6.3 Differential Equations and Motion

Name: Date:

P 13. A rock is thrown downward with velocity 10 ft/sec from a bridge 100 ft above the water. How fast is the rock going when it hits the water?

P 15. A car starts from rest at time $t = 0$ and accelerates at $-0.6t+4$ meters/sec^2 for $0 \leq t \leq 12$. How long does it take for the car to go 100 meters?

P 19. A tomato is thrown upward from a bridge 25 m above the ground at 40 m/sec.

(a) Give formulas for the acceleration, velocity, and height of the tomato at time t.

(b) How high does the tomato go, and when does it reach its highest point?

(c) How long is it in the air?

P 21. An object is shot vertically upward from the ground with an initial velocity of 160 ft/sec.

(a) At what rate is the velocity decreasing? Give units.

(b) Explain why the graph of velocity of the object against time (with upward positive) is a line.

(c) Using the starting velocity and your answer to part b, find the time at which the object reaches the highest point.

(d) Use your answer to part c to decide when the object hits the ground.

(e) Graph the velocity against time. Mark on the graph when the object reaches its highest point and when it lands.

(f) Find the maximum height reached by the object by considering an area on the graph.

(g) Now express velocity as a function of time, and find the greatest height by antidifferentiation.

P 23. A 727 jet needs to attain a speed of 200 mph to take off. If it can accelerate from 0 to 200 mph in 30 seconds, how long must the runway be? (Assume constant acceleration.)

P 29.

(a) Imagine throwing a rock straight up in the air. What is its initial velocity if the rock reaches a maximum height of 100 feet above its starting point?

(b) Now imagine being transplanted to the moon and throwing a moon rock vertically upward with the same velocity as in part a. How high will it go? (On the moon, g = 5 ft/sec^2.)