Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

**Hamster Wheel Trigonometry**

**Hands-On Activity**

* **Goal:**
  + Students will investigate and create sine/cosine curves.
* **Objective:**
  + Given a set of data, students will model/graph how a trigonometric function describes the relationship between a wheel spinning at a constant rate with relationship to the height above the ground with 85% accuracy.
* **Next Lesson’s Objective:**
  + Given a set of data, students will discover a relationship between the given measure and the period, amplitude, and phase shift of a function with 85% accuracy.
* **Materials:**
  + Hamster wheel
  + Ruler
  + Graph paper
  + Post-its
  + Pencil/pen
  + Worksheets provided
* **Review:**
  + Unit Circle & Quadrants
    - “All Students Take Calculus”
    - Values in radians and degrees
  + y=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + y=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Amplitude:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Period:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + C=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + D=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Frequency: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Procedure:**
  + Graph **2 complete periods** that models the height of the hamster wheel in relation to time (sec). **Assume 1 full rotation takes 60 seconds.** Use a cosine curve.

1. Using your ruler, find the diameter of the hamster wheel: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
2. What is the distance of the center of the hamster wheel above the ground? **\_\_\_\_\_\_\_\_\_\_\_\_**
3. Find the distance from the ground to the lowest point of the wheel: **\_\_\_\_\_\_\_\_\_\_\_**

* **Now that you have found your values, refer to the diagram worksheet and label each part.**
* **Next, Create four quadrants out of your hamster wheel based on the time and label each section with a post-it. You can use different colors to represent each time interval.** (Refer back to the Unit Circle and draw connections)
* **As you spin the wheel around, notice that the post-it will touch each quadrant.**
* **Go back to your diagram worksheet and fill in the time intervals of the 4 quadrants based off of your hamster wheel.**

**How much of a rotation does each time interval represent?**

0 seconds= \_\_\_\_\_\_\_\_\_ rotation

15 seconds= \_\_\_\_\_\_\_\_\_ rotation

30 seconds = \_\_\_\_\_\_\_\_\_ rotation

45 seconds = \_\_\_\_\_\_\_\_\_ rotation

60 seconds = \_\_\_\_\_\_\_\_\_ rotation

* **Measure the hamster wheel at each time interval (2 rotations) & record your data in the table below:**

|  |  |  |
| --- | --- | --- |
| **Time (Seconds)** | **Height (Cm)** | **Height Above The Ground (Cm)** |
| 0 | 0 | 3 |
| 15 |  |  |
| 30 |  |  |
| 45 |  |  |
| 60 |  |  |
| 75 |  |  |
| 90 |  |  |
| 105 |  |  |
| 120 |  |  |

**Based on the data you have collected, graph the relation between the time and height of the post-its above the ground on the attached graph.**

**Looking at your graph, answer these concluding Questions:  
  
1.** What is interesting about your graph? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What is the minimum value? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What is the maximum value? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What is the period of this function?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. What is the frequency of this function?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. At what point does the curve begin to repeat?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. What other real-world experiences could you use trigonometry in?

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* **Extra Practice:**

**The London Eye will take you to a height of 135 meters. If the London Eye experience lasts about 30 minutes, has a diameter of 130 meters, has a full rotation every 5 minutes, what will your graph look like?**