Math 110 Passports to Fun Journeys At Kennywood


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**Instructions:** Complete the MATH 110 Passport to Fun in this packet that your teacher has put together for you. The different "journeys" allow you to visit (and ride) different rides in different areas of Kennywood, just like a passport allows you to visit different countries. You will also find some challenges within some "journeys," see if you can conquer the challenges. As you roam Kennywood today have some fun, ride some rides, and do this while doing math!

## MATH 110 Passports to Fun Journey 1: Circular Function Machines

This activity requires that you make some observations at different **circular** rides as you roam Kennywood. As you approach each of the rides listed, you need to count the number of arms, which are holding seats, and then determine the number of degrees between each of the arms or the measure of the angle between arms which are side by side. The rides which you are to observe (or ride) are listed:

Kangaroo Number of Arms:___ Degrees Between Each Arm:_____

Paratrooper Number of Arms:___ Degrees Between Each Arm:_____

Musik Express Number of Arms:___ Degrees Between Each Arm:_____

After you finish collecting the information, make a graph of your data. (There is graph paper on the next page.) The number of arms for the rides should be on the x-axis and the corresponding number of degrees between the arms on the y-axis. Be sure to use a scale on both axes so that the graph will fit on the paper that you have. Put the ride names that you collected data for beside of the number of arms. For example, if the Paratrooper had 16 arms, you would put the word Paratrooper beside or below the number 16 on the x-axis. As you continue to roam, add the names of other circular rides at the appropriate places on the x-axis in the same way you did with the other four rides. After you have all of the data graphed as ordered pairs, draw the line or curve of best fit that passes through the ordered pairs.

***Challenge:*** Can you determine a formula or "function machine" where you can put the number of arms in and get the number of degrees between the arms back out?

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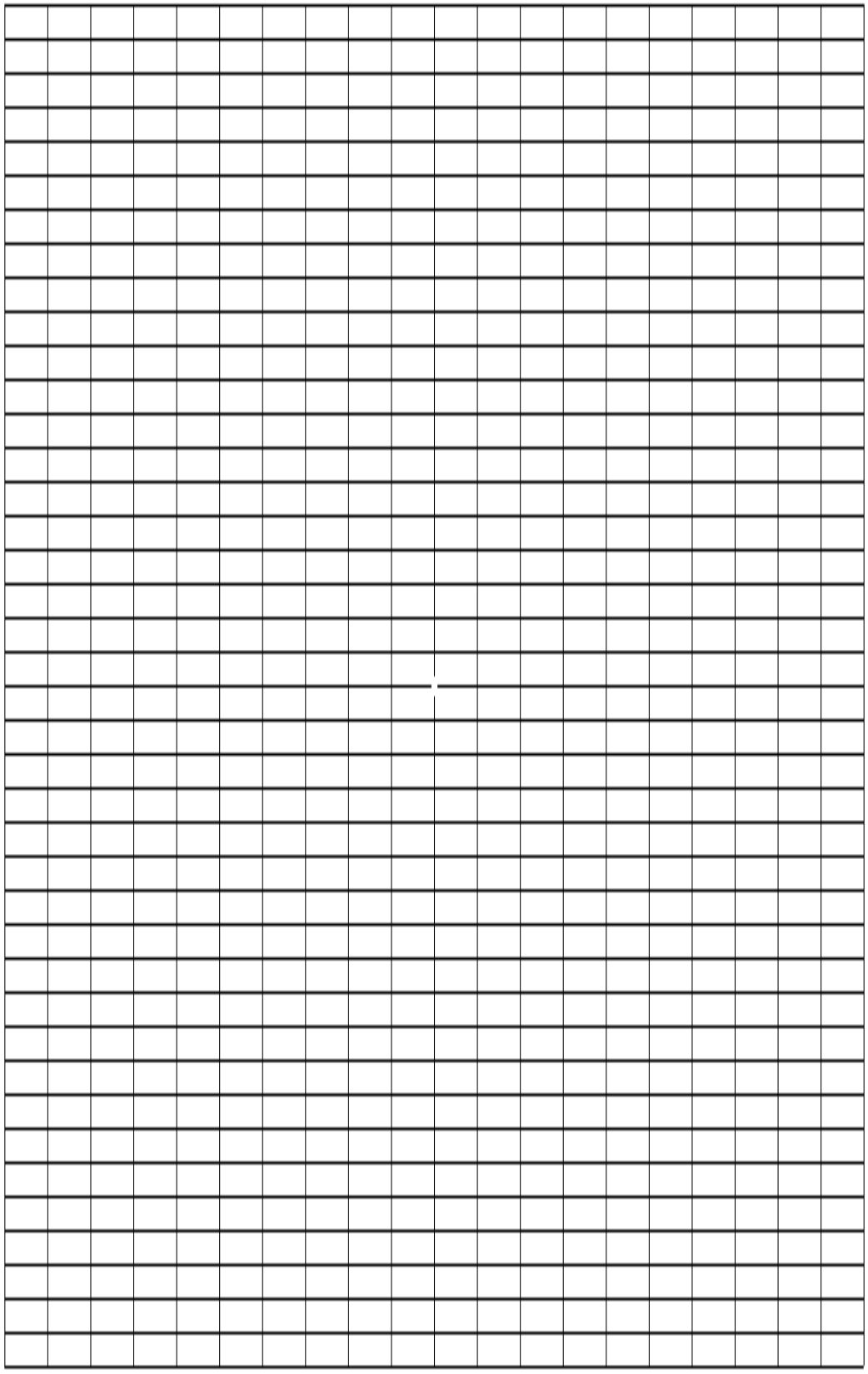

## MATH 110 Passports to Fun Journey 2: Filling the Phantom's Trains

You can actually do this activity while waiting in line to ride one of the top rated coasters in the USA…The Phantom's Revenge. Although, you can also do this activity even if you choose not to ride the Phantom. In order to complete this activity, you need to watch the Phantom as it is dispatched or leaves the station six times. Each time it leaves, you need to record the number people riding in the train. You should also keep track of the total number of people that were riding in all of the trains that have dispatched since you have been observing.

| | | |
|---|---|---|
| 1st Train | Riders in 1st Train:___ | Total Riders So Far:___ (Total in train 1 only) |
| 2nd Train | Riders in 2nd Train:___ | Total Riders So Far:___ (Total in trains 1 and 2) |
| 3rd Train | Riders in 3rd Train:___ | Total Riders So Far:___ (Total in trains 1, 2, and 3) |
| 4th Train | Riders in 4th Train:___ | Total Riders So Far:___ (Total in trains 1, 2, 3, and 4) |
| 5th Train | Riders in 5th Train:___ | Total Riders So Far:___ (Total in trains 1, 2, 3, 4, and 5) |
| 6th Train | Riders in 6th Train:___ | Total Riders So Far:___ (Total in trains 1, 2, 3, 4, 5, and 6) |

Now you are going to make a graph of your data using the graph paper on the next page. You will have the best success if you turn the paper sideways to make the graph. The number of trains dispatched should be plotted using the x-axis and the corresponding *"Total Riders So Far"* should be plotted using the y-axis.

***Challenge:*** Can you come up with a formula or "function machine" for predicting the *"Total Riders So Far"* for a given number of trains that have dispatched?

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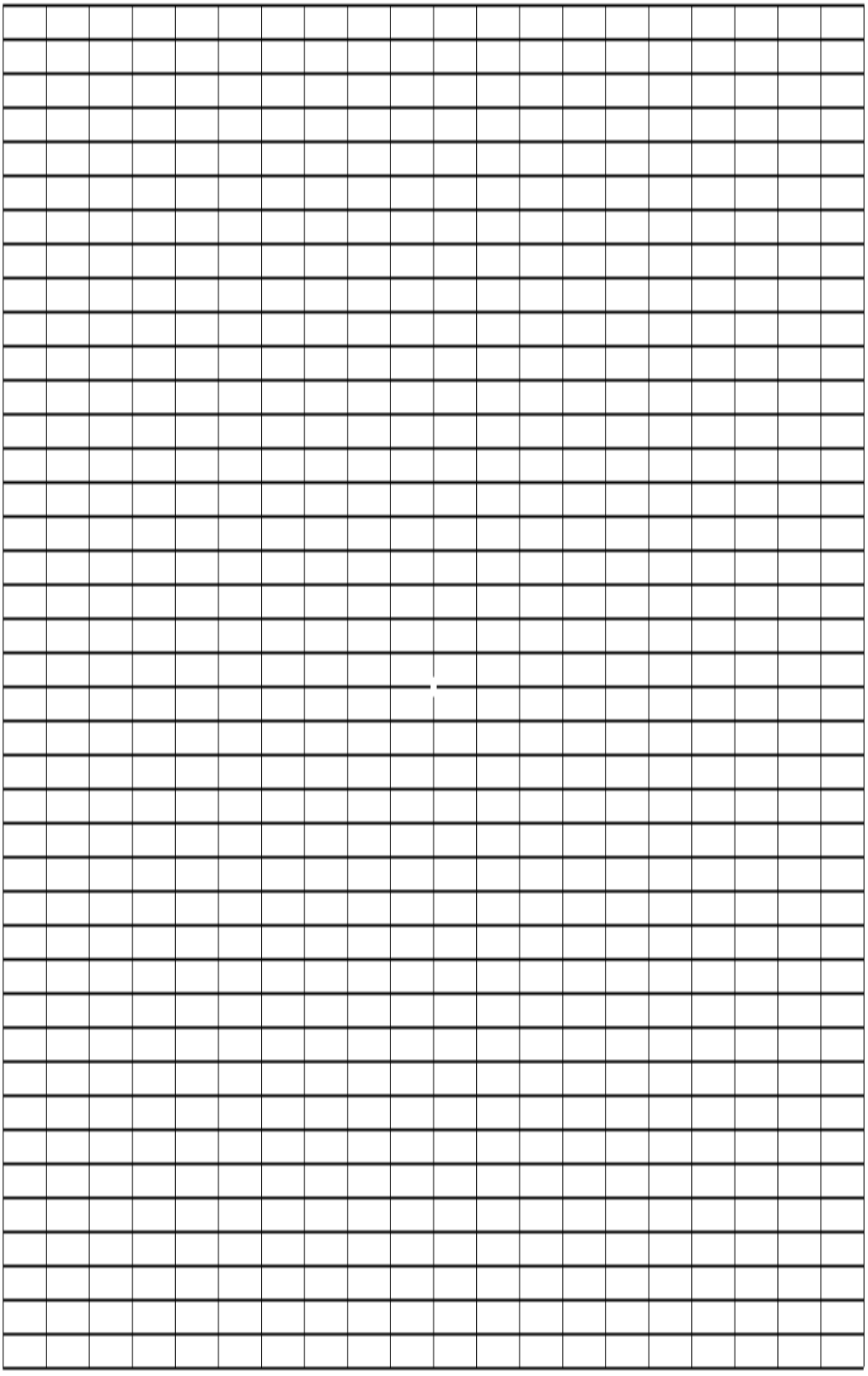

You may notice that the ordered pairs did not quite make a straight line, but they were close. Draw a straight line that "best fits" the ordered pairs. It is true that that line may not pass through any of the ordered pairs that you plotted, but you want the line to be the shortest vertical distance possible away from all of the ordered pairs. Make sure to extend the line beyond your data points so that you can make some predictions.

**Problem 1:** Use the line of "best fit" that you drew on the graph to predict the "Total Riders So Far" that SHOULD have ridden the Phantom after 4 trains have been dispatched. To find this, locate 4 on the x-axis and then take your pencil and lightly draw a vertical line to the line of "best fit" that you drew. Then lightly draw a horizontal line back over to the y-axis to determine the y-value on the line of "best fit" that corresponds to the x-value of 4. That is your predicted "Total Riders So Far," after four trains have dispatched. Your answer may or may not be a whole number. Is that number close to the actual "Total Riders So Far" that you found?

**Problem 2:** Use the line of "best fit" that you drew on the graph, and the process described in Problem 1, to predict the "Total Riders So Far" that SHOULD have ridden the Phantom after 7 trains have been dispatched. This will be the value on the y-axis on the line of "best fit" that corresponds to 7 on the x-axis. Your answer may or may not be a whole number.

**Problem 3:** Explain why the line of "best fit" did not always match the data you collected. In other words, why did the line of "best fit" not always predict the correct "Total Riders So Far" for a given number of dispatched trains. Can you think of anything that may have had an influence on this?

Math 110 Passports to Fun Journeys At Kennywood

## An Algebra Extension to Filling the Phantom's Trains

In this activity you are going to use two ordered pairs that the line of "best fit" passes through to find the equation of the line of "best fit" in the form $y = mx + b$.

**Step 1:** Determine two ordered pairs $(x_1, y_1)$ and $(x_2, y_2)$ on the line of best fit that you are going to use. You may want to try to find whole numbers if possible, but this may not be possible. To make this easier, look for places where the line of "best fit" intersects the crossing of two grid lines and use the coordinates of the crossings as your ordered pairs.

**Step 2:** Determine the slope of the line of "best fit" connecting the two ordered pairs using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$

**Step 3:** Frame the equation $y = mx + b$ and fill in the value of the slope for $m$

**Step 4:** Substitute $x_1$ for the value of $x$ in the equation and substitute $y_1$ for the value of $y$ in the equation and then solve for $b$

**Step 5:** Rewrite the equation of the line of best fit in the form $y = mx + b$ by substituting your $m$ into the equation and your $b$ into the equation

***Challenge:*** What does the slope of the line of "best fit" actually tell you?

**MATH 110 Passports to Fun Journey 3: The Kennywood Number Hunt**

As you roam Kennywood, write a mathematical expression for the situation and then find the answers to the mathematical expressions.

1. On the Paratrooper, there are 50 lights around the top of each of the parachutes. How many total lights are there on the top of the parachutes on the Paratrooper?

2. There are 4 wheels on each car on the Turnpike and the wheels each have the same number of spokes. How many total spokes are there on every car?

3. If one train on the Jack Rabbit leaves and every other seat, starting with the first, has two people in it and the remaining seats have one person, how many people are riding in the train?

4. If every seat on the Kangaroo has 3 people in it, how many people will be riding on the Kangaroo?

5. What percent of the horses on the Carousel are occupied if only the horses on the outside row are occupied?

Math 110 Passports to Fun Journeys At Kennywood

6. On the Racer, the odd seats in the trains have one person and the evens have two (ie. the first seat has one person, the second has two, the third has one person, etc.). How many people are riding the Racer?

7. If 80% of the seats on the Musik Express are filled with three riders each, how many riders are on the Musik Express?

8. If each seat on the Pirate can hold five people, what is the maximum number of people that can ride the Pirate at one time with one seat completely empty?

9. If only the outside (meaning closest to the huge supports) seats on the SwingShot are occupied, what fraction of the seats are occupied?

10. If 3/5 of the seats on the Thunderbolt are full when it dispatches, how many riders are there in that train?

11. The seats on the Arrow 360 are in groups of 3. If every middle seat facing the Log Jammer is empty, what percent of the seats are occupied?

12. The seats on the Wipeout look like restaurant booths without the table. If 40% of the "booths" are full, how many people are riding?

# MATH 110 Passports to Fun Journey 4: When Will It Happen?

Determine the number of people described in each situation…

**Problem 1:** If each seat on the Pittsburg Plunge seats 4 people and each seat is half full every time a boat leaves. How many boats will have dispatched before boat with the $48^{th}$ person "takes the plunge?"

**Problem 2:** If you are standing in line for the Raging Rapids and there are 20 people in front of you. How many FULL rafts will leave BEFORE the raft with you in it leaves?

**Problem 3:** You enter the line for the Wave Swinger just as a group of people are exiting. You notice there are 100 people in front of you. How many times will the ride start BEFORE you get on the ride?

**Problem 4:** You notice that the line for the Whip is not too long, only 20 people. You do not get on the ride because all of the seats are occupied, but none by more than two people. Determine how many of the seats are filled with two people and how many with just one person.

# MATH 110 Passports to Fun Journey 5: The Volcano

**Problem 1:** If the Volcano has a diameter of 56 feet, determine the total distance that a rider travels during one revolution. Then use this to find the total distance that a rider travels during one complete ride. Make your science teacher happy by remembering to use units!

**Problem 2:** Determine the average speed of the Volcano for one complete ride. Use appropriate units.

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

**Problem 3:** Determine the number of "degrees" that a rider travels during one complete ride on the Volcano.

**Problem 4:** Determine the area of the circle made by the arms (not the cabins) of the Volcano as the arms rotate. Again…remember the units.

**Problem 5:** In the space below, sketch a height versus time graph for the Volcano, once the arm is perpendicular to the ground. Put time on the x-axis and height on the y-axis.

# MATH 110 Passports to Fun Journey 6: Taking the Pittsburgh Plunge

**Problem 1:** Given that the entire length of the Pittsburgh Plunge is 622 feet and the wheels on the Pittsburgh Plunge have a diameter of 18 inches, determine the number of times that the wheels turn during each ride.

**Problem 2:** Determine the average speed of the Pittsburgh Plunge during one complete ride. Make sure to make your science teacher happy too by showing units.

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

**Problem 3:** Given that the height of the big drop on the Pittsburgh Plunge is 16 meters, the mass of an unfilled boat is 785 kg, each passenger adds 25 kg to that mass, and the acceleration due to gravity is -9.8 m/s, determine the potential energy of the boat as it is about to "take the plunge". Remember those units again!

$$\text{Potential Energy} = \text{Acceleration of Gravity} \times \text{Mass of the Boat and Passengers} \times \text{Height (in meters)}$$

Number of passengers in the boat:
Mass of passengers in the boat: