EDUCATION DAYWORKBOOK

Grades 6-8

Note to Teachers:

The activities found in the Education Day workbook were written to focus on specific skills by answering interesting questions on rides and other features found throughout ***Six Flags Over Georgia***. We recommend that you look carefully at these activities to determine which ones are the best fit for your class. We believe that students should be given a reasonable set of well-defined lesson goals to accomplish while at the park.

It is suggested that students work in groups of 2 or 4. Students will have a more enjoyable and successful **Education Day at Six Flags Over Georgia** if you discuss strategies and concepts with them before and/or after they arrive.

We have included information that will allow you and/or your students to develop additional activities or questions if you so desire. To assist in this, data about a small selection of rides at ***Six Flags Over Georgia*** can be found at the end of the workbook.

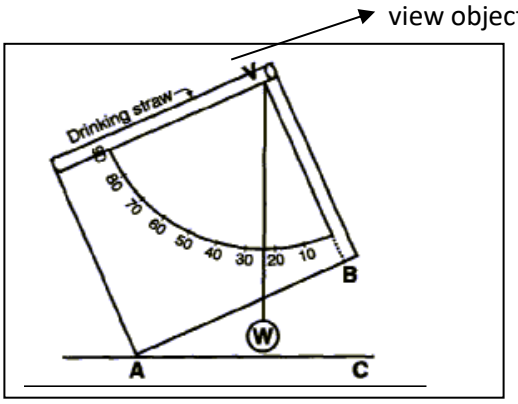
We hope you enjoy your day of fun with science, mathematics and discovery at
Six Flags Over Georgia!

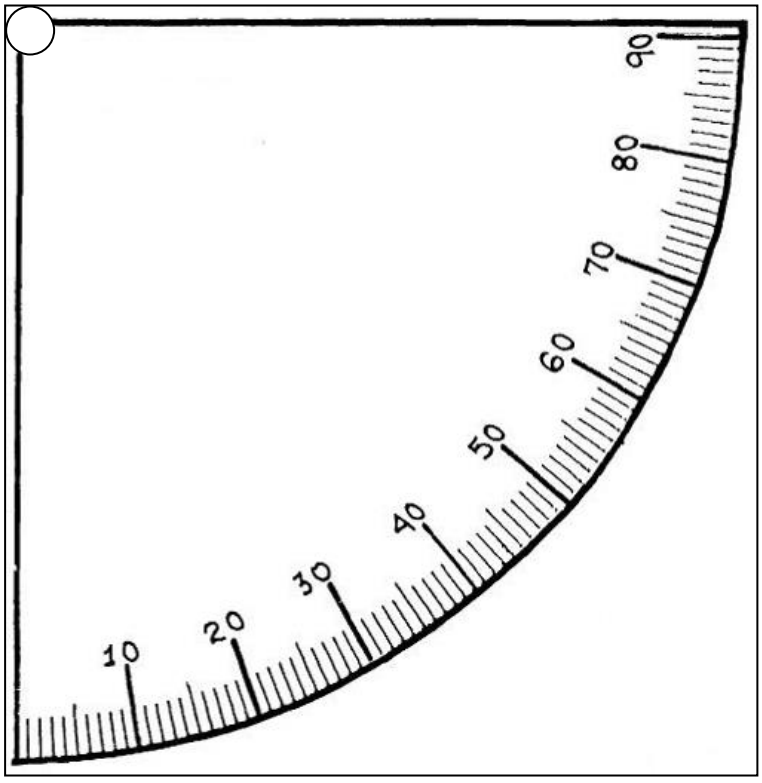
CONSTRUCTING A HEIGHT-FINDER

[Height-Finder should be constructed before going to the park]

Materials needed: **kite string** **tape**
paper clips **index cards or card stock**
drinking straws (with a large diameter)

- Cut out the protractor below.
- Glue or tape it to an **index card** so that the 90º edge is along one edge of the card -- or this page can be copied onto **card stock** and then cut. [Suggestion: To save paper, cut and paste four of the protractor patterns to a page and then copy.]
- Cut a **straw** (with a large diameter) the length of the edge of the protractor. Lay the cut piece of straw along the index card where the 90º edge is located and tape in place (this becomes the scope for sighting the object being measured). NOTE: If you plan to **laminate** the Height-Finder/Table of Tangents (see next page), do so before attaching the straw.
- Cut **kite string** into lengths of about 20 cm. Open one tip of a **paper clip** so that it can be used as a pointer. Attach the string to the curved end of the paper clip.
- Use a **hole punch** to punch a hole at the corner opposite the numbers so that there is a small depression where you will tape the string into place. (Let the end of the string hang over onto the back where it can be taped.) Be sure the string is long enough so that the paper clip pointer hangs across the numbers at the bottom.
- When viewing through the straw, hold the end opposite of where the string is attached nearest your eye.





TANGENT TABLE

Attach to the back of the Height-Finder

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

Suggestion: Reproduce this table to fit onto the back of the Height-Finder for easy reference. Again, you can fit four on a page, then cut and paste; or you can copy them onto **card stock**, cut them apart, and tape onto the back of the finished Height-Finder.

If you have access to a **laminating machine**, you might want to laminate the Height-Finder/Tangent Table BEFORE YOU ATTACH THE STRAW OR THE STRING so it will hold up better during use.

MAKING MEASUREMENTS

TIME

If you must figure an amount of time in order to work a problem, use a stopwatch, a digital watch with a stopwatch mode, or a watch with a second hand. When measuring the period of a ride that involves circular motion, measure the time for several repetitions of the motion, then divide by the number of repetitions. This will give a better estimate of the period of motion than just measuring one repetition. It is best to measure two or three times and then take an average.

DISTANCE

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

- **Pacing:** Determine the length of your stride by walking 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.
- **Ride Structure:** Distance estimates can be made by noting regularities in the structure of a ride. For example, tracks may have regularly spaced cross bars as shown in ***figure a.***

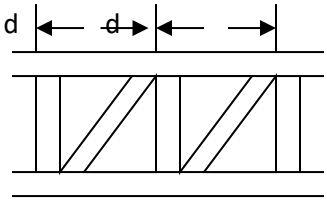


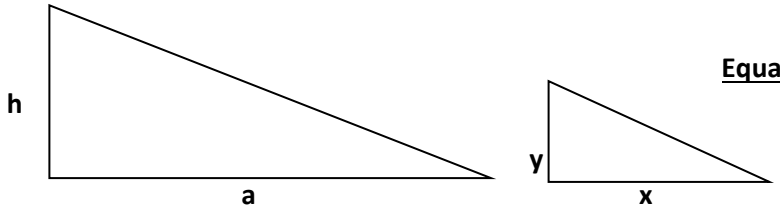
figure a

- **Using a Height Finder:** This is known as Triangulation (see following info)

FINGING THE HEIGHT OF AN OBJECT

Using Ratio and Proportion

Method I:

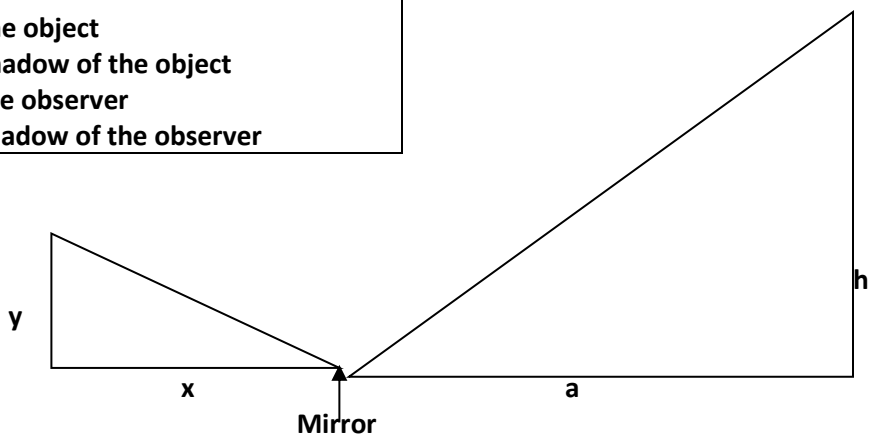


Equation to solve (solve for h):

$$\frac{h}{a} = \frac{y}{x}$$

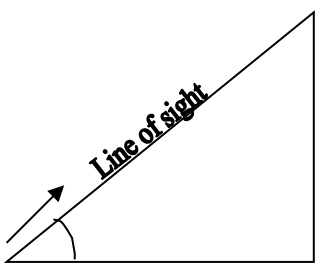
Legend:
- **h = height of the object**
- **a = length of shadow of the object**
- **y = height of the observer**
- **x = length of shadow of the observer**

Method II:
Place the mirror so that you can see the top of the object being observed



USING A HEIGHT FINDER
(Triangulation)

When you want to determine the height of an object that you cannot physically measure, apply a little geometry. Imagine that you are at the bottom **point x** of the diagonal side (hypotenuse) of a right triangle and looking up at the top along the hypotenuse where the top of the **object n** you are measuring is located. The **angle a** created between your view up the hypotenuse and a horizontal line from your eyes to the **object n** can be measured with the Height-Finder. When an object is sighted through the Height-Finder, the number of degrees in **angle a** can be read from the pointer. Find the appropriate **tangent** from the Tangent Table provided.



Height of object "n"

Distance from viewer to object being measured (baseline)

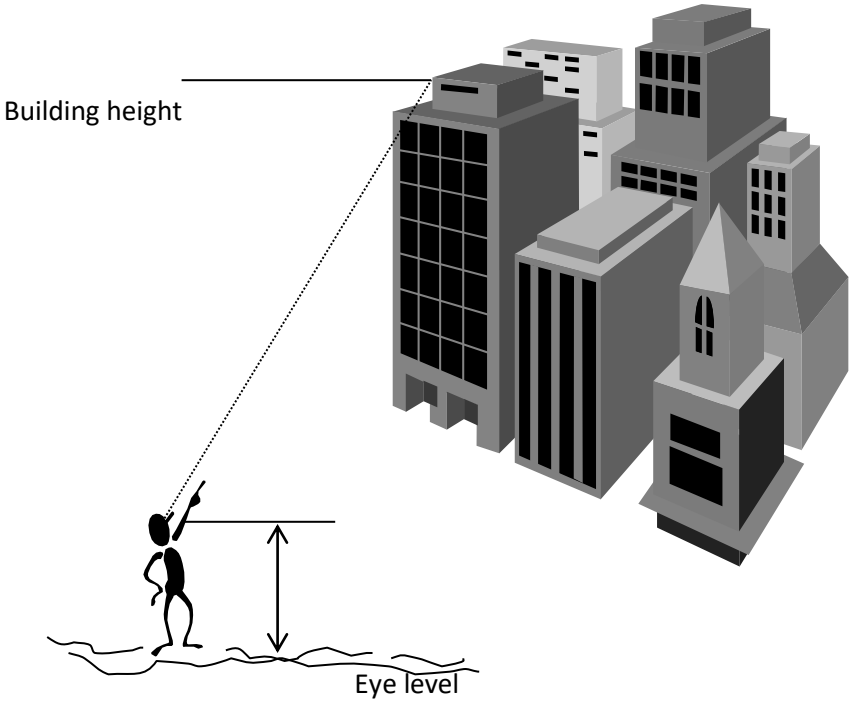
FORMULA:

Tangent of **angle a** (in degrees) _____
times the baseline distance (___ meters)
plus your eye level height
equals the height of the object

-OR-

[Tan a°] X [baseline] + eyelevel = height

Example:
If **angle a = 36°** it would have a tangent of .**73**. If the distance of the baseline from you to the object was 120 ft (or **1,440 inches**) and your eyelevel height was **43 inches**, then the equation to find the height of "**n**" would be as follows:
[.73 x 1440 in.] + 43 in. = 1094.2 in. (91.18 ft.)



BEFORE GOING TO SIX FLAGS

Introduction: Before going anywhere, it is important to plan a budget. In order to have a successful field trip to ***Six Flags Over Georgia*****,** think about any money you will want to spend.

Mission: Problem-solving with decimals

If on your field trip you plan to eat lunch, play 2 games, buy a souvenir, and buy an additional drink during the day, what is a reasonable amount of money to plan on spending? Justify your answer.

Activity or item	Price Range
Boardwalk games	$1.00 – 3.00
Meals	$6.99 – 8.50
Souvenirs	$1.00 – 25.99
Drinks	$3.99 – 5.00
Refillable Souvenir Glass with Soda	$4.00 – 6.00
Soda Refill in Souvenir Glass	$17.99 – 23.50

THROUGHOUT THE PARK

Introduction: Parks like *Six Flags Over Georgia* are designed to anticipate the number of people that can safely be in the park at one time. Engineers estimate the number of people who can fit in line for a ride and the number of people who can ride at one time for safety reasons.

Mission: Estimating and communicating

- Choose three rides anywhere in the park and estimate the number of people that can ride each at one time.
- Describe your answers in terms of median and range.

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Introduction: Have you ever noticed that your heart seems to beat faster when you get excited? What effect does riding a roller coaster have on you?

Mission: Looking for differences in pulse rates

Find a pulse point on your body – your wrist, neck, or temple [be sure to use your pointer finger and not your thumb to count the number of beats]. Using the second hand on a watch or a stopwatch, count the number of pulses in 15 seconds and multiply by 4. **Take your pulse rate before riding and again after riding**. Is there a difference? Why is this so? Collect this data before and after several rides.

Wait, Height, and Probability

Location: Monster Mansion

Introduction: This boat ride takes passengers (aboard a fiberglass boat) on a thrilling ride featuring 107 wild, wacky, and weird monsters who all want to party. Just remember – Don't Go In The Marsh!

Mission: Determining the wait

You must be back at the gate to meet your class in half an hour. You are in line to ride Monster Mansion. After a quick count you realize you are the 100^{th} person in the line. How long will you wait before getting on the ride? Will you be able to complete this ride in time to meet your class? [HINT: (1) Determine the average time it takes for one ride; include the time it takes to load and unload passengers. (2) Consider the number of passengers riding each time and your position in line.]

Location: Blue Hawk

Introduction: Even though each ride seems to run so smoothly, do you think it takes much effort to make them operate smoothly? Think about the amount of energy it takes for this ride to operate.

Mission: Identifying Potential and Kinetic Energy

Draw the main shape of the Blue Hawk ride. Put a "P_e" at the locations of two examples of potential energy in the ride and a "K_e" for two examples of kinetic energy. Explain your answers.

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Location: DC Super Villains Swing

Introduction: Have you ever wondered what it would feel like to ride aboard a spinning top? Riders on the DC Super Villains Swong are seated in individual seats that swing from a rotating top. It's a swinging time!

Mission: Calculating the speed of a ride

- Time the ride from the moment it begins to the moment it ends and count the number of rotations completed in that time.
- Compute the average number of rotations per minute.

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Introduction: Have you and a friend or pen pal ever written to each other in a secret code? Here is a mathematical secret code. See if you can figure it out!

Mission: Using problem-solving techniques

Maria's pen pal asked her to meet him at the DC Super Villains Swing. He gave her the following clues to determine who he was:

- Number the swings #1 - 48.
- Omit every other swing starting with #2 (the even numbered swings) until only one person is left.

(1)In which seat is her pen pal sitting?
(2)What is the pattern for predicting which is the correct swing for any number of swings?
SUGGESTION: It may be helpful to draw this out.

Location: The Dahlonega Mine Train

Introduction: All aboard your own runaway mine car, an exciting ride that plunges riders through an abandoned mine.

Mission: Finding the distance

Time the ride from beginning to end. If the average speed of the train is 35 mph, find the length of the ride by using this formula:

rate (the speed*) x time = the distance

Location: Dare Devil Dive

Introduction: Dare Devil Dive is known for its over-90-degree drop, fast aggressive corners, high speed, and sudden direction changes. Have you ever wondered who rides roller coasters and why people love to ride them? Let's investigate!

Mission #1: Collecting, graphing and interpreting data

Observe the ride at least once as a group. What things did you notice about the ride? Gather data by selecting at least one of the following:

a. Does the time vary from ride to ride? Time the ride from beginning to end five times. Do the times vary? Why or why not? Graph your results.
b. Tally the approximate age of the riders for two ride cycles (classifications should include child, young adult, adult and older adult). What age group is most represented? Give possible reasons for your results.
c. Investigate a question of your own that can be answered by collecting data.

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Mission #2: Finding the height of the highest point of the ride

a. Using your Height-Finder, sight through the straw toward the highest point of the ride. What is the distance from where you are to the base of Dare Devil Dive?
   [Notice and record the angle of the pointer (this is **angle a**)].
b. Use the following formula to determine the height of this ride:

[Tangent of **angle a** (in degrees)] x [baseline distance (in meters)] + your eye level height = height of the object

(NOTE: Another way to do this is by using a graphing calculator with trigonometric functions)

Location: Georgia Scorcher

Introduction: Are you ready for a mind-blowing, looping, lightning-fast ride aboard this famous stand-up coaster? Put your feet to the fire and you'll feel how standing upright adds smoothness to an intimidating journey up Georgia Scorcher's 11-story lift hill!

Mission: Determining rates of travel

a. Determine the rate of travel of one roller coaster car.
b. How could you increase the rate of travel?
c. The length traveled is a distance of 3000 ft. Time and record your ride from beginning to end. Calculate the speed by using the following formula:

[Distance traveled] ÷ [time it took to travel the entire distance] = the speed

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BACK AT SCHOOL

Introduction:
Have you ever thought of a ride that you think would be fun but doesn't exist? What would you have to know to design such a thing?

Mission: Designing a ride

Design a new ride that you have never seen before. Draw it and describe what it would be made of and how it would work. Discuss any design problems there might be in making such a ride and propose how you might solve those problems.

***APPROXIMATE DATA FROM ROLLER COASTER DATABASE* (www.rcdb.com)**

Six Flags Over Georgia

Blue Hawk: Length 2,739ft; Height 122ft; Inversions 5; Drop 109ft; Duration 1:20min; Speed 52mph; 28 riders per train
Dare Devil Dive: Length 2,099ft; Height 95ft; Inversions 3; Speed 52mph; 6 riders per car
Georgia Scorcher: Length 3000ft; Height 107ft; Drop 101ft, Inversions 2; Speed 54mph; Duration !:24min; G-Force 4.0; 32 riders per train; 1,300 riders per hour
Dahlonega Mine Train: Length 2,327ft; Height 37ft; Inversions 0; Duration 2:51min, Capacity 2,200 riders per hr; 30 riders per train

Six Flags OVER GEORGIA

EDUCATION DAYS