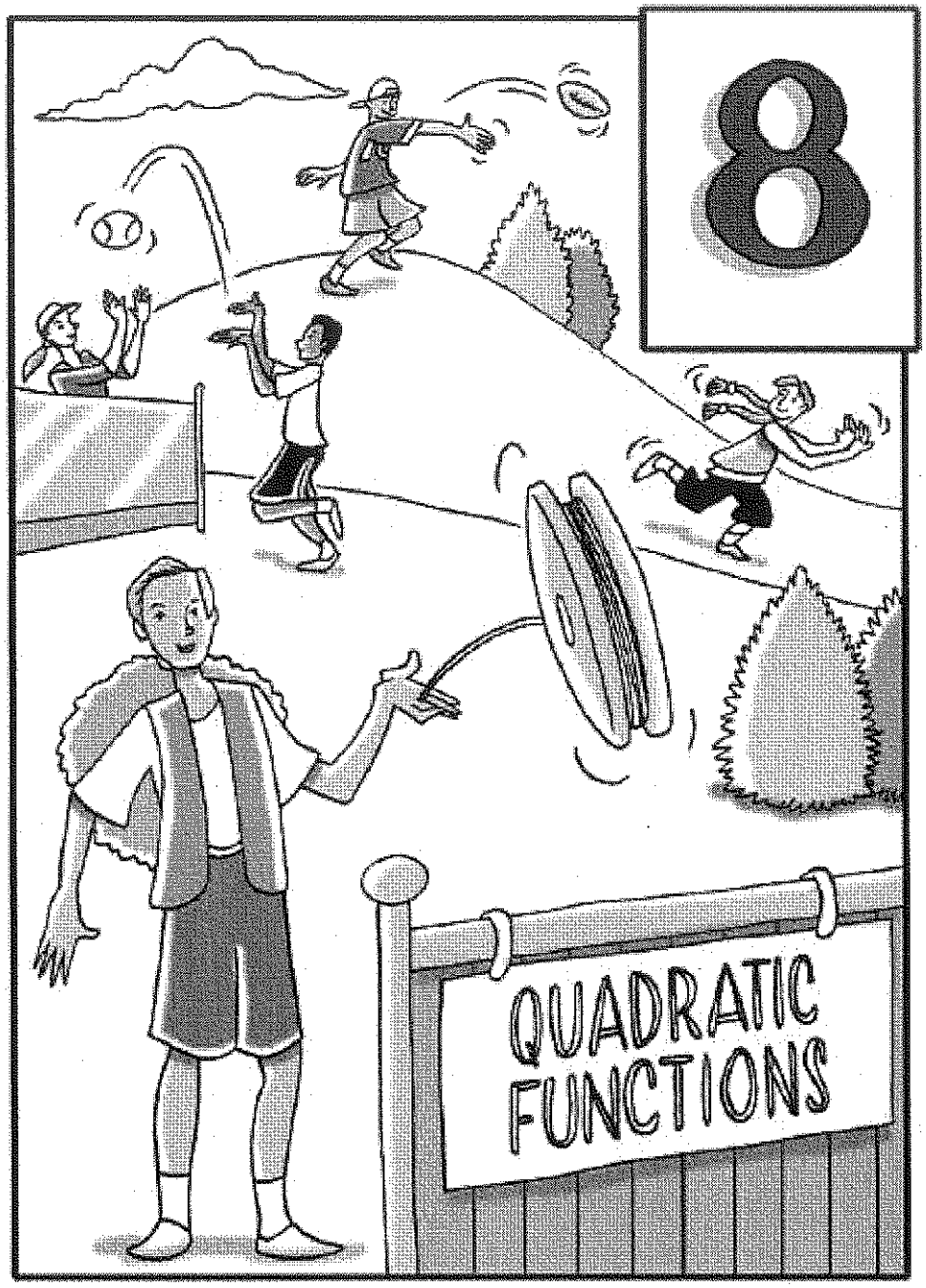

8
QUADRATIC
FUNCTIONS

MATH NOTES

METHODS AND MEANINGS

More Vocabulary for Expressions

Since algebraic expressions come in several different forms, there are special words used to help describe these expressions. For example, if the expression can be written in the form ax^2+bx+c and if a is not 0, it is called a **quadratic** expression. Review the examples of quadratic expressions below.

Examples of quadratic expressions: $x^2-15x+26$

$16m^2-25$

$12-3k^2+5k$

The way an expression is written can also be named. When an expression is written in product form, it is said to be **factored**. When factored, each of the expressions being multiplied is called a **factor**. For example, the factored form of $x^2-15x+26$ is $(x-13)(x-2)$, so $x-13$ and $x-2$ are each factors of the original expression.

Finally, if the expression is a polynomial (see Math Notes box in Lesson 3.1.2) the number of terms can help you name the polynomial. If the polynomial has one term, it is called a **monomial**, while a polynomial with two terms is called a **binomial**. If the polynomial has three terms, it is called a **trinomial**. Review the examples below.

Examples of monomials: $15y^2$ and -2

Examples of binomials: $16m-25$ and $7h^9+\frac{1}{2}$

Examples of trinomials: $12-3k^3+5k$ and $x^2-15x+26$

8-6. Write the area of the rectangle at right as a sum and as a product.

$-3x$	$-6y$	12
$2x^2$	$4xy$	$-8x$

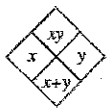
8-7. Multiply the expressions below using a generic rectangle. Then verify Casey's pattern (that the product of one diagonal equals the product of the other diagonal).

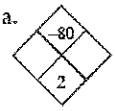
a. $(4x-1)(3x+5)$ b. $(2x-7)^2$

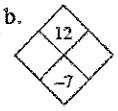
8-8. Review problem 7-108. Write the equation for the following sequences in "first term" form.

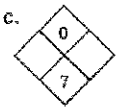
a. $500, 2000, 3500, \ldots$ b. $30, 150, 750, 3750, \ldots$

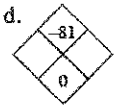
8-9. Remember that a Diamond Problem is a pattern for which the **product** of two numbers is placed on top, while the **sum** of the same two numbers is placed on bottom. (This pattern is demonstrated in the diamond at right.) Copy and complete each Diamond Problem below.

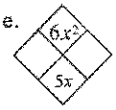


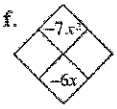
a. 

b. 

c. 

d. 

e. 

f. 

8-10. In a previous course you used the Distributive Property and common factors to change expressions written as sums into expressions written as products. For example:

Since 6 is the greatest common factor of both terms, $12x+18$ may be rewritten:

Here x is a common factor of every term, so x^2+xy+x may be rewritten:
$x^2+xy+x=x(x+y+1)$.

Use the greatest common factor to rewrite each sum as a product.

a. $4x+8$ b. $10x+25y+5$

c. $2x^2-8x$ d. $9x^2y+12x+3xy$

8-11. On graph paper, graph $y=x^2-2x-8$.

8-12. Calculate the value of each expression below.

a. $5-\sqrt{36}$ b. $1+\sqrt{39}$ c. $-2-\sqrt{5}$

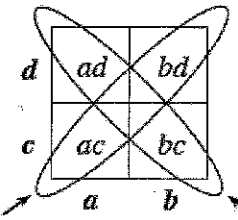
MATH NOTES

METHODS AND MEANINGS

Diagonals of Generic Rectangles

Why does Casey's pattern from problem 8-4 work? That is, why does the product of the terms in one diagonal of a 2-by-2 generic rectangle always equal the product of the terms in the other diagonal?

Examine the generic rectangle at right for $(a+b)(c+d)$. Notice that each of the resulting diagonals have a product of $abcd$. Thus, the product of the terms in the diagonals are equal.



Product = $abcd$ Product = $abcd$

8-17. Use the process you developed in problem 8-14 to factor the following quadratic expressions, if possible.

a. $x^2-4x-12$

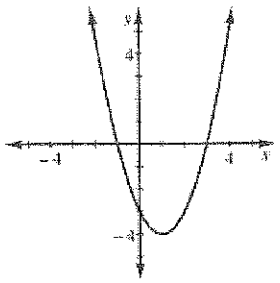
b. $4x^2+4x+1$

c. $2x^2-9x-5$

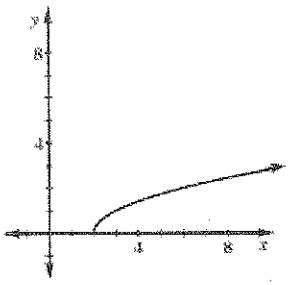
d. $3x^2+10x-8$

8-18. For each rule represented below, state the x- and y-intercepts, if possible.

a.



b.



c.

x	–5	–4	–3	–2	–1	0	1	2
y	8	4	0	–4	0	2	0	–4

d. $5x-2y=40$

8-19. Write the equation for the following two sequences in "first term" form.

a. $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, ...

b. $-7.5, -9.5, -11.5, \ldots$

8-20. The value of Bulls Eye stock has decreased 8% each year for the past several years. If in 2010 the stock was worth \$50 and that pattern continues, how much will it be worth in 2015?

8-21. Find the point of intersection for each system.

a. $y=2x-3$
$x+y=15$

b. $3x=y-2$
$6x=4-2y$

8-22. Solve each equation below for the given variable, if possible.

a. $\frac{4x}{5}=\frac{x-2}{7}$ b. $-3(2b-7)=-3b+21-3b$ c. $6-2(c-3)=12$

8-23. Find the equation of the line that passes through the points (–800, 200) and (–400, 300).

MATH NOTES

METHODS AND MEANINGS

Standard Form of a Quadratic Expression

A quadratic expression in the form $ax^2 + bx + c$ is said to be in **standard form**. Notice that the terms are in order from greatest exponent to least.

Examples of quadratic expressions in standard form: $3m^2 + m - 1$, $x^2 - 9$, and $3x^2 + 5x$. Notice that in the second example, $b = 0$, while in the third example, $c = 0$.

8-29. At 3:25 p.m., two trains left Kalamazoo, Michigan. One train traveled westward at a constant rate of 82 miles per hour, while the other traveled eastward at a constant rate of 66 miles per hour. If they are now 111 miles apart, what time is it now? Write and solve an equation (or system of equations) to answer this question.

8-30. Remember that a square is a rectangle with four equal sides.

a. If a square has an area of 81 square units, how long is each side?

b. Find the length of the side of a square with area 225 square units.

c. Find the length of the side of a square with area 10 square units.

d. Find the area of a square with side 11 units.

8-31. Factor the following quadratic expressions, if possible.

a. $k^2 - 12k + 20$ b. $6x^2 + 17x - 14$

c. $x^2 - 8x + 16$ d. $9m^2 - 1$

e. Parts (a) through (e) are trinomials while part (d) is a binomial, yet they are all quadratics. What makes each of them a quadratic?

8-32. Change each expression into radical form and then give the value. No calculators should be necessary.

a. $125^{2/3}$ b. $16^{1/2}$ c. $16^{-1/2}$ d. $(\frac{1}{81})^{3/4}$

8-33 Solve each equation below for x. Check each solution.

a. $2x - 10 = 0$ b. $x + 6 = 0$ c. $(2x - 10)(x + 6) = 0$

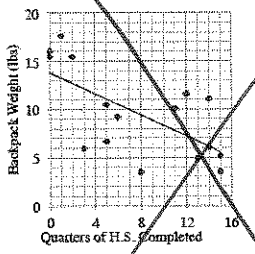
d. $4x + 1 = 0$ e. $x - 8 = 0$ f. $(4x + 1)(x - 8) = 0$

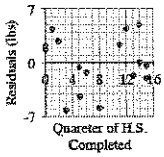
8-34. Do the freshmen really have the largest backpacks, or is that just high school legend stuff? Delenn was able to weigh a random sample of student backpacks throughout the school year. She also recorded the number of quarters of high school completed by the student who owns the bag. Using spreadsheet software, Delenn found the following:

Qtrs Completed	Backpack Weight (lbs)
0	16.03
0	15.47
8	3.52
12	11.62
1	17.66
5	6.67
9	10.48
13	4.96
2	15.47
6	9.21
14	6.10
14	11.10
3	5.96
11	10.06
15	3.54
15	5.18

LSRL: $y = 13.84 - 0.55x$

$r = -0.66$





a. Interpret the slope of the least squares regression line in the context of this study.

b. Calculate and interpret R-squared in context.

c. What is the residual with the greatest magnitude and what point does it belong to?

d. Using the LSRL model, estimate the weight of a backpack for a student who has completed 10 quarters of high school. Use appropriate precision in your answer.

e. Is a linear model the best choice for predicting backpack weight in this study? Support your answer.

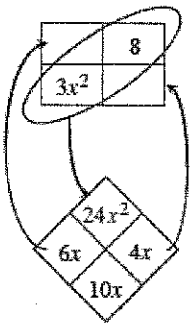
METHODS AND MEANINGS

MATH NOTES

Factoring Quadratic Expressions

Review the process of factoring quadratic expressions developed in problem 8-13 and outlined below. This example demonstrates how to factor $3x^2+10x+8$.

1. Place the x^2 and constant terms of the quadratic expression in opposite corners of a generic rectangle. Determine the sum and product of the two remaining corners: The sum is simply the x-term of the quadratic expression, while the product is equal to the product of the x^2 and constant terms.



2. Place this sum and product into a Diamond Problem and solve it.

3. Place the solutions from the Diamond Problem into the generic rectangle and find the dimensions of the generic rectangle.

2	$6x$	8
x	$3x^2$	$4x$
	$3x$	4

4. Write your answer as a product: $(3x+4)(x+2)$.

8-39. Factor the quadratic expressions below. If the quadratic is not factorable, explain why not.

a. $2x^2+3x-5$

b. x^2-x-6

c. $3x^2+13x+4$

d. $2x^2+5x+7$

8-40. A sequence starts $-3, 1, 5, 9\ldots$

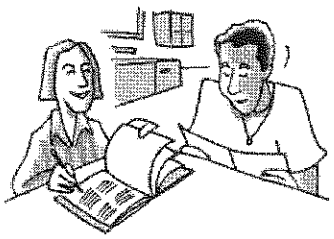
a. If you wanted to find the 50th term of the sequence, would an explicit equation or a recursive equation be more useful?

b. Write the equation in "first term" form as you did in problem 7-108.

c. What is the 50th term of the sequence?

d. Write the explicit equation for the sequence $3, 2\frac{2}{3}, 2\frac{1}{3}, 2, 1\frac{2}{3}, \ldots$ in "first term" form.

8-41. As Jhalil and Joman practice for the SAT, their scores on practice tests rise. Jhalil's current score is 850, and it is rising by 10 points per week. On the other hand, Joman's current score is 570 and is growing by 50 points per week.



a. When will Joman's score catch up to Jhalil's?

b. If the SAT test is in 12 weeks, who will score highest?

8-42. Mary says that you can find an x-intercept by substituting 0 for x, while Michelle says that you need to substitute 0 for y.

a. Who, if anyone, is correct and why?

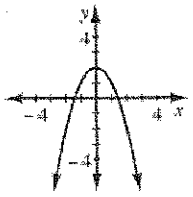
b. Use the correct approach to find the x-intercept of $-4x+5y=16$.

8-43. Find three consecutive integers whose sum is 138 by writing and solving an equation.

8-44. **Match each rule below with its corresponding graph. Can you do this without making any tables? Explain your selections.**

a. $y=-x^2-2$ b. $y=x^2-2$ c. $y=-x^2+2$

1.



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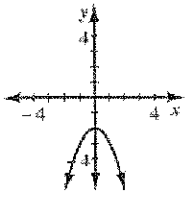

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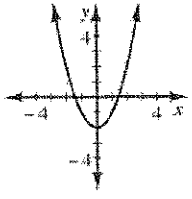


8-49. Factor each polynomial.

a. $x^2 - 64$

b. $y^2 - 6y + 9$

c. $4x^2 + 4x + 1$

d. $5x^2 - 45$

8-50. Simplify each expression below. Your answer should contain no parentheses and no negative exponents.

a. $(-\frac{2}{3}x^5y^{1/3})^0$

b. $(25^{1/2}x^5)(4x^{-6})$

c. $5t^{-3}$

d. $(\frac{x^7y^3}{x})^{1/3}$

8-51. Solve each of the following systems of equations algebraically. Then confirm your solutions by graphing.

a. $y = 4x + 5$
$y = -2x - 13$

b. $2x + y = 9$
$y = -x + 4$

8-52. Consider the sequence 4, 8, ...

a. If the sequence is arithmetic, write the first 4 terms and an equation in "first term" form for $t(n)$.

b. If the sequence is geometric, write the first 4 terms and an equation in "first term" form for $t(n)$.

c. Create another sequence that is neither arithmetic nor geometric and still starts with 4, 8, ...

8-53. Solve the following equations for x.

a. $4x - 6y = 20$

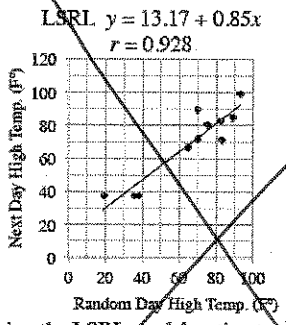
b. $\frac{1}{2}(x - 6) = 9$

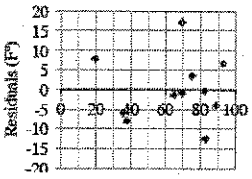
c. $\frac{4}{5} + \frac{18}{x} = 8$

d. $2 + |2x - 3| = 5$

8-54. Mitchell likes to study the weather. He is fascinated by the sophistication of the computer models used to make weather predictions. Mitchell wonders if he can make his own model to predict the next day's high temperature in his area based only on today's high temperature. He selects 11 days at random and gets the temperatures from the Internet. The results from his computer spreadsheet follow.

Random Day (F°)	Next Day (F°)
93.2	99
69.8	71.6
82.9	71.1
82.4	82.9
19.4	37.4
69.8	89.6
35.6	37.4
89.1	84.9
37.9	37.4
75.2	80.6
64.9	66.9





c. Using the LSRL model, estimate tomorrow's high temperature based on today's high temperature of 55 degrees in Mitchell's area. Use appropriate precision.

d. Consider the upper and lower bounds of the prediction Mitchell made in part (c) above. Is Mitchell's model ready to replace the complex models of the professional meteorologists? Support your answer.

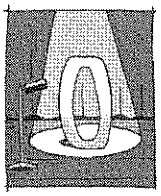
8-58. Graph $y = x^2 - 8x + 7$ and label its vertex, x-intercepts, and y-intercepts.

8-59. What is special about the number zero? Think about this as you answer the questions below.

a. Find each sum:

$0 + 3 =$ $\quad -7 + 0 =$ $\quad 0 + 6 =$ $\quad 0 + (-2) =$

b. What is special about adding zero? Write a sentence that begins, "When you add zero to a number, ..."



c. Julia is thinking of two numbers a and b. When she adds them together, she gets a sum of b. Does that tell you anything about either of Julia's numbers?

d. Find each product:

$3 \cdot 0 =$ $\quad (-7) \cdot 0 =$ $\quad 0 \cdot 6 =$ $\quad 0 \cdot (-2) =$

e. What is special about multiplying by zero? Write a sentence that begins, "When you multiply a number by zero, ..."

8-60. Based on the tables below, say as much as you can about the x- and y-intercepts of the corresponding graphs.

a.

x	y
2	0
0	18
−4	0
−1	−8
6	22
3	0

b.

x	y
7	−4
3	0
10	8
0	−3
8	0
−7	−1

c.

x	y
0	−4
−5	11
3	−2
1	0
13	27
−6	14

8-61. In speed golfing an athlete's score is determined by adding the number of strokes to complete a course to the minutes required to finish. For example 90 strokes in 51 minutes would be a score of 141. The lower the score, the better. Diego wants to see if there is a relationship between the time, t, it takes for him to complete a speed golfing match and the number of strokes, s, he takes in the same match. If so, perhaps focusing on running faster will also reduce the number of strokes.

Time, t	56	92	56	58	45	50
Strokes, s	86	90	80	91	77	86

a. Create a scatterplot with pencil and paper. Determine Diego's best score and circle the point representing Diego's best total score.

b. Discuss what you can about the association from observation of the scatterplot.

c. Diego recalls that he was suffering from seasonal allergies that slowed his running on a particular course. Cross-out that point. Then use your intuition and draw a line of best fit from the remaining points.

d. Estimate the slope of your trend line and interpret it in the context of the problem.

e. Should Diego train to reduce his time so that he sees an increase in his golf score?

8-62. Solve the following systems of equations using any method. Check your solution if possible.

a. $6x - 2y = 10$
$3x - y = 2$

b. $x - 3y = 1$
$y = 16 - 2x$

8-63. The "≤" symbol represents "less than or equal to," while the "<" symbol represents "less than."

a. Similarly, translate "≥" and ">."

b. How can you write an expression that states that 5 is greater than 3?

c. Write another expression that states that x is less than or equal to 9.

d. Translate the expression $-2 < 7$ into words.

MATH NOTES

METHODS AND MEANINGS

Zero Product Property

When the product of two or more numbers is zero, one of those numbers must be zero. This is known as the **Zero Product Property**. If the two numbers are represented by a and b, this property can be written as follows:

If a and b are two numbers where $a \cdot b = 0$, then $a = 0$ or $b = 0$.

For example, if $(2x-3)(x+5)=0$, then $2x-3=0$ or $x+5=0$. Solving yields the solutions $x=\frac{3}{2}$ or $x=-5$. This property helps you solve quadratic equations when the equation can be written as a product of factors.

Review & Preview

8-69. Use a similar process as you did in problems 8-65 and 8-67 to sketch the parabola for $x^2 + x - 6$ by using its intercepts.

8-70. Compare the two equations below.

$$(x+2)(x-1)=0 \text{ and } (x+2)+(x-1)=0$$

a. How are the equations different? b. Solve both equations.

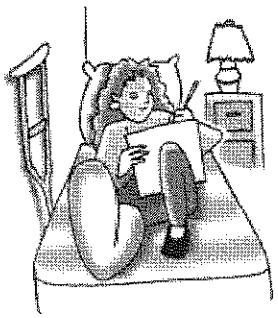
8-71. For each equation below, solve for x.

a. $(x-2)(x+8)=0$ b. $(3x-9)(x-1)=0$

c. $(x+10)(2x-5)=0$ d. $(x-7)^2=0$

8-72. Examine the system of equations below.

$$5x-2y=4$$
$$x=0$$



a. Before solving this system, Danielle noticed that the point of intersection is also the y-intercept of $5x-2y=4$. Explain how she knows this.

b. Find the point of intersection of the two rules above.

8-73. The x-intercepts of the graph of $y=2x^2-16x+30$ are $(3,0)$ and $(5,0)$.

a. What is the x-coordinate of the vertex? How do you know?

b. Use your answer to part (a) above to find the y-coordinate of the vertex. Then write the vertex as a point (x, y).

8-74. Factor each quadratic below completely.

a. $2x^2-2x-4$ b. $4x^2-24x+36$

8-75. Rewrite the following expressions using fractional exponents.

a. $(\sqrt{3x})^3$ b. $\sqrt[x]{81}$ c. $(\sqrt[3]{17})^x$

Review & Preview

8-83. Use the Zero Product Property to find the roots of the polynomials below.

a. $3x^2-7x+4$ b. x^2+6x c. $(x+5)(-2x+3)$

8-84. Jamie was given the problem, "Find the result when the factors of $65x^2+212x-133$ are multiplied together." Before she could answer, her sister, Lauren, said, "I know the answer without factoring or multiplying!" What was Lauren's answer and how did she know?

8-85. Solve the equations below for x. Check your solutions.

a. $(6x-18)(3x+2)=0$ b. $x^2-7x+10=0$

c. $2x^2+2x-12=0$ d. $4x^2-1=0$

8-86. Sketch each parabola below with the given information.

a. A parabola with x-intercepts $(2,0)$ and $(7,0)$ and y-intercept $(0,-8)$.

b. A parabola with exactly one x-intercept at $(-1,0)$ and y-intercept $(0,3)$.

c. The parabola represented by the equation $y=(x+5)(x-1)$.

8-87. Review the meanings of the inequality symbols in the box at right. Then decide if the statements below are true or false.

$<$	less than
$\leq$	less than or equal to
$>$	greater than
$\geq$	greater than or equal to

a. $5<7$ b. $-2\geq 9$ c. $0\leq 0$

d. $-5>-10$ e. $16\leq -16$ f. $1>1$

8-88. Calculate the value of each expression below using a scientific calculator.

a. $\frac{-10+\sqrt{25}}{5}$ b. $\frac{8+\sqrt{40}}{3\cdot 3}$ c. $\frac{8+\sqrt{3^2+2\cdot 3+1}}{-4}$

MATH NOTES

METHODS AND MEANINGS

Forms of a Quadratic Function

There are three main forms of a quadratic function: standard form, factored form, and graphing form. Study the examples below. Assume that $a \neq 0$ and that the meaning of a, b, and c are different for each form below.

Standard form: $f(x) = ax^2 + bx + c$. The y-intercept is $(0, c)$.

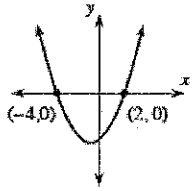
Factored form: $f(x) = a(x+b)(x+c)$. The x-intercepts are $(-b, 0)$ and $(-c, 0)$.

Graphing form (vertex form): $f(x) = a(x-h)^2 + k$. The vertex is (h, k).

8-92. QUALITY CONTROL, Part Two

Lots O'Dough, a wealthy customer, would like to order a variety of parabolas. However, he is feeling pressed for time and said that he will pay you *lots* of extra money if you complete his order for him. Of course you agreed! He sent you sketches of each parabola that he would like to receive. Determine a possible equation for each parabola so that you can pass this information on to the Manufacturing Department.

a.



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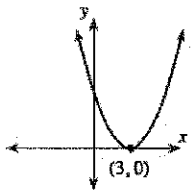

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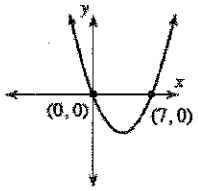
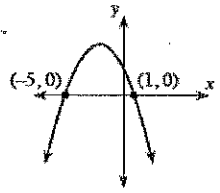


d.

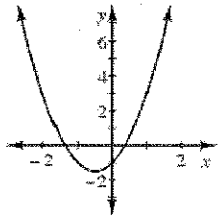


8-93. Find the slope and y-intercept of the graph of $6y - 3x = 24$.

8-94. Examine the graph of $y = 2x^2 + 2x - 1$ at right.

a. Estimate the zeros of $2x^2 + 2x - 1$ from the graph.

b. What happens if you try to use the Zero Product Property to find the roots of $2x^2 + 2x - 1 = 0$?



8-95. Solve the equations below for x. Check your solutions.

a. $x^2 + 6x - 40 = 0$

b. $2x^2 + 13x - 24 = 0$

8-96. Calculate the value of the expressions below. Then compare your answers from parts (a) and (b) to those in part (a) of problem 8-95, and parts (c) and (d) to part (b) in problem 8-95. What do you notice?

a. $\frac{-6+\sqrt{6^2-(4)(1)(-40)}}{2 \cdot 1}$

b. $\frac{-6-\sqrt{6^2-(4)(1)(-40)}}{2 \cdot 1}$

c. $\frac{-13-\sqrt{13^2-(4)(2)(-24)}}{2 \cdot 2}$

d. $\frac{-13+\sqrt{13^2-(4)(2)(-24)}}{2 \cdot 2}$

8-97. Use any method to solve the systems of equations below.

a. $2x - 3y = 5$
$4x + y = 3$

b. $m = -3 + 2n$
$4m + 6n = -5$

8-106. For each quadratic function below, use the idea of completing the square to write it in graphing form. Then state the vertex of each parabola.

a. $f(x) = x^2 + 6x + 15$

b. $y = x^2 - 4x + 9$

c. $f(x) = x^2 + 8x$

d. $y = x^2 + 5x - 2$

8-107. Use factoring and the Zero Product Property to solve each equation.

a. $(x-4)(2x+1) = 0$

b. $x^2 + 5x + 6 = 0$

c. $x(2x-5) = 0$

d. $x^2 + 4x = 0$

8-108. Over a four month period the price of an ounce of gold steadily increased from \$1000 to \$1400. What was the monthly multiplier? What was the monthly percent increase?

8-109. Sketch the parabola $y = 2x^2 + 6x + 4$ by using its intercepts.

8-110. For the line with equation $4(y-2) = 3(x+7)$:

a. State the slope and y-intercept.

b. Is $(-7, 2)$ a point on the line? Explain your reason.

8-111. This problem is a checkpoint for interpreting associations. It will be referred to as Checkpoint 8.

A random sample of competitive cyclists had their maximum sustainable power output (watts) versus VO_2max tested. Their data is shown in the table below. Note: VO_2max, also called "aerobic capacity," is a measure of how much oxygen your body uses when exercising at a maximal effort for an extended period of time.

VO_2max (ml/kg/min)	Power (watts)
54	292
51	362
49	280
43	293
53	280
59	413
64	358
58	293
56	342
55	335
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a. Create a model by finding the LSRL. Sketch the graph and the LSRL.

b. What power does the model predict for the cyclist that has a VO_2max of 43 ml/kg/min? Consider the precision of the measurements in the table and use an appropriate precision in your result.

c. Find the residual for the cyclist in part (b).

d. Find the correlation coefficient and interpret it.

e. Describe the association. Provide numerical values for *direction* and *strength* and interpret them in context.

Check your answers by referring to the Checkpoint 8 materials located at the back of your book.

If you needed help solving these problems correctly, then you need more practice. Review the Checkpoint 8 materials and try the practice problems. Also, consider getting help outside of class time. From this point on, you will be expected to do problems like these quickly and easily.

CL 8-112. Factor and use the Zero Product Property to find the roots of the following quadratic equations.

a. $0 = x^2 - 7x + 12$

b. $0 = 6x^2 - 23x + 20$

c. $0 = x^2 - 9$

d. $0 = x^2 + 12x + 36$

CL 8-113. The price of milk has been steadily increasing 5% per year. If the cost of a gallon is now \$3.89:

a. What will it cost in 10 years?

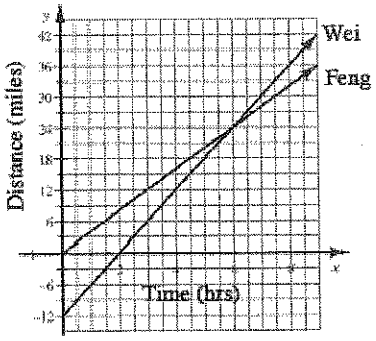
b. What did it cost 5 years ago?

CL 8-114. Use the graph at right to answer the questions below.

a. One of these lines represents Feng, and one represents Wai. Write an equation for each girl's line.

b. The two girls are riding bikes. How fast does each girl ride?

c. When do Feng and Wai meet? At that point, how far are they from school?



CL 8-115. Graph $y = x^2 - 2x$. Identify the roots, y-intercept, x-intercepts, and the vertex.

CL 8-116. Find the coordinates of the y-intercept and x-intercepts of $y = x^2 - 2x - 15$. Show all of the work that you used to find these points.

CL 8-117. Without using a calculator, simplify using only positive exponents.

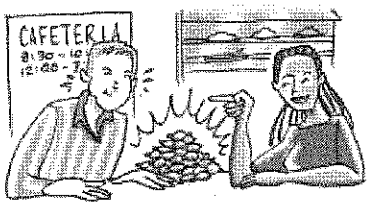
a. $(9^{1/2}x^2y)(27^{1/3}y^{-1})$

b. $(x^{1/2})^{-2}$

c. $(\frac{1}{125})^{2/3}$

d. $\frac{8x^3}{-2x^{-2}}$

CL 8-118. Quinn started off with twice as much candy as Denali, but then he ate 4 pieces. When Quinn and Denali put their candy together, they now have a total of 50 pieces. How many pieces of candy did Denali start with?



CL 8-119. Given the two points $(-24, 7)$ and $(30, 25)$,

a. What is an equation of the line passing through the points?

b. Is $(51, 33)$ also on the same line? Explain your reasoning.

CL 8-120. Write the equation of the following two sequences in "first term" form.

a. $100, 10, 1, 0.1, \ldots$ b. $0, -50, -100, \ldots$

CL 8-121. Write the first four terms of the following sequences.

a. $a_n = 3 \cdot 5^{n-1}$ b. $a_1 = 10,\ a_{n+1} = -5a_n$