Homework 2, Part 2

Section 3.7 of *Rogawski*: 9, 25, 45, 53

Section 3.3 of *Rogawski*: 5, 7, 13, 15, 21, 23

Additional exercises:

Exercise 1 Give an equation of the tangent line to $y = (x^4 + 2)^3$ at $x = 1$.

Answer: $y = 27 + 108(x - 1)$

Exercise 2 Imagine a water pipe with a faucet at the end and with the other end connected to a water supply that applies 50 pounds per square inch of water pressure when the faucet is closed. When the valve is opened and water flows through the pipe, the water pressure in the pipe drops. The water pressure is $p = 50 - 2v^2$ pounds per square inch when the water is flowing v feet per second. Figure 1 shows the graph of the velocity of water as a function of t (seconds) for $0 \le t \le 200$. What is the approximate rate of change of the water pressure with respect to t at $t = 150$?

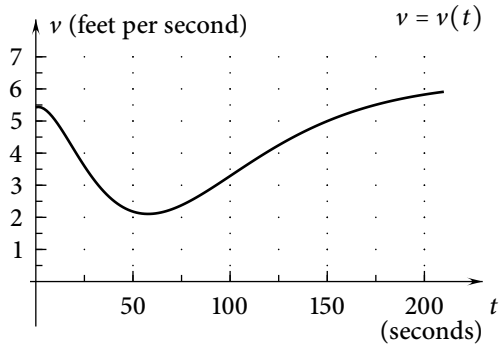

FIGURE 1

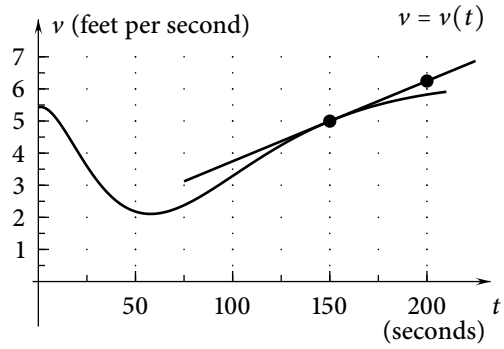

FIGURE 2

Answer: One answer: Figure 2 • $v(150) \approx 5$ • $\left.\frac{dv}{dt}\right|_{t=150} \approx 0.025$ •

$\left.\frac{dp}{dt}\right|_{t=150} \approx -0.5$ pounds per square inch per second

Exercise 3 A leaky bucket contains $V(t) = (3 - t)^2$ gallons of water at time t (hours). What is the rate of flow out of the bucket when it contains 1 gallon of water?

Answer: Water is flowing out at the rate of 2 gallons per hour.

Exercise 4 What is the rate of change with respect to time of the volume $V = w^3$ of an expanding cubic crystal at a moment when its width is 10 millimeters and its width is increasing 3 millimetes per day?

Answer: 900 cubic millimeters per day

Exercise 5 An object moves along the parabola $y = x^2$ in such a way that its x-coordinate increases at the constant rate of 5 units per minute. How rapidly is the object's y-coordinate increasing when its x-coordinate is 1?

Answer: $\frac{dy}{dt} = 10$ units per minute

Exercise 6 The force of air resistance (drag) on a car is $D = \frac{1}{30}v^2$ pounds when the velocity is v miles per hour. The car is accelerating at a constant rate of 30 miles per hour^2. What is the rate of increase with respect to time of the drag when the car is going 50 miles per hour?

Answer: [Acceleration] = $\frac{dv}{dt}$ • At the moment in question: $\frac{dD}{dt} = \frac{1}{15}(50)(30) = 100$ pounds per hour