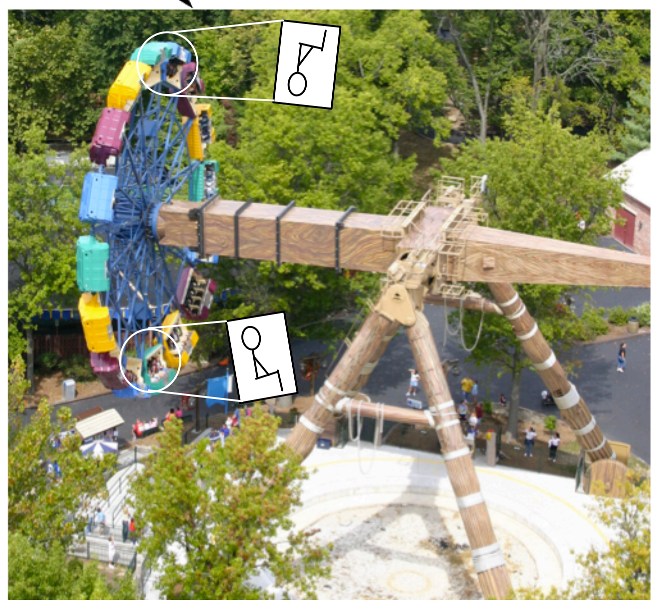
Name:	Partner:	Teacher:	**Xcalibur**

QUALITATIVE QUESTIONS:

1. Watch the ride to see how the orientation of the riders changes. Use the pictures on this page to help you name and describe the positions of riders oriented in the following ways:
   a. Where are the riders' torsos nearly vertical with heads up?

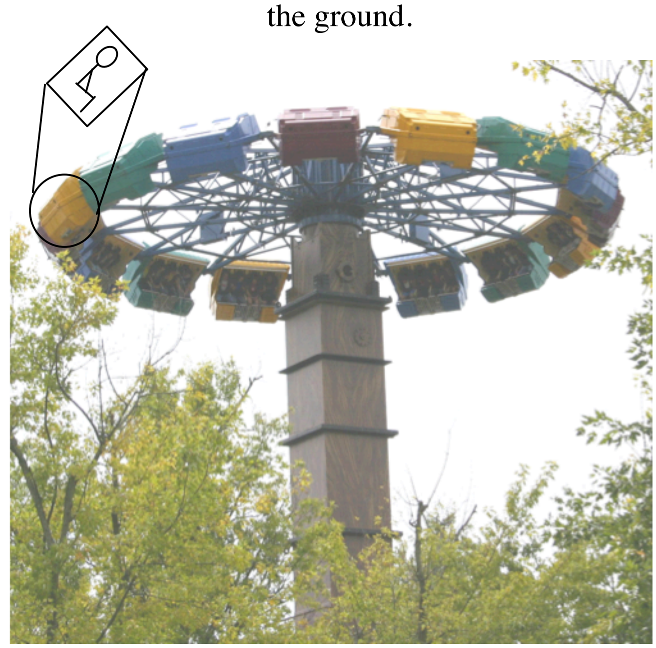
   b. Where are the riders' torsos nearly vertical with heads down?

   c. Where are the riders' torsos nearly horizontal relative to the ground?



Side position – note that riders at different points on the circle are oriented differently relative to the ground.

Bottom position – ride at full speed. All riders are oriented the same relative to the ground.



Top position – all riders are oriented the same relative to the ground.

QUALITATIVE QUESTIONS (continued)

d. Describe how the riders' torsos are generally oriented relative to the wheel's spokes and the giant arm throughout the ride.

2. The graphs on the following page show an altitude vs. time graph, the Force Factor vs. time for the head to toe axis and the Force Factor vs. time for the front to back axis. Label the graphs with letters corresponding to the following ride positions:
   - A. Bottom position once the ride reaches full speed.
   - B. Ascending side position
   - C. Top position
   - D. Descending side position
   - E. Bottom position before the ride begins to slow down.

3. Explain why the Force Factor values gradually increase in magnitude as the ride begins.

4. Explain why the Force Factor values oscillate as the ride tips to the side position.

5. Explain why the Force Factor values reach a fairly constant value at the top position.

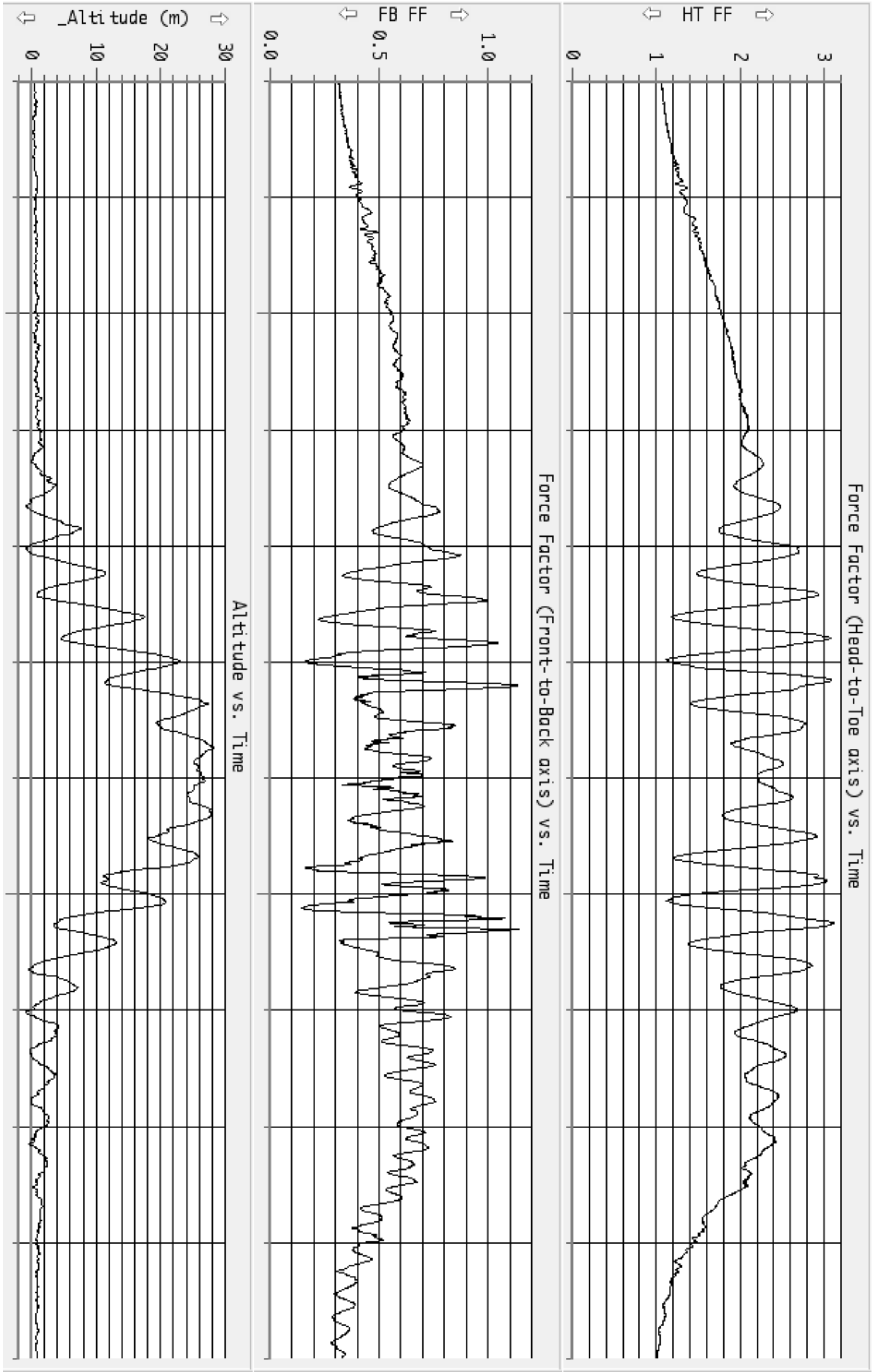
6. Does the restraining bar in front of the passenger ever push the passenger back into his or her seat? Justify your answer based on the graphs.

7. Why don't the riders fall out of the top of the side position where they are upside down?

8. Is the rider's torso ever truly vertical during the ride? Justify your answer based on the graphs.

Name: Partner: Teacher:

Xcalibur



QUALITATIVE QUESTIONS (continued)

9. When you sit in the ride before it starts moving, how is your torso oriented?

10. Draw free-body diagrams for the forces on a rider at the following positions (shown in question 1):

a. At rest, before the ride starts.

b. At the bottom position, full speed.

c. At the top position.

d. At the side position when the rider is at the top.

e. At the side position when the rider is at the bottom.

11. Sketch a side-view diagram of one of the passenger pods. Show where the spokes attach to the pod that allow the pod to pivot.

Name: Partner: Teacher: **Xcalibur**

QUANTITATIVE QUESTIONS:

1. Once the ride is spinning at full speed, determine the period of the ride.

2. Determine the circumference of the circle of seats by counting paces while walking around the ride before getting on the ride.

   Number of paces: ____________
   Circumference:

3. From the circumference, determine the radius of the circle of seats.

4. Determine the radius of the circle made by the arm of the ride from the altitude vs. time graph on the previous page.

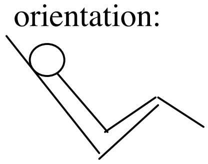
QUANTITATIVE QUESTIONS (continued)

5. Calculate the tangential velocity of the riders from your measured values.

6. Calculate the centripetal acceleration of the ride from your measured values.

7. a. Draw a side-view free-body diagram for a rider sitting in the seat **before the ride begins to move**.
b. Make your free-body diagram quantitative by assuming the rider's mass is 70 kg and using Force Factor values from the graphs.

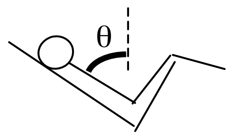
rider's
orientation:



c. How big is the centripetal force on the rider? Why?

Name:	Partner:	Teacher:
		Xcalibur

8. a. Once the ride is at full speed at the **bottom position**, observe the ride to estimate the angle between the rider's torso and the vertical.

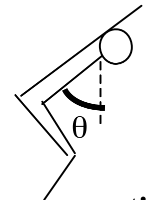


b. Draw a **quantitative** side-view free-body diagram for a 70 kg rider using Force Factor values from the graphs.

c. Use trigonometric analysis to determine the centripetal force on the rider at the full-speed bottom position.

d. Determine the centripetal acceleration of the rider at the full-speed bottom position.

9. a. Once the ride is at the **top position,** observe the ride to estimate the angle between the rider's torso and the vertical.

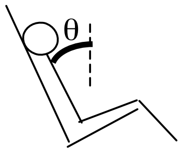


b. Draw a **quantitative** side-view free-body diagram for a 70 kg rider using Force Factor values from the graphs.

c. Use trigonometric analysis to determine the centripetal force on the rider at the top position.

d. Determine the centripetal acceleration of the rider at the top position.

10. a. Once the ride is at the **side position**, observe the ride to estimate the angle between the rider's torso and the vertical when the rider is at the **bottom of the circle** of seats.

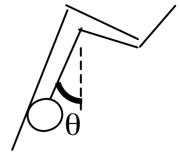


b. Draw a **quantitative** side-view free-body diagram for a 70 kg rider using Force Factor values from the graphs.

c. Use trigonometric analysis to determine the centripetal force on the rider at the bottom of the circle with the ride in the side position.

d. Determine the centripetal acceleration of the rider at the bottom of the circle with the ride in the side position.

11. a. Once the ride is at the **side position**, observe the ride to estimate the angle between the rider's torso and the vertical when the rider is upside-down at the **top of the circle** of seats.



b. Draw a **quantitative** side-view free-body diagram for a 70 kg rider using Force Factor values from the graphs.

c. Use trigonometric analysis to determine the centripetal force on the rider at the top of the circle with the ride in the side position.

d. Determine the centripetal acceleration of the rider at the top of the circle with the ride in the side position.