

adding a rectangular wading pool. Find the dimensions of the wading pool. (Hint: Area of a triangle =  $\frac{1}{2}bh$ , and area of a rectangle =  $lw$ .)

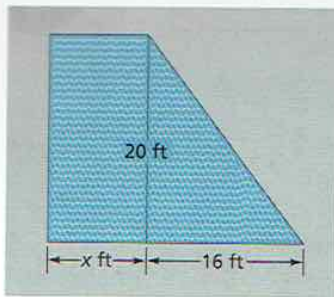


ILLUSTRATION 3

10. **House construction** A house builder wants to install two triangular windows with the dimensions shown in Illustration 4. What angles will he have to cut to make the windows fit? (Hint: The sum of the angles in a triangle equals  $180^\circ$ .)

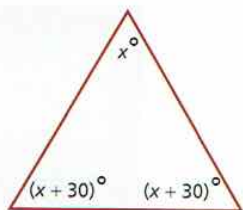


ILLUSTRATION 4

11. **Length of a living room** If a carpenter adds the porch with dimensions shown in Illustration 5 to the living room, the living area will be increased by 50%. Find the length of the living room.

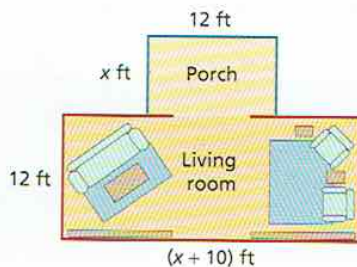


ILLUSTRATION 5

inches. Find the depth,  $d$ , of the trough. (Hint: Area of a trapezoid =  $\frac{1}{2}h(b + b')$ .)

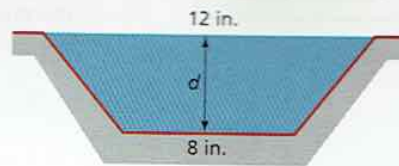


ILLUSTRATION 6

13. **Investment problem** An executive invests \$22,000, some at 7% and some at 6% annual interest. If he receives an annual return of \$1420, how much is invested at each rate?
14. **Financial planning** After withdrawing the money from her IRA (individual retirement account), a woman wants to invest enough money to have an annual income of \$5100. If she can invest \$20,000 at 9% annual interest, how much more will she have to invest at 7.5% to achieve her goal?
15. **Ticket sales** An adult ticket for a college basketball game costs \$2.50, and a student ticket costs \$1.75. If 585 tickets were sold, with total receipts of \$1217.25, how many tickets were student tickets?
16. **Ticket sales** Of the 800 tickets sold for a movie, 480 were adult tickets costing \$3 each. If the gate receipts were \$2080, what did a student ticket cost?
17. **Investment problem** A woman invests \$37,000, part at 8% and the rest at  $9\frac{1}{2}\%$  annual interest. The  $9\frac{1}{2}\%$  investment provides \$452.50 more income than the 8% investment. How much is invested at each rate?
18. **Investment problem** Equal amounts are invested at 6%, 7%, and 8% annual interest. The three investments yield a total of \$2037 annual interest. Find the total investment.
19. **Discount** After being discounted 20%, a radio sells for \$63.96. Find the original price.
20. **Markup** A merchant increases the wholesale cost of a washing machine by 30% to determine the selling price. If the washer sells for \$588.90, find the wholesale cost.
21. **Break-point analysis** A machine to mill a brass plate has a setup cost of \$600 and a unit cost of \$3 for each plate manufactured. A bigger machine has a setup cost

- of \$800 but a unit cost of only \$2 for each plate manufactured. Find the break point.
22. **Break-point analysis** A machine to manufacture fasteners has a setup cost of \$1200 and a unit cost of \$0.005 for each fastener manufactured. A newer machine has a setup cost of \$1500 but a unit cost of only \$0.0015 for each fastener manufactured. Find the break point.
  23. **Computer sales** A computer store has fixed costs of \$8925 per month and a unit cost of \$850 for every computer it sells. If the store can sell all the computers it can get for \$1275 each, how many must be sold for the store to break even? (*Hint*: The break-even point occurs when costs equal income.)
  24. **Restaurant management** A restaurant has fixed costs of \$137.50 per day and an average unit cost of \$4.75 for each meal served. If a typical check is \$6, how many customers must eat at the restaurant each day for the owner to make a profit?
  25. **Mowing lawns** If a woman can mow a yard with a lawn tractor in 2 hours, and her husband can mow the same lawn with a push mower in 4 hours, how long will it take to mow the lawn if they work together?
  26. **Filling a swimming pool** A garden hose can fill a swimming pool in 3 days, and a larger hose can fill the pool in 2 days. How long will it take to fill the pool if both hoses are used?
  27. **Filling a swimming pool** An empty swimming pool can be filled in 10 hours. When full, the pool can be drained in 19 hours. How long will it take to fill the empty pool if the drain is left open?
  28. **Preparing seafood** In his job as a seafood chef, Sam stuffs shrimp. He can stuff 1000 shrimp in 6 hours. When his sister helps him, they can stuff 1000 shrimp in 4 hours. If Sam gets sick, how long will it take his sister to stuff 500 shrimp?
  29. **Winterizing a car** A car radiator has a 6-liter capacity. If the liquid in the radiator is 40% antifreeze, how much liquid must be replaced with pure antifreeze to bring the mixture up to a 50% solution?
  30. **Mixing milk** If a bottle holding 3 liters of milk contains  $3\frac{1}{2}\%$  butterfat, how much skimmed milk must be added to dilute the milk to 2% butterfat?
  31. **Preparing solutions** A nurse has 1 liter of a solution that is 20% alcohol. How much pure alcohol must she add to bring the solution up to a 25% concentration?
  32. **Diluting solutions** If there are 400 cubic centimeters of a chemical in 1 liter of solution, how many cubic centimeters of water must be added to dilute it to a 25% solution? (*Hint*: 1000 cc = 1 liter.)
  33. **Cleaning a swimming pool** A swimming pool contains 15,000 gallons of water. How many gallons of chlorine must be added to "shock the pool" and bring the water to a  $\frac{3}{100}\%$  solution?
  34. **Mixing gasolines** A new automobile engine can run on a mixture of gasoline and a substitute fuel. If gas costs \$1.50 per gallon and the substitute fuel costs 40¢ per gallon, what percent of a mixture must be substitute fuel to bring the cost down to \$1 per gallon?
  35. **Evaporation** How many liters of water must evaporate to turn 12 liters of a 24% salt solution into a 36% solution?
  36. **Preparing medicine** A doctor prescribes an ointment that is 2% hydrocortisone. A pharmacist has 1% and 5% concentrations in stock. How much of each should the pharmacist use to make a 1-ounce tube?
  37. **Driving rates** John drove to a distant city in 5 hours. When he returned, there was less traffic, and the trip took only 3 hours. If John drove 26 miles per hour faster on the return trip, how fast did he drive each way?
  38. **Distance problem** Suzi drove home at 60 miles per hour, but her brother Jim, who left at the same time, could drive at only 48 miles per hour. When Suzi arrived, Jim still had 60 miles to go. How far did Suzi drive?
  39. **Distance problem** Two cars leave Pima Community College, traveling in opposite directions. One car travels at 60 miles per hour and the other at 64 miles per hour. In how many hours will they be 310 miles apart?
  40. **Bank robbery** Some bank robbers leave town, speeding at 70 miles per hour. Ten minutes later, the police give chase, traveling at 78 miles per hour. How long will it take the police to overtake the robbers?
  41. **Jogging problem** Two cross-country runners are 440 yards apart and are running toward each other, one at 8 miles per hour and the other at 10 miles per hour. In how many seconds will they meet?
  42. **Driving rates** One morning John drove 5 hours before stopping to eat. After lunch, he increased his speed by 10 miles per hour. He completed a 430-mile trip in 8 hours of driving time. How fast did he drive in the morning?

43. **Boating problem** A motorboat goes 5 miles upstream in the same time it requires to go 7 miles downstream. If the river flows at 2 miles per hour, find the speed of the boat in still water.
44. **Wind velocity** A plane can fly 340 miles per hour in still air. If it can fly 200 miles downwind in the same amount of time it can fly 140 miles upwind, find the velocity of the wind.
45. **Coin problem** A child has equal numbers of nickels, dimes, and quarters. If the coins are worth \$3.20, how many of each type are there?
46. **Coin problem** Maria has twice as many quarters as dimes. If all the dimes were quarters and all the quarters



In Exercises 49–50, use a calculator to solve each problem.

49. **Machine tool design** 712.51 cubic millimeters of material was removed by drilling the blind hole shown in Illustration 7. Find the depth of the hole. (*Hint:* The volume of a cylinder is given by  $V = \pi r^2 h$ .)
50. **Architecture** The Norman window with dimensions as shown in Illustration 8 is a rectangle topped by a semicircle. If the area of the window is 68.2 square feet, find its height  $h$ .

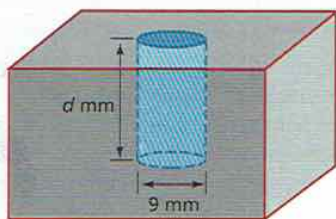


ILLUSTRATION 7

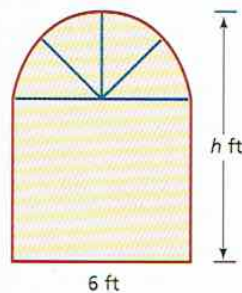


ILLUSTRATION 8

## 2.3

### QUADRATIC EQUATIONS

- Completing the Square
- The Quadratic Formula
- The Discriminant
- Formulas

Equations such as  $2x^2 - 11x - 21 = 0$  and  $3x^2 - x - 2 = 0$  are called **quadratic** or **second-degree** equations.