Problem Set 81

1. Use the formula PV = nRT to find the volume of 0.832 mole of gas at 3 atmospheres of pressure and a temperature of 400 K. (R = 0.0821)

2. Beth left port and sailed 10 miles on a heading of 217°. She then altered her course to sail 8 more miles on a heading of 227°. How far is she from port, and what is the heading from port to her location?

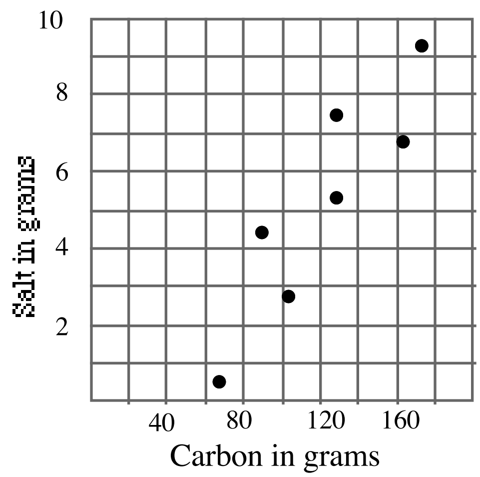
3. The container held 500 ml of a solution that was 52% water. How much water should be evaporated so that the solution that remained would be only 40% water?

4. The winner of the Great Snail Race managed an incredible 15 inches in 4 minutes. What was the snail's rate in miles per hour?

5. The curmudgeon chortled with glee when the results were announced because only 60% had made it. If 1120 had not made it, how many had tried?

6. Find an angle whose supplement is 30° greater than 4 times its complement.

7. Estimate the location of the "line of best fit" indicated by the data points shown. Then write the equation of the line that expresses salt as a function of carbon: S = mC + b

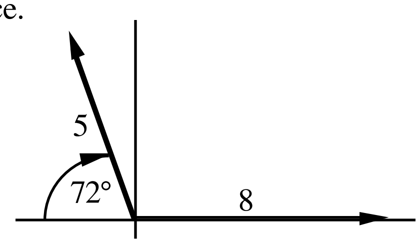


8. List three other polar forms of $6\angle 137°$.

9. Convert (–4, –1) to polar coordinates, and list four forms of the polar coordinates.

10. Add: (–5, –20°) + (4, 115°)

11. Two forces act on the point as shown. Find the resultant force.



12. Multiply: $(x^{1/2} + y^{1/2})(x^{1/2} - y^{-1/4})$

13. Divide $4x^3 - 2x + 3$ by $2x - 4$.

Solve the system in problems 14–16.

14. $\begin{cases} \frac{3}{2}x - \frac{1}{5}y = 28 \\ 0.02x + 0.4y = 4.4 \end{cases}$

15. $\begin{cases} 2x + y - z = 7 \\ x - 2y + z = -2 \\ 2y + z = 0 \end{cases}$

16. $\begin{cases} x + y + z = 7 \\ 2x - y - z = -4 \\ z = 2y \end{cases}$

Solve the equation in problems 17–19.

17. $3^{5x-2} = 9^{3x+7}$

18. $\sqrt[3]{8x - 2x^2} - x = 0$

19. $\sqrt{k - 24} = 6 - \sqrt{k}$

20. Find the antilogarithm:
 (a) base 6 of $-\frac{1}{2}$
 (b) of $\frac{2}{3}$ base 8
 (c) base 10 of 2.73

21. Estimate, and then evaluate each of the following:
(a) $\log 8.37$ (b) $\log 83.7$ (c) $\log 837$

22. Solve each logarithmic equation:
(a) $\log_4 1 = x$ (b) $\log_{16} x = -\frac{5}{4}$ (c) $\log_x 1 = 0$

23. Graph $\frac{(x-3)^2}{9} + \frac{(y-1)^2}{9} = 1$ and $(x-2)^2 + \frac{(y-2)^2}{36} = 1$ on the same set of axes. In how many points do these two conics intersect?

24. Find f^{-1} if $f(x) = 2^x + 1$. Graph both f and f^{-1} on the same set of axes.

25. Graph (a) $f(x) = \sqrt{x-3} - 1$, (b) $g(x) = (x-5)^3 + 1$, and (c) $h(x) = \sqrt[3]{x-1} + 3$ on the same set of axes.

Add in problems 26 and 27.

26. $\frac{3x-2}{x+4} - \frac{4x-3}{-4-x}$

27. $\frac{x}{x+y} + \frac{3}{x^2y} + \frac{2}{xy}$

28. Simplify: $\frac{3+4i}{3-3i}$

29. Use a calculator to simplify:
(a) (b) $7\sqrt[3]{5\sqrt{3}}$

30. Solve: $-4^2 - |-4+5|(x-3^0) - (-2x-5) = 8$

Problem Set 82

1. Use the relationship PV = nRT to find the number of moles in a quantity of an ideal gas when the temperature is 473 K, the pressure is 2 atmospheres, and the volume is 10 liters (R = 0.0821).

2. To arrive at the checkpoint in the orienteering race Juan determined that from the starting point he needed to proceed 875 meters on a heading of 105°, and then turn and go 1425 meters on a heading of 50°. How far is the checkpoint from the start, and what is the heading from the start to the checkpoint?

3. A quantity of an ideal gas was confined in a container whose volume was fixed at 4.5 liters. The initial pressure and temperature were 0.0036×10^{-2} newtons per square meter and 50×10^{7} K. If the temperature was changed to 40×10^{4} K, find the final pressure.

4. The total weight of the sodium monohydrogen phosphate, Na_2HPO_4, was 852 grams. What was the weight of the sodium (Na) in this amount of the compound? What percent by weight of the compound was sodium? (Na, 23; H, 1; P, 31; O, 16)

5. The faucet ran water at a rate of 9 liters per minute. How many cubic feet per hour would the same faucet run?

6. A circular cone whose radius is 3 meters has a volume of 15 m^3. Find the height of the cone.

Graph the system in problems 7 and 8. Tell how many points the graphs intersect in, and tell whether the system is consistent, inconsistent, or dependent.

7. $\begin{cases} y = \frac{1}{2}(x+1)^2 - 1 \\ (x+1)^2 + (y+4)^2 = 9 \end{cases}$

8. $\begin{cases} y = -2(x-1)^2 + 6 \\ (x-2)^2 + (y-1)^2 = 16 \end{cases}$

9. Graph $(x + 3)^2 + 5(y - 2)^2 = 20$. Write the equations that would be used to graph this conic on a graphing calculator. Use the calculator to find the zeros of the conic.

10. Use the quadratic formula to solve $0 = 2x^2 - 5x - 5$. Graph $y = 2x^2 - 5x - 5$ on a graphing calculator and find the zeros of the conic. How do the two sets of answers compare?

11. Solve $3x^2 + 1 = 4x$ by completing the square.

Use substitution to solve the system in problems 12 and 13. Determine whether the system is consistent, inconsistent, or dependent.

12. $\begin{cases} 3x - 5y = 11 \\ 2x - 4y = -6 \end{cases}$

13. $\begin{cases} 2x + 7y = 10 \\ 42y + 12x = 50 \end{cases}$

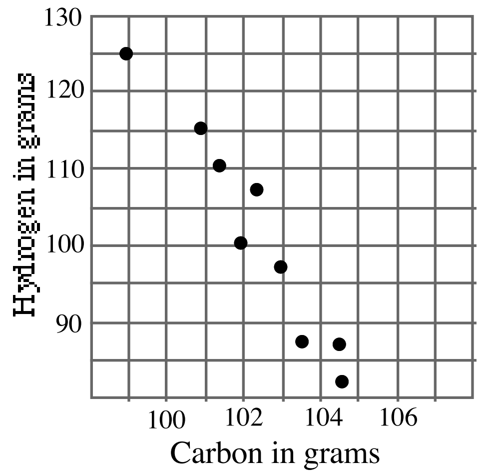
14. Solve: $\begin{cases} x - 2y - z = -9 \\ 2x - y + 2z = 7 \\ 3x - y = 0 \end{cases}$

15. Three students each measured one of 3 similar objects and record the lengths as 154 cm, 1.62 m, and 1430 mm. What is the average length of the 3 objects?

16. Begin with $ax^2 + bx + c = 0$ and develop the quadratic formula.

17. Let $f(x) = \sqrt{x} + 3$ and $g(x) = x + 3$.
    (a) Find the domain and range of f.
    (b) Find f(g(x)).
    (c) Graph f and f(g(x)) on the same set of axes.
    (d) Find the domain and range of f(g(x)).

18. Estimate the location of the "line of best fit" indicated by the data points shown. Then write the equation of the line that expresses hydrogen (H) as a function of carbon (C): $H = mC + b$



19. Convert (–2, –7) to polar coordinates, and list four forms of the polar coordinates.

20. Add: $-4\angle -30° + 6\angle -200°$

Solve the equation in problems 21–23.

21. $8^{2x^2-x+1} = 16^{2x^2-x-3}$

22. $\sqrt[3]{8x^2+18x+8} - 2 = x$

23. $\sqrt{s} = 4 - \sqrt{s+8}$

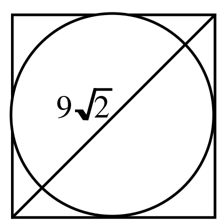
24. Find the antilogarithm:

(a) base 7 of 0 (b) of $\frac{3}{5}$ base 32 (c) base 10 of 1.47

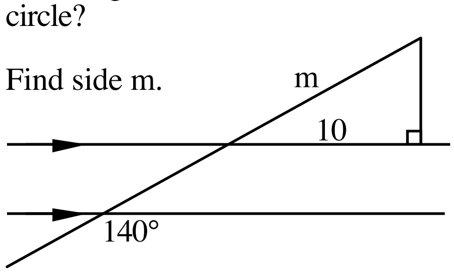
25. Estimate, and then evaluate each of the following:

(a) log 0.27 (b) log 27 (c) log 2700

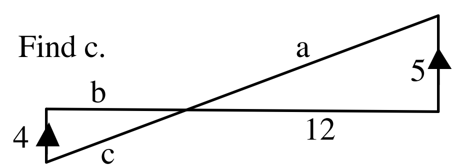
26. The diagonal of a square is $9\sqrt{2}$ meters, as shown. What is the length of one side of the square? What is the area of the square? What is the area of one of the triangles? What is the area of the circle?



27. Find side m.

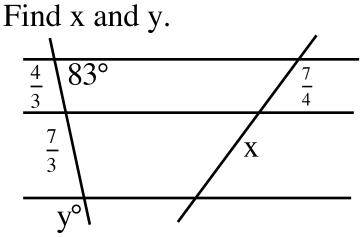


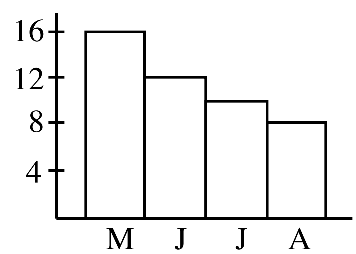
28. Find c.



29. The histogram below shows the number of games that Damon's favorite baseball team won in May June, July, and August. What is the average number of wins per month? If 20 games were played each month, what is the team's overall winning percentage?

30. Find x and y.





Problem Set 83

1. The rate of decomposition varied directly as the amount of substance present. When the amount was 5 kilograms, the rate was 0.005 kilograms per second. What was the rate of decomposition when the amount was 0.3 kilogram? Use the ratio method.

2. The number of revolutions per minute (RPM) varies inversely as the number of teeth in the gear. If 60 teeth result in 150 RPM, what would be the RPM if the gear had 100 teeth? Use the constant method.

3. Blues vary inversely as yellows squared. If 100 blues go with 3 yellows, how many blues go with 10 yellows?

4. Use the formula $PV = nRT$ to find the volume of 0.0163 mole of ideal gas at 10 atmospheres of pressure and a temperature of 870 K ($R = 0.0821$).

5. The first part of the trip was in a surrey at 8 mph and the last part was in a buckboard at 12 mph. If the total trip was 104 miles and took 10 hours, how much of the trip was made in each type of carriage?

6. Millsap observed that 4 times the number of igneous rocks exceeded 8 times the number of sedimentary rocks by 80. He also noted that 10 times the number of sedimentary rocks exceeded the number of igneous rocks by 140. How many rocks were igneous, and how many were sedimentary?

7. There were 10 students huddled in a mass. How many different ways could 5 students at a time stand in a line?

Graph the system in problems 8 and 9. Tell how many points the graphs intersect in, and tell whether the system is consistent, inconsistent, or dependent.

8. $\begin{cases} y = x \\ \dfrac{(x-1)^2}{16} + \dfrac{(y-2)^2}{4} = 1 \end{cases}$

9. $\begin{cases} (x+3)^2 + (y+1)^2 = 9 \\ \dfrac{(x+3)^2}{9} + \dfrac{(y+1)^2}{9} = 1 \end{cases}$

10. Graph (a) $f(x) = 3^x$, (b) $g(x) = e^x$, and (c) $h(x) = -e^x$ on the same set of axes.

11. Solve $2x^2 + 5x - 4 = 0$. Then graph $y = 2x^2 + 5x - 4$ on a graphing calculator and find the zeros.

12. The center of a conic is the point $(3, -2)$. The major axis is vertical and 12 units long. The minor axis is 6 units long. Find the standard equation of this conic.

13. The center of a circle is the point $(2, -3)$, and the circle passes through the point $(5, 1)$. Find the standard equation of the circle, and the equations that would be used to graph this conic on a graphing calculator. (HINT: find the distance between the points.)

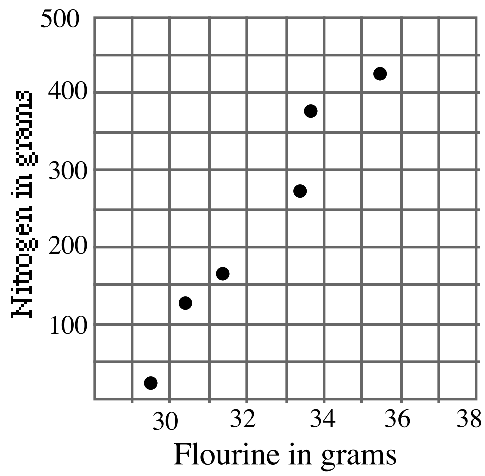
14. Use substitution to solve: $\begin{cases} 2x + 3y = -7 \\ 3x - 4y = 15 \end{cases}$

Solve the system in problems 15 and 16.

15. $\begin{cases} 2x - 3y + 2z = 3 \\ x - y - 2z = -6 \\ 3x - y = 0 \end{cases}$

16 $\begin{cases} \dfrac{2}{7}x - \dfrac{1}{6}y = 1 \\ 0.3x + 0.07y = 0.84 \end{cases}$

17. Estimate the location of the line indicated by the data points and write the equation that gives nitrogen (N) as a function of fluorine (F): N = mF + b



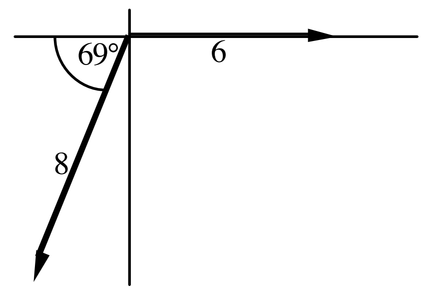
Solve the equation in problems 18 and 19.

18. $9^{7-4x} = 27^{3x+5}$

19. $\sqrt{p+20} + \sqrt{p} = 10$

20. Add: (4, 60°) – (6, –200°)

21. Two forces are applied to an object as indicated. Find the resultant force on the object.



22. Which of the following sets of ordered pairs are functions?
(a) (4, 2), (2, 4), (5, 7), (7, 5)
(b) (4, –2), (–2, 6), (5, 7), (7, –5)
(c) (–4, 2), (5, 3), (–4, 7), (3, 5)

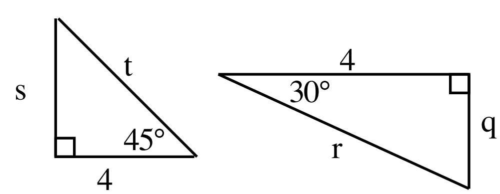
23. Find the antilogarithm:
(a) base 9 of 0 (b) of $\dfrac{4}{3}$ base 27
(c) base 10 of 2.34

24. Estimate, and then evaluate each of the following:
(a) log 0.029 (b) log 2.9 (c) log 290

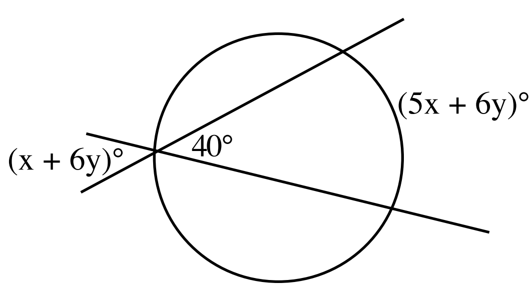
25. Solve each of the following equations:
(a) $\log_x 8 = \dfrac{3}{2}$ (b) $\log_{81} x = \dfrac{5}{4}$ (c) $\log_{125} 25 = x$

26. Find x: $\dfrac{a}{c+x} = m\left(\dfrac{1}{r} + \dfrac{1}{t}\right)$

27. Find all the missing sides:



28. Solve for x and y.



Simplify the expression in problems 29 and 30.

29. $\left(\sqrt[3]{x^2 y}\right)^4$

30. $3i^7 + 4i^5 - 5i^2 + 3\sqrt{-9} - 2i^{143}$

Problem Set 84

1. The number of victories varied inversely as the skill of the opponents. The team won 8 games when the opponents had a skill factor of 2. How many victories could be expected when the opponent's average skill factor was 8? Use the ratio method.

2. Odysseus found that his troubles varied directly as his distance from his home island of Ithaca. If he had 20 troubles when he was 400 miles from home, how many troubles did he have when he was only 60 miles from home? Use the constant method.

3. Use $PV = nRT$ to find the number of moles of ideal gas that has a volume of 6 liters, a pressure of 1.7 atmospheres, and a temperature of 300 K.

4. Two containers are on the shelf. The first one contains a 30% iodine solution and the other contains an 80% iodine solution. How much of each should be used to get 50 liters of a solution that is 40% iodine?

5. Blake loved black jelly beans. He saw that only 4 of the 20 jelly beans in the candy bowl were black. If he reached in and randomly took two jelly beans, what was the probability that they were both black?

6. Four of the five starters on the basketball team had heights of 5'9", 5'11", 6'1", and 6'2". If the starting line-up had an average height of 6'2", what was the height of the fifth starter? (HINT: begin by converting the measurements to inches.)

7. Without using a calculator, compute each of the following:
   (a) ${}_8P_5$ (b) ${}_8C_5$ (c) ${}_{10}C_8$

8. Compute each of the following:
   (a) ${}_{30}P_{10}$ (b) ${}_{30}C_{10}$ (c) ${}_{30}C_{20}$

9. There are twenty students in a room, and in the room are 5 chairs in a row. How many different ways could these students sit in the chairs, if only one student is allowed per chair?

10. There are twenty students in a room, and in the room are 5 chairs in a row. The chairs are to be filled by a leadership committee of 5 students. How many different leadership committees are possible?

11. Graph the following system. How many points do the graphs intersect in? Is this a consistent, inconsistent, or dependent system?

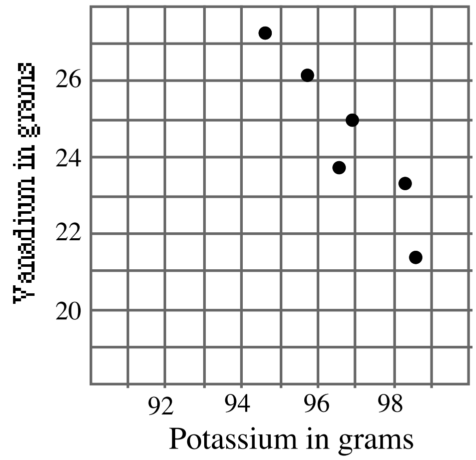
$$\begin{cases} (x-4)^2 + (y+3)^3 = 9 \\ \dfrac{(x-2)^2}{25} + \dfrac{(y+3)^2}{4} = 1 \end{cases}$$

12. Graph (a) $f(x) = 2^x$, (b) $g(x) = \log_2 x$, and (c) $h(x) = e^x$ on the same set of axes.

13. Graph (a) $f(x) = -\frac{2}{3}x + 2$, (b) $g(x) = -\frac{2}{3}x^2 + 2$, and (c) $h(x) = \sqrt{x+3} - 3$ on the same set of axes.

14. Graph $f(x) = \dfrac{1}{x+3} - 2$ and find $f^{-1}(x)$.

15. Estimate the location of the line indicated by the data points and write the equation that gives vanadium (V) as a function of potassium (K): $V = mK + b$



Solve the system in problem 16 and 17.

16. Use substitution: $\begin{cases} 5x - 3y = 0 \\ 3x - 2y = -4 \end{cases}$

17. $\begin{cases} x + y + z = 8 \\ 2x - 3y - z = -6 \\ 2x - z = 0 \end{cases}$

Solve the equation in problems 18 and 19.

18. $4^{-8x} = 64^{x^2 - 1}$

19. $\sqrt[3]{4x - 8} - x + 2 = 0$

20. Add: $-30\angle -20° + 5\angle 70°$

21. Add: $\dfrac{4}{x^2} - \dfrac{2}{-x(x-3)} + \dfrac{5x}{3 - x}$

22. First use the discriminant to determine the number and type of solution that $-2x^2 - x = 3$ has, then solve the equation.

23. Find the equation of the line that passes through (–4, 5) and which is perpendicular to $2x - 5y = 7$.

Simplify the expression in problems 24–28.

24. $\left(2 + 3\sqrt{20}\right)\left(4 - 4\sqrt{45}\right)$

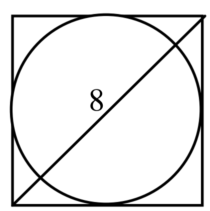
25. $\sqrt{-3}\sqrt{-12} + 3i^2 + (2 + 4i)(3i - 5)$

26. $\dfrac{\left(x^2\right)^{a+b} x^{-2a+b} y^a}{y^{a/4}}$

27. $\dfrac{p}{x - \dfrac{xp}{1 - \dfrac{p}{x}}}$

28. $4\sqrt{8\sqrt[3]{16}}$

29. A circle is inscribed in a square whose diagonal has a length of 8 inches. Find the perimeter and the area of the square and the circle.



30. Solve: $-[-2 - 3(x - 2^2)] - 3(2x - 5^0) = 7 - 2(2x + 2)$

Problem Set 85

1. The weight of the carbon varied inversely as the total weight of the fluorine. The carbon weighed 300 grams when the fluorine weighed only 2 grams. What was the weight of the carbon when the fluorine weighed 0.5 gram? Use the constant method.

2. The weight of the silicon varied directly as the weight of the phosphorus. When the silicon weighed 400 kilograms, the phosphorus weighed only 100 kilograms. What was the weight of the silicon when the phosphorus weighed only 12 kilograms? Use the ratio method.

3. The temperature of a quantity of an ideal gas was held constant at 1400 K. If the pressure of 1200 newtons per square meter was increased to 1600 newtons per square meter, what was the final volume if the volume was initially 200 ml?

4. Lothario looked for consecutive odd integers. He wanted three, such that the product of the first and the third was 25 less than the product of 10 and the opposite of the second. What integers did he want?

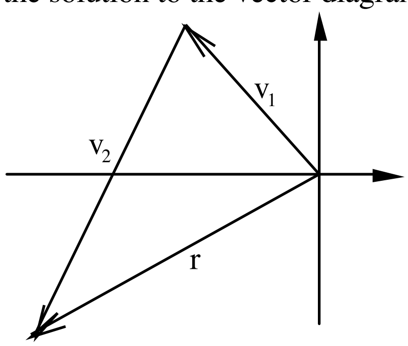
5. Without using a calculator, compute each of the following:
   (a) ${}_6P_4$ (b) ${}_6C_4$ (c) ${}_{10}C_7$

6. How many different ways can a committee of 4 people be formed from a group of 15 people?

7. There were 12 players on the team. On picture day they decided to take pictures in groups of 7. How many pictures were possible, so that no two pictures had all the same players in them?

Estimate the solution to the vector diagram in problems 8 and 9. Use a scale of 1 cm = 1 unit.

8.



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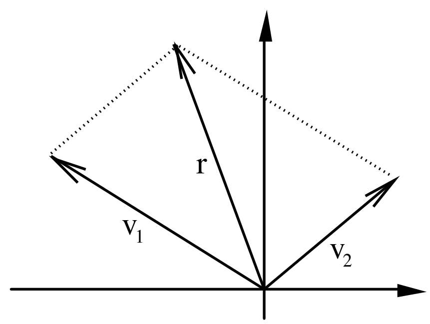
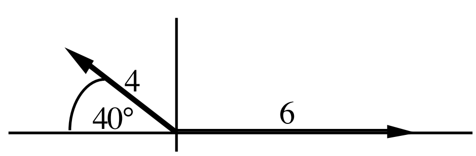


10. Draw a head-to-tail vector diagram to estimate the solution to (4, 30°) + (5, 150°).

11. Add: $-7\angle 76° + 11\angle -53°$

12. Two forces are applied on an object as indicated. Find the resultant force on the object.



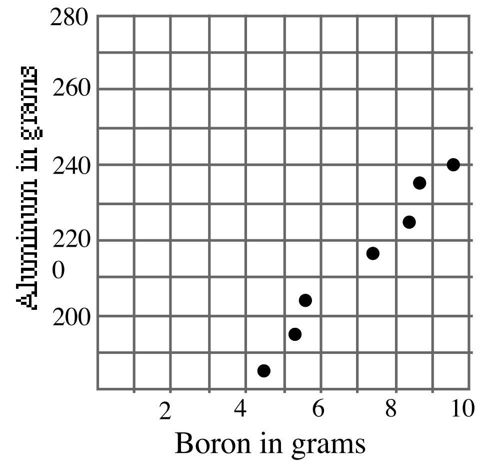
13. Write 3 other polar forms of $7\angle 57°$.

14. Graph the following system. In how many points do the graphs intersect? Is this a consistent, inconsistent, or dependent system?

$$\begin{cases} y = -2(x-5)^2 + 6 \\ \dfrac{(x-5)^2}{4} + (y+2)^2 = 1 \end{cases}$$

15. Estimate the location of the line indicated by the data points and write the equation that expresses aluminum (Al) as a function of boron (B): Al = mB + b

16. Use the equation found above to predict the amount of boron if there are 180 grams of aluminum, and the amount of aluminum if there are 10 grams of boron.



17. Find the antilogarithm:
    (a) base 8 of $-\frac{5}{3}$ (b) of $\frac{3}{5}$ base 32
    (c) base 10 of 3.19

18. Estimate, and then evaluate each of the following:
    (a) log 0.0057 (b) log 0.57
    (c) log 57

19. Use substitution to solve $\begin{cases} 3x + 2y = 5 \\ 5x + 6y = 7 \end{cases}$.

Solve the system in problems 20 and 21.

20. $\begin{cases} x + 2y - 3z = 5 \\ 2x - y - z = 0 \\ y - 3z = 0 \end{cases}$

21. $\begin{cases} \frac{3}{8}x - \frac{1}{4}y = -2 \\ 0.012x + 0.02y = 0.496 \end{cases}$

22. Solve: $4^{x^2+2x} = 32^{x^2-3}$

23. Add: $\frac{2x+3}{x-a} - \frac{4}{a-x}$

24. Natural gas flowed through the pipeline at a rate of 100 cubic feet per second. Convert this flow rate to cubic centimeters per minute.

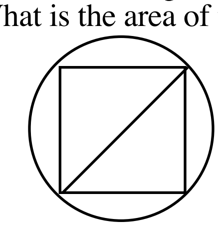
25. Use a graphing calculator to find the zeros of $y = 0.03(x - 4)^2 - 20$.

26. Begin with $ax^2 + bx + c = 0$ and derive the quadratic formula by completing the square, and then solve $-2x^2 + 1 = 6x$.

27. Are there any outliers in the following set of data? Explain why you gave the answer that you did. 12, 17, 1, 19, 38, 22, 14

28. Let $f(x) = |x| - 2$, and $g(x) = x + 4$.
    (a) Find the domain and range of g.
    (b) Find $(f \circ g)(x)$ and graph $(f \circ g)(x)$.
    (c) Find the domain and range of $(f \circ g)(x)$.

29. A square is inscribed in a circle whose area is 25π m^2. What is the radius of the circle? What is the length of a diagonal of the square? What is the length of a side of the square? What is the area of the square?



30. Simplify: $\frac{4 - \sqrt{2}\,i}{3 + \sqrt{2}\,i}$

Problem Set 86

1. Assuming anyone can play any position, how many different 5 person teams can be formed from a 10 player roster?

2. Monkeys varied directly as turtles squared. When there were 2 turtles, there were 100 monkeys. How many monkeys were there when there were 5 turtles?

3. The total weight of the carbonic acid, H_2CO_3, was 372 grams. What was the weight of the carbon (C) in this amount of acid, and what percent by weight of the acid is carbon? (H, 1; C, 12; O, 16)

4. After the count was completed and the tally made, the observers were amazed to find that only 0.14 of the ducks were ring-necked. If 120,000 ducks were tallied, how many were ring-necked?

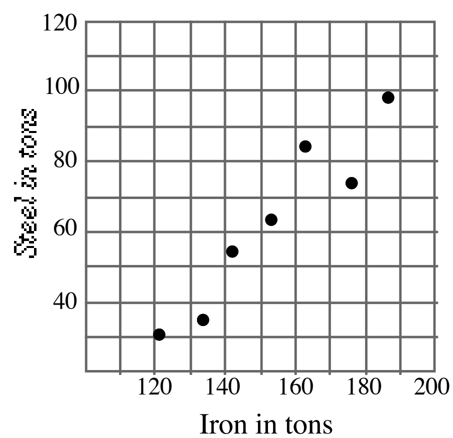
5. The base of a right prism that is 4 feet tall is a 45-45-90 triangle that has sides that are 8 inches in length. Find the volume and surface area of the prism.

6. The mean of five numbers is 9. Four of the numbers are 2, 1, 6, and 13. What is the fifth number, and what is the median?

7. Find the equation of the line that passes through (7, 2) and is parallel to the line $4x - 6y = 25$.

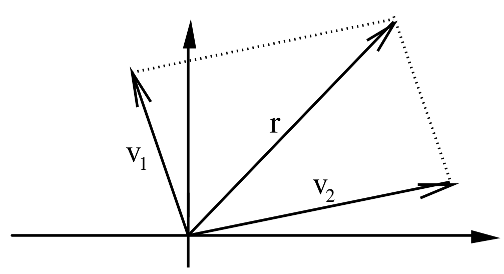
8. Find the line of best fit associated with the following set of ordered pairs:
   (–4.1, 2.7), (–2.9, 2.3), (–1.7, 0.7), (0, –0.2), (2.1, –0.5), (3.8, –2.4)

9. Estimate the location of the line indicated by the data points and then write the equation that expresses steel (S) as a function of iron (I): $S = mI + b$



10. Estimates of the data points on the scatter plot at the right are (122, 31), (134, 35), (143, 54), (154, 64), (164, 85), (177, 74), (187, 98). Use these estimates to find the linear regression model for this data. Compare this equation to the one obtained in problem 9.

11. Estimate the solution to the vector diagram. Use a scale of 1/4 inch = 1 unit.



12. Draw a head-to-tail vector diagram to estimate the solution to $5\angle 35° + 6\angle 140°$.

13. Add: $(-10, -40°) + (10, -220°)$

14. Simplify: $-\sqrt{-2}\sqrt{-2} + 2i^3 - i^2 + (4i - 2)(2i - 4)$

15. Without using a calculator, compute each of the following:
    (a) ${}_{10}P_8$ (b) ${}_{10}C_8$ (c) ${}_{15}C_{12}$

16. Solve each of the following logarithmic equations:

(a) $\log_x \frac{1}{2} = -\frac{1}{2}$ (b) $\log_4 x = -3$ (c) $\log_5 625 = x$

17. Graph (a) $f(x) = -2^x$, (b) $g(x) = -\log_2 x$, and (c) $h(x) = 2^x + 2$ on the same set of axes.

18. Graph (a) $f(x) = e^x$, (b) $g(x) = e^{x+3}$, and (c) $h(x) = e^x + 3$ on the same set of axes.

Add the expressions in problems 19 and 20.

19. $\frac{x+4}{x^2+2x-3} - \frac{2}{1-x}$

20. $\frac{x-3}{x^2-x-12} - \frac{x+2}{-3-x}$

21. Graph the system below. In how many points do the graphs intersect? Is this a consistent, inconsistent, or dependent system?

$$\begin{cases} (x-1)^2 + (y-2)^2 = 9 \\ \frac{(x-1)^2}{36} + \frac{(y-2)^2}{9} \end{cases}$$

22. Use substitution to solve: $\begin{cases} 3x + 2y = 7 \\ 4x - 5y = -6 \end{cases}$

23. Solve the following system: $\begin{cases} 2x - 2y - z = 16 \\ 3x - y + 2z = 5 \\ -y + 3z = 0 \end{cases}$

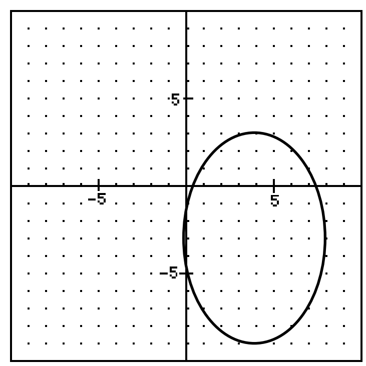
24. Solve by mechanically graphing: $\begin{cases} 2x - 5y = -15 \\ 3x + 4y = -4 \end{cases}$

Solve the equations in problems 25 and 26.

25. $27^{x^2+2} = 81^{x^2-2x}$

26. $\sqrt{p-48} = 12 - \sqrt{p}$

27. Find the standard equation of the conic whose graph is shown.



28. Write the equations that would be used to graph the conic of problem 27 on a graphing calculator. Find the zeros of this conic.

29. Find the standard equation of the origin centered circle that passes through the point (–5, 12).

30. Find t: $\frac{a}{c+x} = m\left(\frac{1}{r} + \frac{1}{t}\right)$

Problem Set 87

1. The varsity volleyball team has 12 girls on the roster. Only 6 girls can play at a time. How many different ways could the coach choose 6 girls from the 12 on the roster?

2. The number of folk dancers needed at the festival varied directly as the number of people who attended the festival. When 4800 attended, 240 dancers were needed. How many attended the festival if 600 dancers were needed? Use the constant method.

3. The number of macaws varied inversely as the number of apes squared. When there were 4 macaws, there were 10 apes. How many macaws were there when there were only 2 apes? Use the ratio method.

4. There were 100 liters of a solution that was 50% alcohol in the container. How many liters of a 20% solution should be added to reduce the concentration of the solution in the container to 23% alcohol?

5. In a group of athletes 15 were runners, 10 were swimmers, and some did both. Six of the athletes confessed that they only swan. Draw a Venn diagram that shows this information. If one athlete is randomly chosen from this group, what is the probability that athlete will be strictly a runner?

6. The tank was leaking water at a rate of 10 liters per hour. Convert this rate of leakage to cubic inches per minute.

7. Arrange the following lengths in order from shortest to longest: 1.4 mi, 34920 cm, 2254 m

8. Solve these logarithmic equations:
   (a) $\log_2 x = \log_2 4$
   (b) $\log_3 (x + 1) = \log_3 (2x)$
   (c) $\log_b (3n) = \log_b (n + 2)$

9. Evaluate these logarithmic expressions:
   (a) $\log_7 7^3$
   (b) $\log_8 8^5$
   (c) $\log_b b^x$

10. Compare the strengths of two earthquakes that have the given Richter ratings:
    (a) 7 and 6 (b) 5 and 3 (c) 8 and 5

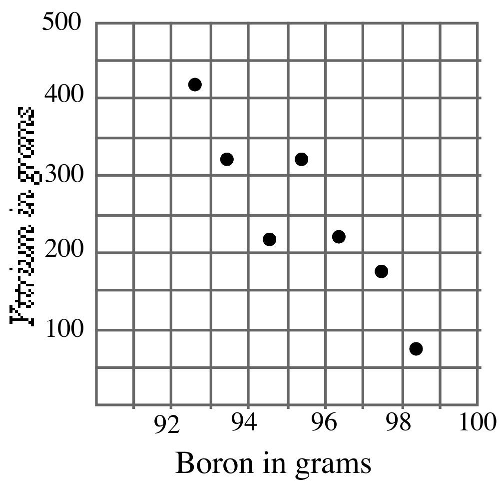
11. Find the pH of a solution that has the following $[H^+]$ (a) 0.01 (b) 0.000004

12. Find the $[H^+]$ in a solution that has the following pH: (a) 1.5 (b) 8.95

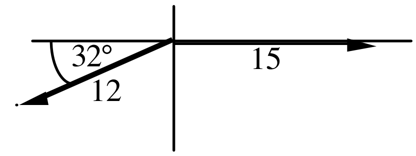
13. Estimate the location of the line indicated by the data points and then write the equation that expresses yttrium as a function of boron:
    $$Y = mB + b$$

14. Estimates of the data points on the scatter plot at the right are (92.6, 420), (93.4, 320), (94.5, 220), (95.4, 325), (96.4, 220), (97.5, 175), (98.4, 75). Use these estimates to find the linear regression model for this data.

15. Draw a parallelogram vector diagram to estimate the solution to $(6, 40°) + (8, 160°)$.



16. Two forces are applied to the point as indicated. Find the resultant force.



17. Add: $-6\angle -150° + 4\angle 20°$

Add the expressions in problems 18 and 19.

18. $\dfrac{5x+2}{x^2+3x-10} - \dfrac{2x}{2-x}$

19. $\dfrac{-7}{-x+3} - \dfrac{2x}{x^2-9}$

20. Without using a calculator, evaluate each of the following:
(a) ${}_{12}P_9$ (b) ${}_{12}C_9$ (c) ${}_{10}C_7$

21. Graph the following system. In how many points do the graphs intersect? Is this system consistent, inconsistent, or dependent?

$$\begin{cases} (x-3)^2 + (y+2)^2 = 25 \\ \dfrac{(y+2)^2}{25} + \dfrac{(x-3)^2}{25} = 1 \end{cases}$$

22. Let $f(x) = (x + 1)^3 + 2$. Find $f^{-1}(x)$, and graph both f and f^{-1} on the same set of axes.

23. Use a graphing calculator to find all the roots of $y = x^3 - 3x^2 - 2x - 0.31$.

24. Use the discriminant to determine the number and type of solutions that $-3x^2 - 4 = 2x$ has. Then solve the equation.

25. Solve: $\begin{cases} 2x + 3y - z = -3 \\ x + 2y = 0 \\ x - 2y + z = -2 \end{cases}$

26. Solve: $4^{4x-7} = 8^{2x+5}$

27. Multiply: $(x^{1/3} + y^{2/3})(x^{2/3} + y^{1/3})$

Simplify the expression in problems 28–30.

28. $\dfrac{5i-2}{-1-i}$

29. $9\sqrt{27\sqrt[3]{3}}$

30. $\dfrac{-9^{-3/2}}{-(-27)^{-2/3}}$

Problem Set 88

1. The 1906 San Francisco earthquake measured 8.3 on the Richter scale. The 1964 Alaskan earthquake was rated 8.4. How many times more powerful was the Alaskan earthquake?

2. There were 20 guys on the tennis team. Only 11 play in a match. How many different ways could the coach make a team of 11 players from the 20 on the roster?

3. The initial pressure, volume, and temperature of a quantity of an ideal gas were 700×10^5 newtons per square meter, 700×10^{-5} liter, and 56×10^4 K. What would be the final volume if the pressure was changed to 3500×10^4 newtons per square meter, and the temperature was changed to 8000×10^5 K?

4. The laboratory assistant stumbled upon a container of methyl bromide, CH_3Br. If the methyl bromide weighed 950 grams, what did the bromine (Br) weigh? What percent by weight of the methyl bromide is the bromine? (C, 12; H, 1; Br, 80)

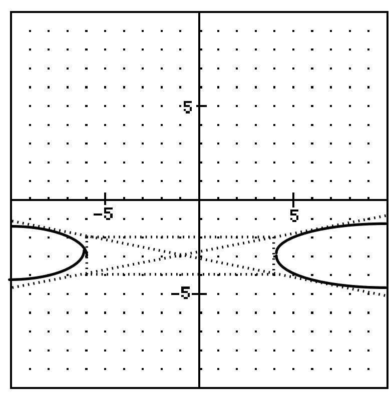
5. The large plane could travel 3000 miles in 1 more hour than it took the small plane to cover 800 miles. If the rate of the large plane was 3 times the rate of the small plane, find the rates and the times of both.

6. Graph $\frac{y^2}{4} - \frac{x^2}{16} = 1$ and find the equations of the asymptotes.

7. Graph $25x^2 - 9y^2 = 225$.

8. Graph $\frac{(y+2)^2}{4} - \frac{(x-2)^2}{9} = 1$ and find the equations of the asymptotes.

9. Find the standard equation of the graph shown at the right.



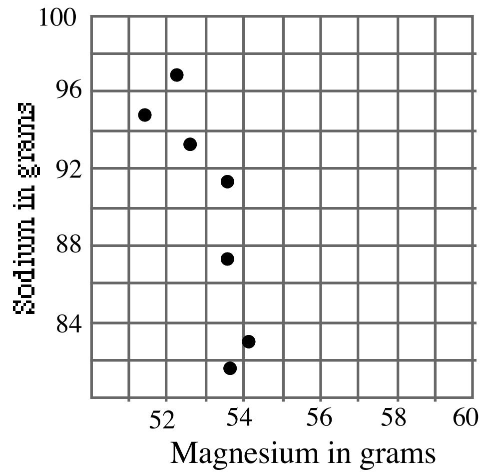
10. Solve: (a) $\log_4 (2x + 3) = \log_4 (4x - 5)$
    (b) $\log_3(3x^2 - 8) = \log_3(x - 6)$

11. Evaluate: (a) $\log_7 7^6$ (b) $\log_e e^x$

12. Find the pH of a solution if its $[H^+]$ is 8.6×10^{-13}.

13. Estimate the location of the line indicated by the data points and then write the equation that expresses sodium (Na) as a function of magnesium (Mg):

$$Na = mMg + b.$$



14. Estimates of the data points on the scatter plot at the right are (51.4, 94.8), (52.3, 96.6), (52.6, 93.2), (53.6, 91.2), (53.6, 87.2), (53.7, 81.4), (54.3, 82.9). Use these estimates to find the linear regression model.

15. Add: (–20, –200°) + (30, –30°)

16. Write 3 other polar forms of $-3\angle -137°$.

17. Draw a head-to-tail vector diagram of $3\angle 220° + 6\angle 70°$, and then use the diagram to estimate the solution.

18. Graph (a) $f(x) = e^x$, (b) $g(x) = -e^x$, and (c) $h(x) = e^{x+4}$ on the same set of axes.

19. Use substitution to solve: $\begin{cases} 3x - 5y = 11 \\ 2x - 4y = 6 \end{cases}$

20. Solve: $\begin{cases} \frac{2}{7}x - \frac{2}{5}y = 0 \\ 0.2x - 0.04y = 2.4 \end{cases}$

21. Solve: $\begin{cases} 3x - y - 2z = -6 \\ 2x - y + z = 2 \\ -y + z = 0 \end{cases}$

Graph the system in problems 22 and 23. Tell how many points the graphs intersect in. Determine whether the system is consistent, inconsistent, or dependent.

22. $\begin{cases} y = 2(x-3)^2 - 5 \\ y = \frac{1}{x} \end{cases}$

23. $\begin{cases} (x+2)^2 + (y-5)^2 = 36 \\ \frac{(x+2)^2}{64} + \frac{(y-7)^2}{9} = 1 \end{cases}$

24. Solve: $\sqrt{2x^2 + 4x + 30} + 3 = x$

25. Use the quadratic formula to solve $-3x^2 + 1 = 6x$.

26. Add: $\frac{7x+2}{x^2 - 2x - 15} - \frac{2}{5-x}$

27. Without using a calculator, evaluate each of the following: (a) ${}_8P_6$ (b) ${}_8C_6$ (c) ${}_{12}C_9$

28. Estimate $\frac{5712 \times 10^{-2}}{0.0416 \times 10^{3}}$, and then use a calculator to get a more precise answer.

29. Find the standard deviation of the following set of data: 15, 19, 23, 29, 31, and 33

30. Simplify: $\sqrt[3]{16} + \sqrt[4]{16} + \frac{4}{\sqrt[3]{4}}$

Problem Set 89

1. The menu at the local pizza parlor listed 12 toppings for a pizza. Darrell and Katie had only enough money for a 4 topping pizza. How many different pizzas did they have to choose from to make their order?

2. The time to complete the job varied inversely as the number of men working. When 500 men worked, the job could be completed in 10 days. How long would 200 men take to complete the same job?

3. Find three consecutive even integers such that 4 times the product of the first and the third is 28 greater than the product of –10 and the sum of the second and the third.

4. Oedipus beat Rex to the finish line by 4000 feet. If Rex ran at 20 feet per second and Oedipus ran at 40 feet per second, what was the length of the race course?

5. When Cruella peered through the crack, she could see that the number of spotted puppies had increased 640 percent. If she could now see 592 spotted puppies, how many spotted puppies had she seen previously?

6. Solve $\begin{cases} 2x - 3y = -2 \\ 4x + 5y = 7 \end{cases}$ by using substitution.

Solve the system in problems 7 and 8 without using a graphing calculator.

7. $\begin{cases} BT_D + 6T_D = 24 \\ BT_D - 6T_D = 12 \end{cases}$

8. $\begin{cases} x^2 + y^2 = 16 \\ 2x - y = 4 \end{cases}$

Solve the system in problems 9 and 10 by using a graphing calculator.

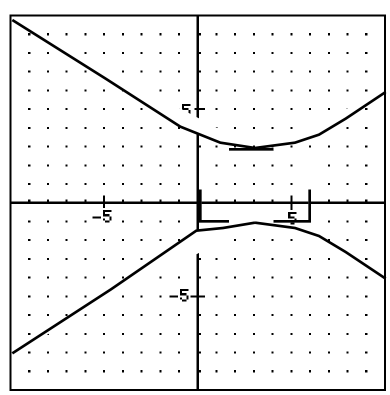
9. $\begin{cases} 4x + y = 8 \\ y = (x-3)^2 - 10 \end{cases}$

10. $\begin{cases} 2x - y = 7 \\ (x-3)^2 + (y-3)^2 = 16 \end{cases}$

11. Graph $(x+4)^2 - \dfrac{(y+1)^2}{9} = 1$ and find the equations of the asymptotes.

12. Write the equations that would be used to graph the hyperbola in problem 11 on a graphing calculator. Graph this equation on a graphing calculator. Graph the asymptotes that you found in problem 11 on the same screen. (You will have graphed a total of 4 functions on the same screen when you are completed with this problem.)

13. Find the standard equation of the graph shown at the right.



14. Solve: $\log_8(2x^2 + 3x) = \log_8(4x + 3)$

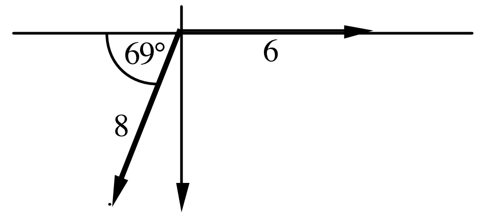
15. Find the $[H^+]$ of a solution if the pH of the solution is 5.78.

16. Solve: $3^{2x^2+7} = 27^{x^2-6}$

17. Add: $\dfrac{2}{4-x} - \dfrac{3}{x^2-16}$

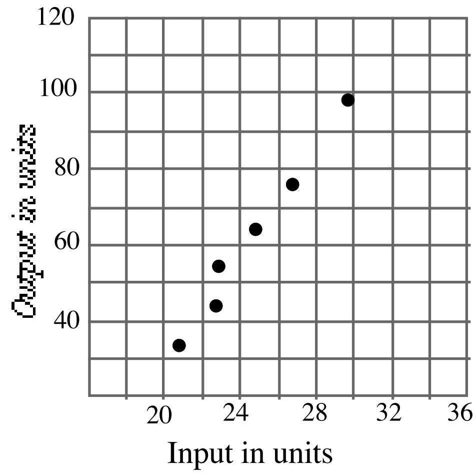
18. Draw a parallelogram vector diagram to estimate $(-4, -170°) + (4, -290°)$.

19. Two forces are applied to a point as indicated. Estimate the resultant force, and then calculate the resultant force.



20. Add: $4\angle 40° - 6\angle -120°$.

21. Draw the line suggested by the data points, and write the equation that expresses output as a function of input.



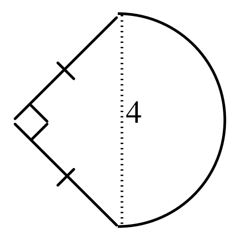
22. Estimates of the data points on the scatter plot at the right are (21, 34), (23, 44), (23, 53), (25, 64), (27, 76), and (30, 97). Use these estimates to find the linear regression model.

23. Graph (a) $f(x) = -2^x$, (b) $g(x) = 2^{x+3}$, and (c) $h(x) = 2^x + 3$ on the same set of axes.

24. Graph (a) $f(x) = \log_2 x$, (b) $g(x) = \log_5 x$, and (c) $h(x) = \log_2 x + 4$ on the same set of axes.

The figure at the right is the base of a right cylinder that is 8 cm tall.

25. Find the volume of the cylinder. The dimension given is measured in cm.



26. Find the surface area of the cylinder.

27. Find R_2: $\frac{a}{x} = m\left(\frac{a}{R_1} + \frac{b}{R_2}\right)$

Simplify the expression in problems 28–30.

28. $\frac{2 - 3i}{4i - 1}$ 29. $\frac{x^a y^{2b} (x^{a+2})^{1/2}}{y^{3b}}$ 30. $3\sqrt{\frac{3}{8}} + 4\sqrt{\frac{8}{3}} - 2\sqrt{24}$

Problem Set 90

1. Dana had 12 books that she wanted to read. When leaving for Spring Break her mother told her there was only room of 4 books in the suitcase. How many different combinations of books could Dana take with her?

2. The discipline quotient varied inversely as the square of the number of unruly students. If the discipline quotient was 300 when the number of unruly students totaled 5, what was the discipline quotient when the number of unruly students totaled 10?

3. The solution needed to be exactly 36% arsenic. Two solutions were available. One was 60% arsenic, and the other was only 20% arsenic. How much of each should be used to get 200 liters of solution that is 36% arsenic?

4. Sergio painted some boats red and painted the rest blue. The number of red boats was 5 less than 3 times the number of blue boats. Also, 6 times the number of blue boats was 70 less than 10 times the number of red boats. How many were red and how many were blue?

5. Greg was amazed, because as he watched $\frac{7}{16}$ of the spotted puppies metamorphosed into striped puppies. If the number that metamorphosed totaled 672, how many were spotted when Greg began to watch?

6. List the first five terms of the sequences defined below.
   (a) $a_n = 3n - 4$
   (b) $a_n = -2^n + 1$
   (c) $a_n = 2a_{n-1} + 1$, where $a_1 = -2$

7. Determine whether each of the following progressions is arithmetic, geometric, or neither. If the progression is arithmetic or geometric, define it recursively.
   (a) 2, 4, 8, 12, 16, ...
   (b) 7, 3, –1, –5, –9, ...
   (c) 1, –3, 9, –27, 81, ...

8. What is the 20th term of the arithmetic sequence shown: 1, –3, –7, ... ?

9. Which of the following is true regarding arithmetic sequences?
   (a) The common difference is variable.
   (b) The common difference can never be negative.
   (c) The common difference must be an integer.
   (d) The sixth term of 26, 20, 14, ... is negative.

10. Use substitution to solve $\begin{cases} 6x + 5y = 8 \\ 4x + 2y = 3 \end{cases}$.

Solve the system in problems 11–13 without using a graphing calculator.

11. $\begin{cases} BT_D + 3T_D = 60 \\ BT_D - 3T_D = 36 \end{cases}$

12. $\begin{cases} x^2 + y^2 = 4 \\ 3x = 4y \end{cases}$

13. $\begin{cases} x + 2y + 2z = 6 \\ 2x - y + 3z = 6 \\ y - z = 0 \end{cases}$

14. Use a graphing calculator to solve $\begin{cases} \dfrac{(x-4)^2}{16} + \dfrac{y^2}{64} = 1 \\ y = \sqrt[3]{x+2} + 3 \end{cases}$.

15. Graph $\dfrac{(y+1)^2}{4} - \dfrac{(x-2)^2}{4} = 1$ and find the equations of the asymptotes.

16. Write the equations that would be used to graph the hyperbola in problem 15 on a graphing calculator. Graph these equations on a graphing calculator. Graph the asymptotes that you found in problem 15 on the same screen.

Solve the equations in problems 17–19

17. $-4x + 7 = -3x^2$

18. $\sqrt{x+3} + \sqrt{2x} = 2$

19. (a) $\log_7 (2x) = \log_7 (x + 5)$ (b) $\log_x (2x + 3) = \log_x (-3x - 4)$

20. Evaluate: (a) log 100 (b) log 1000 (c) log 500

21. How many times more powerful was the 1811 New Madrid, MO earthquake that rated 8.7 than the 1964 earthquake that rated 8.4?

22. Find the linear regression model for the following set of data:
(–3.2, –2.2), (–2.4, –1.3), (–0.5, 0.2), (0.6, 0.8), (2.1, 1.6), (3.8, 2.5)

23. Add: $(-5, 20°) + (8, -150°)$

24. Add: $\dfrac{x-3}{2x^2+3x-14} + \dfrac{3x}{2-x}$

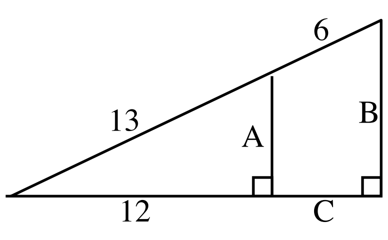
25. Find $g^{-1}(x)$ if $g(x) = 2^x + 3$. Graph g and g^{-1} on the same set of axes.

26. Simplify: $-3i^3 + 2\sqrt{-27}\sqrt{-3} + (-i-1)(-3i+2)$

27. Expand: $(x^{1/2} + y^{-1/2})^3$

28. Find the surface area of a sphere whose volume is 288π in^3.

29. Find B.



30. The radius of the circle is 5 cm.
Find the length of $\overset{\frown}{ABC}$.