



### Problem 1 – Maximizing Horizontal Distance

A daredevil motorcycle rider is trying to break two records: one for the longest horizontal distance jumped on a motorcycle and one for the longest airtime. She has hired you to determine how to set up the ramp so as to maximize her chances of breaking the records.

Due to safety considerations, she cannot travel any faster than 60 mph (88 ft/sec) on the ramp. The velocity is fixed, but you can change the angle of the ramp, which will also change the height of the ramp.

1. Experiment with different values of  $\theta$  in the **MaxDistance > Explore** portion of the program. What do you notice? Is there a “best” value for  $\theta$  that will make for the longest jump?
2. What does the horizontal axis represent in this model?
3. What does the vertical axis represent?
4. Is this model completely realistic? (Hint: What happens as  $\theta$  gets close to  $90^\circ$ ?)
5. Capture at least 10 different data points of the form  $(\theta, \text{length})$ . Graph the data in a scatter plot. Describe the shape of scatter plot.
6. Is there an angle that maximizes the length of the jump? Explain how you know.
7. Record the quadratic regression function here:
8. Use the regression equation to calculate the angle of the ramp that will maximize the length of the jump. Show your work below.

9. How long will the jump be?
  
10. What would be your advice to the rider about how to maximize her horizontal distance during the jump?

### **Problem 2 – Maximizing Airtime**

11. Use what you know about projectile motion to write a model for the height of the rider versus time.
  
12. What does the horizontal axis represent in this model?
  
13. What does the vertical axis represent?
  
14. What does  $x = 0$  represent?
  
15. Experiment with different values of  $\theta$ . What do you notice?
  
16. Capture at least 10 different data points of the form  $(\theta, \text{time})$ . Graph the data in a scatter plot. Describe the plot.
  
17. Is there a value of  $\theta$  that maximizes the airtime? Explain how you know.
  
18. What would be your advice to the rider about how to maximize her airtime?