in free fall.

9. Compare your answers to problems 4 and 8. If there is a significant difference, can you suggest a reason?

10. Use your answers from this section to calculate the free fall speed for the Brian Drain Ride.

Rum Runner (High School)

Before the Ride

1. There are eight rows on the Rum Runner. As a ride loads, determine the gender and number of riders in each seat and fill in the tables below. Collect data of the distribution of people for at least three separate groups of people.

1st Ride:

Seat Number	1	2	3	4	5	6	7	8
# of Females								
# of Males								

2nd Ride:

Seat Number	1	2	3	4	5	6	7	8
# of Females								
# of Males								

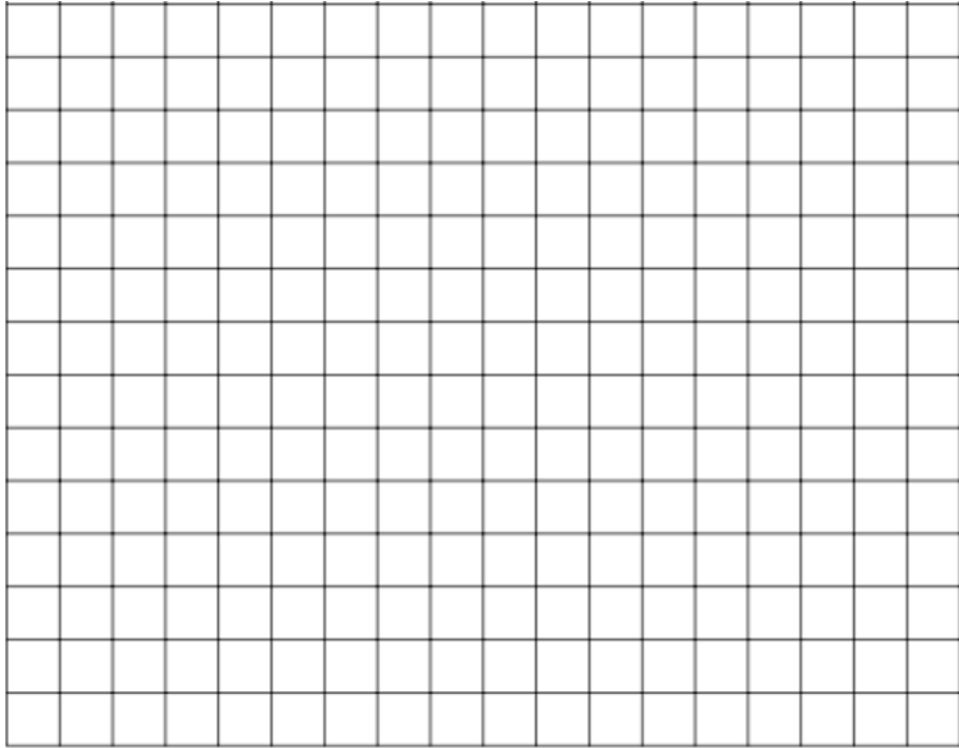
3rd Ride:

Seat Number	1	2	3	4	5	6	7	8
# of Females								
# of Males								

Average of the 3 Rides:

Seat Number	1	2	3	4	5	6	7	8
# of Females								
# of Males								

2. Use the data from problem 1, to sketch a double-bar graph with the seat number on the horizontal axis and number of males or females on the vertical axes. (Remember to label your graph and provide a graph key)



3. What observations can you make about the position of riders by gender looking at the double bar graph.

4. Another way to represent this data is by using a Box and Whisker graph. Before you can construct a Box and Whisker graph, you must compute the five number summary. Use the data in question 1 to calculate the five number summary for the number of people.

Female Riders: Min: _____ Quartile 1: _____ Median: _____ Quartile 3: _____ Max: _____

Male Riders: Min: _____ Quartile 1: _____ Median: _____ Quartile 3: _____ Max: _____

5. Construct two Box and Whisker graphs to illustrate the distribution of riders' seat choice by gender.



6. Compare the shape of the two Box and Whisker Plots.
7. Compare the center of the two Box and Whisker Plots.
8. Compare the spread of the two Box and Whisker Plots.

9. 25% of the seats had _____ males or less sitting in them.
25% of the seats had _____ females or less sitting in them.
10. 25% of the seats had _____ males or more sitting in them.
25% of the seats had _____ females or more sitting in them.
11. 50% of the seats had between _____ and _____ males sitting in them.
50% of the seats had between _____ and _____ females sitting in them.
12. According to your observation, is there a significant difference between the gender and row choice for riders of the Rum Runner? Explain.

During the Ride

13. Does the position of your seat affect the way you feel on this ride?
14. What happens to the way you feel as the ride swings higher?
15. Do you feel the same swinging forward as you do swinging backwards?

After the Ride

For each problem circle the response in parentheses that correctly completes the statement. Then explain your reasoning.

16. To feel the lightest, you should sit (closer to, farther from) the center of the gondola.

Explain your answer.

17. When you are highest above the ground, you are traveling (slowest, fastest). Explain your answer.

18. When you are highest above the ground, you feel the (lightest, heaviest). Explain your answer.

19. Assuming the ride rotates 180 degrees, determine the ride period by timing 10 swings. On a circular or semi-circular ride, the time it takes you to make one rotation is the period.

20. Calculate the speed of the ride.

Rides for Everyone (Elementary School)

Read the following passage. Then answer the multiple-choice questions as well as open response item.

Introduction

Magic Springs is one of the best family places to go in Arkansas! As the thrill capital of Arkansas, the park has a lot of rides and water slides. Every member of your family will find something to enjoy at the park. The beauty of Magic Springs is matched only by the thrill of its roller coasters. There are also a wide variety of family rides. Your little ones won't be left out of the action, there are kiddie rides the youngest will love!

Thrill Rides

The *Arkansas Twister* is a wooden roller coaster built in the 1990's! It's ready to take you on a wild 60 mile per hour ride over 3,500 feet of track. It also features a 90-foot drop! It will get your heart racing all the way to the finish.

Are you up to a challenge? It takes nerves of steel to handle the *X-Coaster*. This rollercoaster travels 150 feet straight up before twisting upside-down and back down the track up to 60 miles per hour. This is a very thrilling ride! Your hair will be flying. Your adrenaline will be pumping. Your heart will be thumping.

The *Brain Drain* is the newest thrill ride guaranteed to give hair-raising fun to guests who dare to drop. It's a thrilling free-fall drop tower ride providing guests with a breathtaking experience as it carries them 130 feet up over the park, and then drops riders back towards the ground reaching a maximum speed of 45 miles per hour!

Load a raft with your friends and hit the river. That is, if you don't mind a tidal wave! The best way to cool down quickly in the Arkansas heat is a 50-foot drop on the *Plummet Summit*. The chills and spills will hang around long after you've taken the plunge. On your way out, be sure to stop on the bridge. You can get a fresh soaking from the next rafters headed down the river!

Family Rides

Are you looking for a roller coaster to start out on? Look no further than *The Diamond Mine Coaster*. This roller coaster is small but powerful. It is exciting for kids and fun for adults!

The *Rum Runner Pirate Ship* will make you feel like you are on the mighty seas. You will go higher and higher as you rock back and forth! It will leave your stomach tingling and your heart twittering.

The *Old No. 2 Logging Company Log Flume* is a family favorite! Get in your log and take off. You will go twisting and turning through the water. This ride ends with a splash-down at the end of the river!

Go for a spin on our *Carousel*. This ride is the classic merry-go-round experience. You will have fun from the very beginning by picking out which beautifully painted animal or creature you want to ride. You'll want to ride over and over again.

Kids' Rides

Imaginations fly high on *Fearless Flyers*. It features kid-sized airplanes that go up and down as the planes go around. This will make a great time to snap a photo. Remember to smile as you wave at the camera.

On *Looney Ballooney* you will soar through the air on our colorful hot air balloons! The hot air balloons rise up as the ride spins. If you want added excitement, you can make your balloon basket twirl even faster.

All aboard the *Kit 'n Kaboodle Express*! Your kids can be the engineer of their own train. They can take a fun, colorful trip around the tracks.

Conclusion

Magic Springs includes all of these rides and many more. If all of the rides aren't enough, Magic Springs also includes more fun. It has a water park, live concerts and entertainment, games, and yummy food! Your fun day will create many fun memories to look back on. So what are you waiting for?

1. What is the author's purpose for writing this passage?
 - a. To entertain the reader with a story about a field trip to Magic Springs
 - b. To persuade the reader to go to Magic Springs
 - c. To inform the reader that Magic Springs also has a water park.
 - d. To encourage the reader to ride the X-Coaster.

2. Why did the author use italics throughout the passage?
 - a. They are the names of rides.
 - b. They are subheadings in the passage.
 - c. To give directions to the park
 - d. To help you say the words.

3. Under which heading would you most likely find information about rides that a young child would want to ride?
 - a. Thrill Rides
 - b. Family Rides
 - c. Kids' Rides
 - d. Baby Rides

4. This passage about Magic Springs is a/an
 - a. Fantasy
 - b. Advertisement
 - c. Menu
 - d. Fiction

5. According to the passage, which ride would make a great time to take a picture?
 - a. Plummet Summit
 - b. Rum Runner Pirate Ship
 - c. Carousel
 - d. Fearless Flyers

6. Someone would most likely read this passage to?
 - a. Learn more about Magic Springs
 - b. Find out more about Arkansas.
 - c. Determine how hot Arkansas summers can get.
 - d. Enjoy a good story.

7. A person that is scared of heights would be most afraid of which ride?
 - a. Arkansas Twister
 - b. X-Coaster
 - c. Brain Drain
 - d. Plummet Summit

8. What do you think the author meant when he used the term "nerves of steel"?
 - a. Someone might take your belongings.
 - b. You are nervous about riding rides.
 - c. You have a steel plate in your body.
 - d. You are very brave.

Open Response:

In this passage, you read about different types of rides that they have at Magic Springs. Which type of rides do you think you would enjoy most? Use specific examples and details from the passage to support your answer.

Writing Activities (Elementary School)

1. Writing Genre: Descriptive Narrative

Write an essay describing your favorite ride at Magic Springs. Be sure to include specific details so that your reader will be able to picture (visualize) it. Before you begin writing, think about your favorite ride. What do you like about this ride? How does it look and move? How does this ride make you feel? Why is this ride better than all of the other rides at Magic Springs?

2. Writing Genre: Expository

Write about your favorite game to play at Magic Springs. Be sure to give specific details and explain how to play the game so that your reader will understand. Before you begin writing, think about the Magic Springs game that you like to play. What type of game is it? What do you enjoy about the game? How did you learn to play it? What are the steps that others would need to follow to be successful at the game?

Writing Activities (Middle School)

1. Writing Genre: Descriptive Narrative

Describe your memorable day at Magic Springs, focusing on the sights, sounds, and emotions of the experience. How did you feel as you entered the park? What rides did you go on, and what did you enjoy about them? What was the weather like, and how did it affect your experience? What was your favorite part of the day, and why? How did you feel as you left the park at the end of the day? In reflecting on your day at the amusement park, what did you learn about yourself, and what memories will you cherish from the experience?

2. Writing Genre: Persuasive Essay

Write a persuasive essay arguing which ride at Magic Springs is the best. Provide specific details about the ride, such as its speed, intensity, and any unique features. Consider the thrill factor, as well as any physical or emotional sensations that riders might experience. Use your own experience to support your claim. Encourage readers to try the ride for themselves and experience the excitement firsthand.

Writing Activities (High School)

1. Writing Genre: Creative Writing

Write a poem about your experience visiting Magic Springs. Use descriptive language to convey the sights, sounds, and sensations of the park. Consider the excitement and anticipation you felt before entering the park, the rush of adrenaline on the rides, and the joy and satisfaction of spending time with friends. Your poem can be structured however you choose, but it should convey the emotions and impressions of your day at the amusement park.

2. Writing Genre: Expository

Compare and contrast two Magic Springs rides of your choice in an essay. Start by providing detailed descriptions of each ride, including their names and unique features. Analyze the similarities and differences between the two rides, such as their speed, height, intensity, and design. Finally, consider the target audience for each ride, and explain how different age groups or thrill-seekers may prefer one ride over the other.

Heart Pounding Experience (Middle & High School)

Introduction

According to a recent experiment, half a day at the theme park could burn 1200 calories, the equivalent of 4.5 McDonald's cheeseburgers, or 171 fries! The research also showed that theme park rides can cause a person's heart rate to climb up to 160 beats per minute (BPM), which is well into the scientifically recognized "fat burning zone". ^[1]

A day at Magic Springs will likely involve a fast heart rate. Activities like walking between rides, walking up steps, or even lifting or carrying a backpack can cause your heart rate to increase.

Hypothesis

Generate a hypothesis of when your heart rate will be the highest and lowest during your day at the park. Can you make a guess of how many beats per minute (BPM) you will measure at those times?

Experiment

Do steps 1 and 2 at home, before arriving at the park.

1. Before arriving at the park, practice finding your pulse. There are two main areas of the body where the pulse can be felt: the wrist and the neck.
 - a. Neck: Put two fingers of your left hand onto the side of your windpipe. Push down gently and you will feel your pulse. It will feel like a small "thump". Move your fingers around if you do not feel it immediately.
 - b. Wrist: Using your pointer and middle finger of your right hand, slide from the base of your left thumb to where your hand meets your wrist. Again, it may take some experimentation to find the best location to feel your pulse.
2. Once you have felt your pulse, use it to find your resting heart rate several times while you are relaxed. Be sure to do this before heading out to Magic Springs. Make sure that you are in a relaxed environment and seated for at least 10 minutes. Time the number of beats that you feel for 30 seconds. Multiply the number of beats by 2 to get the heart rate in "beats per minute".

Record the time of day and resting heart rate below. Calculate the average. To measure your heart rate, you can also use a heart rate monitor on a smart watch or Fitbit.

Time (Hour : Minute)	Beats Felt in 30 Seconds	Heart Rate (BPM)
Averages		

3. Measure your heart rate when you first arrive at the park, at several different times during the day and at different locations around the park. Measure your heart rate while waiting in line and immediately after riding a few rides. Don't forget to take a few measurements when you are more relaxed, like at lunchtime.

a. Resting Heart Rate (from step 2). _____

b. Heart rate upon arriving at the park. _____

c. Heart rate after one hour at the park. _____

d. Heart rate while waiting in line, ride. _____

Which ride? _____

e. Heart rate after riding ride 1. _____

f. Heart rate while waiting in line, ride 2. _____

Which ride? _____

g. Heart rate after riding ride 2. _____

h. Heart rate at lunch or break time. _____

i. Heart rate at the end of the day at the park. _____

j. Resting heart rate when you get home from school. _____

Questions

1. Physical activity always increases your heart rate. What are some other factors that might affect heart rate? Do you think there are psychological factors involved as well?

(Suggestion: look up “fight or flight” response.)

8. Why was it important to know your resting heart rate for this experiment? Could you prove or disprove your hypotheses without knowing your resting heart rate?

9. Why might the experimental design involve measuring your heart rate while resting at the park? What information can this provide that your normal resting heart rate cannot?

^[1] A Day at the Theme Park Gets the Heart Pumping:

(<https://www.scoop.co.nz/stories/GE1702/S00065/a-day-at-the-theme-park-gets-the-heart-pumping.htm>)