Roller Coasters Part Two

Name:

Purpose

What happens when you hurtle down a hill at 60 mph in a roller coaster? When you find yourself in a stressful situation, your body makes a choice faster than you can think: stick around and fight, or retreat to safety. This initial response to stress is called the fight or flight response. Many changes begin just a few seconds after adrenaline pumps through your body. You will investigate some of these responses in this activity.

Similarity, Right Triangles, & Trigonometry (G-SRT)

Standard (G-SRT.5)-Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Standard (G-SRT.8)-Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Materials ✓ Stopwatch ✓ Calculator ✓ Pencil or Pen ✓ Roller Coasters Data Bank

Instructions

Before You Ride

1. As you wait to ride, measure your pulse using the following procedure:
   a. Locate your pulse by placing two fingers on the carotid artery on the side of your neck (HINT: For accurate results, do not use your index finger or thumb.)
   b. Ask a friend to time 30 seconds using a stopwatch or a wristwatch; count the number of beats during 30 seconds
   c. Multiply the number you obtain by 2. The result is your pulse rate in beats per minute. Record the rate here.

   _____

2. While resting, measure your breathing rate by counting the number of breaths in 30 seconds. Multiply this number by 2 to calculate the breathing rate in breaths/minute.

   _____

3. Do you think your pulse rate will be higher, lower, or the same after you finish the ride? Predict how your breathing rate might change during the ride.

   _____

   _____

As You Ride

4. After you go down the first big hill, see if you can observe any changes in your body:
   a. Can you feel your heart pounding? _____
   b. Has your breathing changed? _____
   c. Are your muscles relaxed or tense? _____
   d. How does your stomach feel? Do you notice sweaty palms? _____
   e. Do you have any sensations in your throat? _____
   f. Do you feel more or less alert than usual? _____
   g. Does your hearing or vision feel different than usual? _____

After You Ride

5. Take your pulse again immediately following the ride and record it here. Measure and record your breathing rate. How have these rates changed compared to the rates before the ride? What would be the advantage to your body of changing your breathing or pulse rates?

   _____

   _____

   _____

6. Record your observations about your body's responses to the first big hill. For each response, try to think of advantages it would give your body for either fight or flight.

   _____

   _____

   _____

7. Predict what would happen to your body if you rode the roller coaster many times without resting.

   _____

   _____

   _____

Roller Coasters Part One

Name:

Purpose

In this activity, students estimate the capacity of a roller coaster, the length of its lift, and the speeds it attains. Through their work, students see real-world applications of formulas and methods learned in the classroom. Among the mathematical ideas students deal with in this activity are:

- indirect measurement
- the Pythagorean Theorem
- dimensional analysis
- the relationship d = rt

One of the most popular amusement park rides is the roller coaster. You can see that by the lines of people waiting to get on. There you wait patiently, all for a few minutes of terror!

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Instructions

Before You Ride

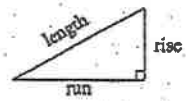
As you wait for the ride to begin, use the information in the Data Bank to compute and record each of the following.

1. Approximately how many riders can a train carry in 1 hour?

2. Estimate how many times a train can ride each hour. Explain your reasoning.

3. Use your answers to problems 1 and 2 to estimate how many passengers a train can carry.

4. The Data Bank lists Lift Rise and Lift Run, but it does not tell you the length of the lift. But you can estimate that length using the Pythagorean Theorem, as given in the model to the right. Do that here.



Pythagorean Theorem
$(\text{length})^2 = (\text{rise})^2 + (\text{run})^2$

5. Estimate the amount of time it takes to climb the lift at the start of the ride. You may want to use your wristwatch or a stopwatch.

As You Ride

6. Count the number of people on your train and compare this answer with your estimate from problem 3.

After You Ride

7. Using your work from problem 5 and problem 4, estimate the average speed of the roller coaster while climbing the lift.

8. Convert your answer to problem 7 to miles per hour. Remember that there are 60 seconds in 1 minute, 60 minutes in 1 hour, and 5,280 feet in one mile.

9. Based upon your answer to problem 8 and your experience on the ride, how many times as fast do you think the roller coaster was moving when it reached its greatest speed?

10. During the lift at the beginning of the ride, a roller coaster moves very slowly and requires outside power to move it. During the remainder of the ride, a roller coaster moves very quickly, while requiring no outside power. Explain why this is so.

Instructions

Roller coasters can be wooden or steel, and can be looping or non-looping. You'll notice a big difference in the ride depending on the type of material used. In general, wooden coasters are non-looping. They're also not as tall and not as fast, and they don't feature very steep hills or as long a track as steel ones do. Wooden coasters do offer one advantage over steel coasters, assuming you're looking for palm-sweating thrills: they sway a lot more. Tubular steel coasters allow more looping, higher and steeper hills, greater drops and rolls, and faster speeds.

In this activity take some time to ride Diamondback and record your observations:

Before the Ride

1. Record your heart rate:
   a. _____ bpm
2. How do you feel as you make your way through the line, up the stairs, and eventually into the loading zone?

_____
_____
_____
_____
_____

During the Ride

3. Remember the total time, in seconds, that it took you to reach the bottom of the first drop. _____ Seconds

After the Ride

4. Using the number you recall from the first decant, what average speed did you travel down the hill? _____ mph
5. How did your experience on the Diamondback, a steel coaster, compare to other steel or wooden coasters?

_____
_____
_____
_____
_____

Roller Coaster Data Banks

Adventure Express

- Cars/Train: 5
- Train Capacity: 30
- Hourly Capacity: 1600
- Train Mass: 2380 lbs/car
- Incline Length: 34.7 m
- Incline Height: 16.8 m
- Decent Angle: 26°
- Track Length: 888.8 m

The Beast

- Cars/Train: 6
- Train Capacity: 36
- Hourly Capacity: 1200
- Train Mass: 2300 lbs/car
- Incline Length: 159.1 m
- Incline Height: 41.1 m
- Decent Angle: 45°
- Track Length: 2255.5 m

Vortex

- Cars/Train: 7
- Train Capacity: 28
- Hourly Capacity: 1500
- Train Mass: 1200 lbs/car
- Incline Length: 116.9 m
- Incline Height: 46 m
- Decent Angle: 55°
- Track Length: 907 m
- 1st Loop Height: 89 ft

Racer

- Cars/Train: 5
- Train Capacity: 30
- Hourly Capacity: 2640
- Train Mass: 2200 lbs/car
- Incline Length: 132.7 m
- Incline Height: 26.8 m
- Decent Angle: 50°
- Track Length: 2081.8 m

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