

45. **EFFECT OF SUPPLY ON PRICE OF EGGS** Refer to Exercise 44. If 25,000 cartons of eggs are available at the beginning of a certain week and the weekly supply is falling at the rate of 1000 cartons/week, at what rate is the wholesale price changing?

46. **ELASTICITY OF DEMAND FOR INK-JET CARTRIDGES** The demand function for a certain make of ink-jet cartridge is

$$p = -0.01x^2 - 0.1x + 6$$

where  $p$  is the unit price in dollars and  $x$  is the quantity demanded each week, measured in units of a thousand. Compute the elasticity of demand and determine whether the demand is inelastic, unitary, or elastic when  $x = 10$ .

47. **ELASTICITY OF DEMAND FOR CDS** The demand function for a certain brand of compact disc is

$$p = -0.01x^2 - 0.2x + 8$$

where  $p$  is the wholesale unit price in dollars and  $x$  is the quantity demanded each week, measured in units of a thousand. Compute the elasticity of demand and determine whether the demand is inelastic, unitary, or elastic when  $x = 15$ .

48. **PRODUCTION FUNCTION FOR A FURNITURE COMPANY** The manager of Dixie Furniture Company estimates that the daily output of her factory (in thousands of dollars)  $Q$  is given by

$$Q = 5x^{1/4}y^{3/4}$$

where  $x$  is the amount spent on labor and  $y$  is the amount spent on capital (both measured in thousands of dollars).

- Find the daily output of the factory if \$16,000 is spent on labor and \$81,000 is spent on capital each day.
  - Suppose that the output of the factory is to be maintained at the level found in part (a). By how much should the amount spent on capital be changed if the amount on labor is increased by \$1000? What is the MRTS?
49. **OUTPUT OF A COUNTRY** Suppose that the output  $Q$  of a certain country is given by  $Q = 20x^{3/5}y^{2/5}$  billion dollars if  $x$  billion dollars are spent on labor and  $y$  billion dollars are spent on capital.
- Find the output of the country if it spends \$32 billion on labor and \$243 billion on capital.
  - Suppose that the output of the country is to be maintained at the level found in part (a). By how much should the amount spent on capital be changed if the amount spent on labor is increased by \$1 billion? What is the MRTS?

50. **VOLUME OF A CUBE** The volume  $V$  of a cube with sides of length  $x$  in. is changing with respect to time. At a certain instant of time, the sides of the cube are 5 in. long and increasing at the rate of 0.1 in./sec. How fast is the volume of the cube changing at that instant of time?

51. **OIL SPILLS** In calm waters, the oil spilling from the ruptured hull of a grounded tanker spreads in all directions.

52. **DISTANCE BETWEEN TWO SHIPS** Two ships leave the same port at noon. Ship  $A$  sails north at 15 mph, and Ship  $B$  sails east at 12 mph. How fast is the distance between them changing at 1 P.M.?

53. **OIL SPILLS** In calm waters, the oil spilling from the ruptured hull of a grounded tanker spreads in all directions. Assuming that the area polluted is circular, determine how fast the radius of the circle is changing when the area of the circle is  $1600\pi$  ft<sup>2</sup> and increasing at the rate of  $80\pi$  ft<sup>2</sup>/sec.

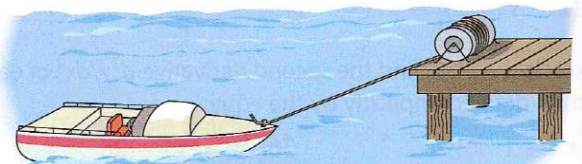
54. **DISTANCE BETWEEN TWO CARS** A car leaves an intersection traveling east. Its position  $t$  sec later is given by  $x = t^2 + t$  ft. At the same time, another car leaves the same intersection heading north, traveling  $y = t^2 + 3t$  ft in  $t$  sec. Find the rate at which the distance between the two cars will be changing 5 sec later.

55. **DISTANCE BETWEEN TWO CARS** A car leaves an intersection traveling west. Its position 4 sec later is 20 ft from the intersection. At the same time, another car leaves the same intersection heading north so that its position  $t$  sec later is  $t^2 + 2t$  ft from the intersection. If the speed of the first car 4 sec after leaving the intersection is 9 ft/sec, find the rate at which the distance between the two cars is changing at that instant of time.

56. **WATCHING A HELICOPTER TAKE OFF** At a distance of 50 ft from the pad, a man observes a helicopter taking off from a heliport. If the helicopter lifts off vertically and is rising at a speed of 44 ft/sec when it is at an altitude of 120 ft, how fast is the distance between the helicopter and the man changing at that instant?

57. **WATCHING A ROWING RACE** A spectator watches a rowing race from the edge of a river bank. The lead boat is moving in a straight line that is 120 ft from the river bank. If the boat is moving at a constant speed of 20 ft/sec, how fast is the boat moving away from the spectator when it is 50 ft past her?

58. **DOCKING A BOAT** A boat is pulled toward a dock by means of a rope wound on a drum that is located 4 ft above the bow of the boat. If the rope is being pulled in at the rate of 3 ft/sec, how fast is the boat approaching the dock when it is 25 ft from the dock?



59. **A MELTING SNOWBALL** Assume that a snowball is in the shape of a sphere. If the snowball melts at a rate that is proportional to its surface area, show that its radius decreases at a constant rate.

**Hint:** Its volume is  $V = (4/3)\pi r^3$ , and its surface area is