Name: Solving Quadratic and Other Equations | 3.1

Ready, Set, Go!

[redacted]

Ready

Topic: Comparing additive and multiplicative patterns.

The sequences below exemplify either an additive (arithmetic) or a multiplicative (geometric) pattern. Identify the type of sequence, fill in the missing values on the table and write an equation.

1.

Term 0	1st	2nd	3rd	4th	5th	6th	7th	8th
Value 1	2	4	8	16	32	a. 64	b. 128	c. 256

×2 ×2 ×2 ×2 ×2 ×2 ×2 ×2

d. Type of Sequence: Geometric e. Equation: $f(x) = 1 \cdot 2^x$

2.

[redacted]						6th	7th	8th
[redacted]								

e. Type of Sequence: [redacted] f. Equation: [redacted]

3.

Term 0	1st	2nd	3rd	4th	5th	6th	7th	8th
Value 1	-3	9	-27	81	a. -243	b. 729	c. -2187	d. 6561

×3 ×3 ×3 ×-3 -3 -3 -3

e. Type of Sequence: Geometric f. Equation: $f(x) = 1 \cdot (-3)^x$

4.

[redacted]						6th	7th	8th
[redacted]								

e. Type of Sequence: [redacted] f. Equation: [redacted]

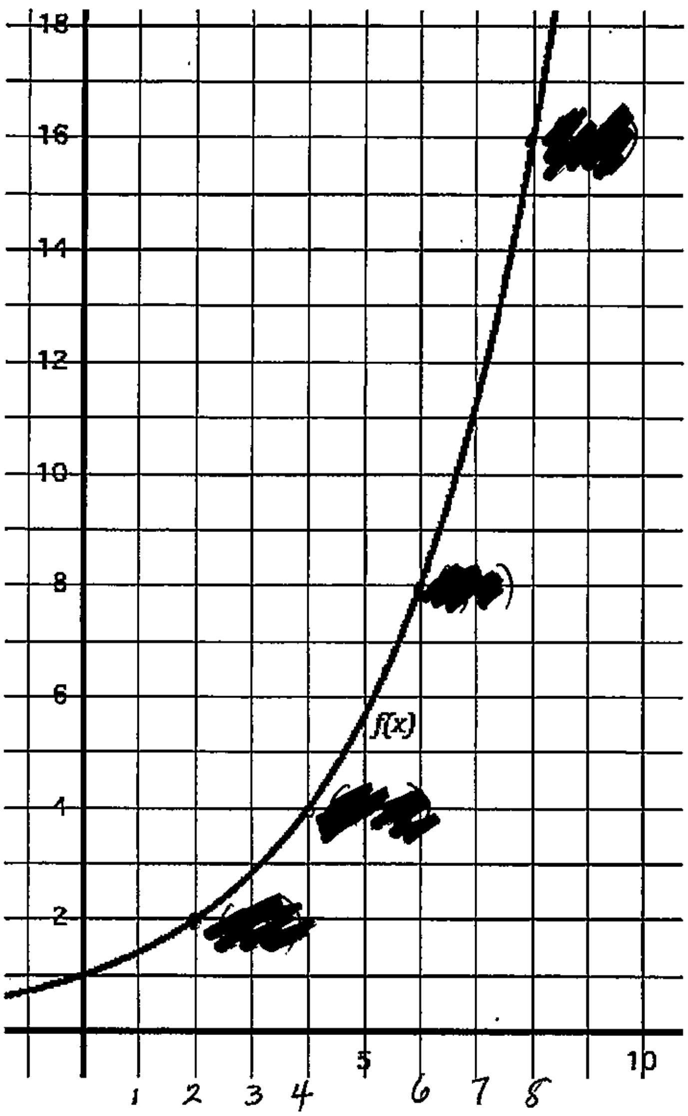
5.

Term 0	1st	2nd	3rd	4th	5th	6th	7th	8th
Value -16	-9	-2	5	12	a. 19	b. 26	c. 33	d. 40

+7 +7 +7 +7 +7 +7 +7 +7

e. Type of Sequence: Arithmetic f. Equation: $f(x) = 7x - 16$

Use the graph of the function to find the desired values of the function. Also create an explicit equation for the function.



6. Find the value of $f(2)$ [redacted]

7. Find where $f(x) = 4$

$x = 4$

8. Find the value of $f(6)$ [redacted]

9. Find where $f(x) = 16$

$x = 8$

10. What do you notice about the way that inputs and outputs for this function relate? (Create an in-out table if you need to.)

[redacted]

11. What is the explicit equation for this function?

$f(x) = (\sqrt{2})^{x}$ [redacted]

$= 2^{\frac{1}{2}x}$

Set

Topic: Evaluate the expressions with rational exponents.

Fill in the missing values of the table based on the growth that is described.

12. The growth in the table is triple at each whole year.

[redacted]

Years	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2	$\frac{5}{2}$	3	$\frac{7}{2}$	4
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted] The growth in the table is triple at each whole year.

Years	0	$\frac{1}{3}$	$\frac{2}{3}$	1	$\frac{4}{3}$	$\frac{5}{3}$	2	$\frac{7}{3}$	$\frac{8}{3}$
bacteria	2	$2\sqrt[3]{3}$	$2\sqrt[3]{3^2}$	6	$6\sqrt[3]{3}$	$6\sqrt[3]{3^2}$	18	$18\sqrt[3]{3}$	$18\sqrt[3]{9}$

$2r^3 = 6$
$r^3 = 3$
$r = \sqrt[3]{3}$

$2\sqrt[3]{9}$ $\times 3$ $6\sqrt[3]{9}$ $\times 3$

14. The values in the table grow by a factor of four at each whole year.

Years	[redacted]
bacteria	[redacted]

Go

Topic: Simplifying exponents

Simplify the following expressions using exponent rules and relationships, write your answers in exponential form. (For example: $2^2 \cdot 2^5 = 2^7$)

15. $3^2 \cdot 3^5 = 3^{2+5} = 3^7$

16. $\frac{5^3}{5^2} =$ [redacted]

17. $2^{-5} = \frac{1}{2^5}$

18. [redacted]

19. $\frac{7^5}{7^2} \cdot \frac{7^3}{7^4}$ [redacted]

20. $\frac{3^{-2} \cdot 3^5}{3^7} = \frac{3^{-2+5}}{3^7} = \frac{3^3}{3^7} = \frac{1}{3^{7-3}} = \frac{1}{3^4}$

Name: Solving Quadratic and Other Equations | 3.2

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Topic: Simplifying Radicals

A very common radical expression is a square root. One way to think of a square root is the number that will multiply by itself to create a desired value. For example: $\sqrt{2}$ is the number that will multiply by itself to equal 2. And in like manner $\sqrt{16}$ is the number that will multiply by itself to equal 16, in this case the value is 4 because 4 x 4 = 16. (When the square root of a square number is taken you get a nice whole number value. Otherwise an irrational number is produced.)

This same pattern holds true for other radicals such as cube roots and fourth roots and so forth. For example: $\sqrt[3]{8}$ is the number that will multiply by itself three times to equal 8. In this case it is equal to the value of 2 because $2^3 = 2 \times 2 \times 2 = 8$.

With this in mind radicals can be simplified. See the examples below.

Example 1: Simplify $\sqrt{20}$	*Example 2*: Simplify $\sqrt[5]{96}$
$\sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{2 \cdot 2 \cdot 5} = 2\sqrt{5}$	$\sqrt[5]{96} = \sqrt[5]{2^5 \cdot 3} = 2\sqrt[5]{3}$

Simplify each of the radicals.

1. $\sqrt{40}$ $= \sqrt{4 \cdot 10}$ $= \sqrt{4} \cdot \sqrt{10}$ $= 2\sqrt{10}$

2. $\sqrt{50}$ = [redacted]

3. $\sqrt[3]{16}$ $\sqrt[3]{8 \cdot 2} = 2\sqrt[3]{2}$

4. $\sqrt{72}$ [redacted]

5. $\sqrt[4]{81}$ $= \sqrt[4]{3^4}$ $= 3$

6. $\sqrt{32}$ [redacted]

7. $\sqrt[5]{160}$ $= \sqrt[5]{2^5 \cdot 5}$ $2\sqrt[5]{5}$

8. $\sqrt{45}$ [redacted]

9. $\sqrt[3]{54}$ $= \sqrt{27 \cdot 2}$ $= \sqrt[3]{3^3 \cdot 2}$ $= 3\sqrt[3]{2}$

Set

Topic: Finding arithmetic and geometric means and making meaning of rational exponents.

You may have found arithmetic and geometric means in your prior work. Finding arithmetic and geometric means requires finding values of a sequence between given values from non-consecutive terms. In each of the sequences below determine the means and show how you found them.

Find the *arithmetic* means for the following. Show your work.

10.

[redacted]		3
		11

[redacted]

11.

x	1	2	3	4	5
y	18	a. 11	b. 4	c. −3	-10

$18 + 4d = -10 \quad 4d = -28 \quad d = -7$

12.

x	[redacted]						7
y							

Find the *geometric* means for the following. Show your work.

13.

x	1	2	3
y	3	6	12

$3 \cdot r \cdot r = 12 \quad 3r^2 = 12 \quad r^2 = 4 \quad r = 2$

14.

[redacted]	1	2	3	4
				875

15.

x	1	2	3	4	5	6
y	4	a. 12	b. 36	c. 108	d. 324	972

$4 \cdot r^5 = 972 \quad r^5 = 243 \quad r = 3$

Fill in the tables of values and find the factor used to move between whole number values, F_w, as well as the factor, F_c, used to move between each column of the table.

16.

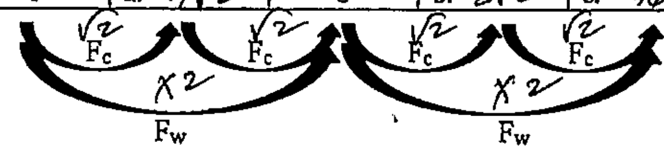
x	0	[redacted]
y	4	

d. F_w = [redacted]
e. F_c = [redacted]

17.

x	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2
y	4	a. $4\sqrt{2}$	8	b. $8\sqrt{2}$	c. 16

d. $F_w = 2$
e. $F_c = \sqrt{2}$



18.

x	[redacted]
y	[redacted]

d. $F_w =$ [redacted]
e. $F_c =$ [redacted]

Go

Topic: Evaluating functions

Find the desired values for each function below.

19. $f(x) = 2x - 7$

[redacted]

20. $g(x) = 3^x(2)$

a. Find $g(-4)$
$g(-4) = 3^{-4}(2) = \frac{2}{3^4} = \frac{2}{81}$

b. Find $g(x) = 162$
$162 = 3^x(2)$ $81 = 3^x$ $x = 4$

c. Find $g\left(\frac{1}{2}\right)$
$g\left(\frac{1}{2}\right) = 3^{\frac{1}{2}} \cdot 2 = 2\sqrt{3}$

21. $I(t) = 210(1.08^t)$

a. Find $I(12)$
$I = (210)(1.08)^{12} = 528.82$

b. Find $I(t) = 420$
$420 = 210(1.08)^t$ $2 = (1.08)^t$
$t \approx 9$

c. Find $I\left(\frac{1}{2}\right)$
$I\left(\frac{1}{2}\right) = 210\ (1.08)^{1/2} = 218.24$

22. $h(x) = x^2 + x - 6$

[redacted]

23. $k(x) = -5x + 9$

a. Find $k(-7)$
$k(-7) = -5(-7) + 9 = 44$

b. Find $k(x) = 0$
$0 = -5x + 9$ $x = \frac{9}{5}$

c. Find $k\left(\frac{1}{2}\right)$
$k\left(\frac{1}{2}\right) = -5\left(\frac{1}{2}\right) + 9$
$= \frac{-5}{2} + 9$
$= \frac{-5+18}{2}$ = [redacted]

24. $m(x) = (5^x)2$

[redacted]

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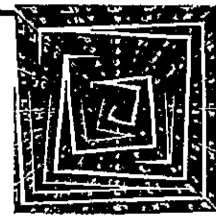

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Topic: Meaning of Exponents

In the table below there is a column for the exponential form, the meaning of that form, which is a list of factors and the standard form of the number. Fill in the form that is missing.

Exponential form	List of factors	Standard Form
5^3	$5 \cdot 5 \cdot 5$	125
1a. [redacted] 7^7	$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$	b. 823,543
2. 2^{10}	a. [redacted]	b. [redacted]
3a. 3^4	b. $3 \cdot 3 \cdot 3 \cdot 3$	81
4. 11^5	a. [redacted]	b. [redacted]
5a. 3^{10}	$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	b. 59,049
6a. [redacted]	b. [redacted]	625

*ANSWERS VARY #7 – 11

Provide at least three other equivalent forms of the exponential expression. Use rules of exponents such as $3^5 \cdot 3^6 = 3^{11}$ and $(5^2)^3 = 5^6$ as well as division properties and others.

	1st Equivalent Form	2nd Equivalent Form	3rd Equivalent Form
7. $2^{10} =$	$(2^5)^2$	$(2^2)^5$	$2^6 \cdot 2^4$
8. $3^7 =$	[redacted]	[redacted]	[redacted]
9. $13^{-8} =$	$13^{-10} \cdot 13^2$	$\frac{13^2}{13^{10}}$	$(3^{-2})^4$
10. $7^{\frac{1}{3}} =$	[redacted]	[redacted]	[redacted]
11. $5^1 =$	$5^{\frac{1}{2}} \cdot 5^{\frac{1}{2}}$	$\frac{5^3}{5^2}$	$(5^2)^{\frac{1}{2}}$

Set

Topic: Finding equivalent expressions and functions.

Determine whether all three expressions in each problem below are equivalent. Justify why or why they are not equivalent.

12. [redacted]

13. $64(2^{-x})$ | $\frac{64}{2^x}$ | $64\left(\frac{1}{2}\right)^x$

$64 \cdot 2^{-x} = \frac{64}{2^x}$ ✓ $\quad \frac{64}{2^x} \quad$ $\cancel{= 64\left(\frac{1^x}{2^x}\right)}$

14. [redacted]

15. $50(2^{x+2})$ | $25(2^{2x+1})$ | $50(4^x)$

$= 50(2^x \cdot 2^2) = 50 \cdot 2^2 \cdot 2^x$

$= 50 \cdot 4 \cdot 2^x =$ [redacted]

$25 \cdot 2^{2x} \cdot 2^1$

$50 \cdot 2^{2x}$

$50 \cdot 4^x = 50 \cdot 2^{2x}$

16. $30(1.05^x)$ [redacted]

17. $20(1.1^x)$ | $20(1.1^{-1})^{-1x}$ | $20\left(1.1^{\frac{1}{5}}\right)^{5x}$

$20(1.1^x)$

$20 \cdot (1.1^{+1x})$

$20(1.1^x)$

$20(1.1^{\cancel{x}})$

$20(1.1^x)$

Go

Topic: Using rules of exponents

Simplify each expression. Your answer should still be in exponential form.

18. $7^3 \cdot 7^5 \cdot 7^2$ [redacted]

19. $(3^4)^5 = 3^{20}$

20. $(5^3)^4 \cdot 5^7 =$ [redacted]

21. $x^3 \cdot x^5 = x^8$

22. x^{-b} [redacted]

23. $x^a \cdot x^b = x^{a+b}$

24. $(x^a)^b =$ [redacted]

25. $\frac{y^a}{y^b} = y^{a-b}$

26. $\frac{(y^a)^c}{y^b} =$ [redacted]

27. $\frac{(3^4)^6}{3^7} = \frac{3^{24}}{3^7} = 3^{17}$

28. $\frac{r^5s^3}{rs^2}$ [redacted]

29. $\frac{x^5y^{12}z^0}{x^8y^9}$ $\frac{y^3}{x^3} = \left(\frac{y}{x}\right)^3$

[redacted]

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Topic: Standard form or Quadratic form

In each of the quadratic equations, $ax^2 + bx + c = 0$ identify the values of a, b and c.

1. $x^2 + 3x + 2 = 0$

   a = 1

   b = 3

   c = 2

2. $2x^2 + 3x + 1 = 0$

   a = [redacted]

3. $x^2 - 4x - 12 = 0$

   a = 1

   b = −4

   c = −12

Write each of the quadratic expressions in factored form.

4. $x^2 + 3x + 2$ [redacted]

5. $2x^2 + 3x + 1$

   $(2x+1)(x+1)$

6. $x^2 - 4x - 12$ [redacted]

7. $x^2 - 3x + 2$

   $(x-2)(x-1)$

8. $x^2 - 5x - 6$ [redacted]

9. $x^2 - 4x + 4$

   $(x-2)(x-2)$

10. $x^2 + 8x - 20$ [redacted]

11. $x^2 + x - 12$

    $(x+4)(x-3)$

12. $x^2 - 7x + 12$ [redacted]

Set

Topic: Radical notation and rational exponents

Each of the expressions below can be written using either radical notation, $\sqrt[n]{a^m}$ or rational exponents $a^{\frac{m}{n}}$. Rewrite each of the given expressions in the form that is missing. Express in most simplified form.

	Radical Form	Exponential Form
13.	$\sqrt[3]{5^2}$	$5^{\frac{2}{3}}$
14.	[redacted]	$16^{\frac{3}{4}}$
15.	$\sqrt[3]{5^7 \cdot 3^5}$	$5^{7\cdot\frac{1}{3}}$, $3^{5\cdot\frac{1}{3}}$ $5^{7/3} \cdot 3^{5/3}$
16.	[redacted]	$9^{\frac{2}{3}} \cdot 9^{\frac{4}{3}}$
17.	$\sqrt[5]{x^{13}y^{21}}$	$x^{\frac{13}{5}} \cdot y^{\frac{21}{5}}$
18.	$\sqrt[3]{27a^5b^2}$	[redacted]
19.	$\sqrt[5]{\frac{32x^{13}}{243y^{15}}}$	$(32x^{13})^{\frac{1}{5}} / (243y^{15})^{\frac{1}{5}}$ $2x^{\frac{13}{5}} / 3y^{\frac{15}{5}} = \frac{2x^{\frac{13}{5}}}{3y^3}$
20.	[redacted]	$9^{\frac{3}{2}}s^{\frac{6}{3}}t^{\frac{1}{2}}$

Solve the equations below, use radicals or rational exponents as needed.

21. $(x+5)^4 = 81$

$(x+5)^4 = 3^4$

$x+5 = 3$

$x = \pm 2$

22. $2(x-7)^5 + 3 = 67$

[redacted]

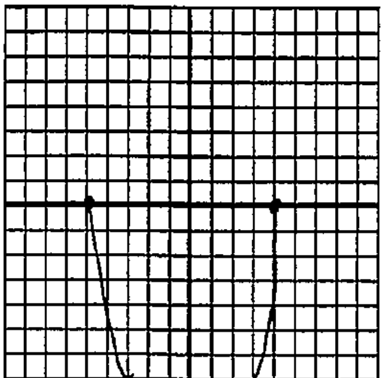
Go

Topic: x-intercepts and y-intercepts for linear, exponential and quadratic

Given the function, find the x-intercept (s) and y-intercept if they exist and then use them to graph a sketch of the function.

23. $f(x) = (x+5)(x-4)$

$x=-5$ $(-5,0)$
$x=4$ $(4,0)$

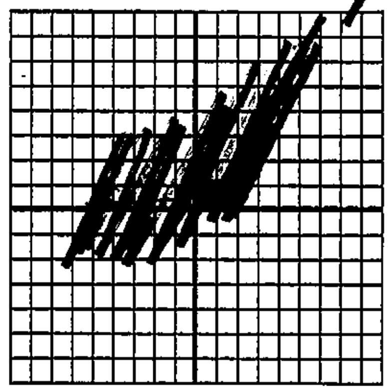


$x=0$ y-int ?
$y=(0+5)(0-4)$
$y=-20$
$(0,-20$

a. x-intercept(s): $(-5,0)$ $(4,0)$

b. y-intercept: $(0,-20)$

24. $g(x) = 5(2^{x-1})$



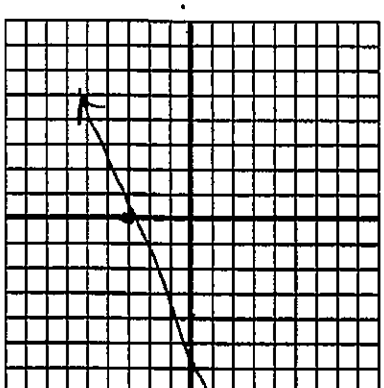
[redacted]

a. x-intercept(s): [redacted]

b. y-intercept: [redacted]

25. $h(x) = -2(x+3)$

$0=-2x-6$



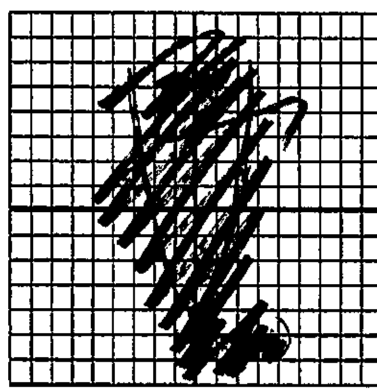
$\frac{6}{-2} = \frac{-2x}{-2}$
$x=-3$

$y=-2(0+3)$
$y=-2(3)$
$y=-6$

a. x-intercept(s): $(-3,0)$

b. y-intercept: $(0,-6)$

26. $k(x) = x^2 - 4$



[redacted]

a. x-intercept(s): [redacted]

b. y-intercept: [redacted]

Name: Solving Quadratic and Other Equations | 3.5

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Ready

Topic: Converting measurement of area, area and perimeter.

While working with areas it sometimes essential to convert between units of measure, for example changing from square yards to square feet and so forth. Convert the areas below to the desired measure. (Hint: area is two dimensional, for example 1 yd² = 9 ft² because 3 ft along each side of a square yard equals 9 square feet.)

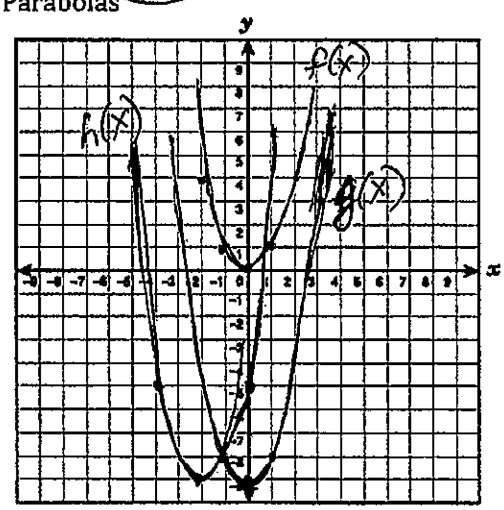
1. 7 yd² = ? ft²
   $7\,yd^2 \times \frac{(3\,ft)^2}{(1\,yd)^2} = 63\,ft^2$
2. 5 ft² = ? in² [redacted]
3. 1 mile² = ? ft² 5280 ft = 1 mile
   $1\,mi^2 \times \frac{(5280\,ft)^2}{1\,mi^2} = 27{,}878{,}400$
4. 100 m² = ? cm² [redacted]
5. 300 ft² = ? yd²
   $300\,ft^2 \times \frac{(1\,yd)^2}{(3\,ft)^2} = \frac{300}{9}\,yd^2 = \frac{100}{3}\,yd^2$
6. 96 in² = ? ft² [redacted]

Set

Topic: Transformations and Parabolas, Symmetry and Parabolas

7a. Graph each of the quadratic functions.

$f(x) = x^2$
$g(x) = x^2 - 9$
$h(x) = (x + 2)^2 - 9$



b. How do the functions compare to each other?
g(x) translated down 9 units
h(x) translated left 2 units, then down 9 units

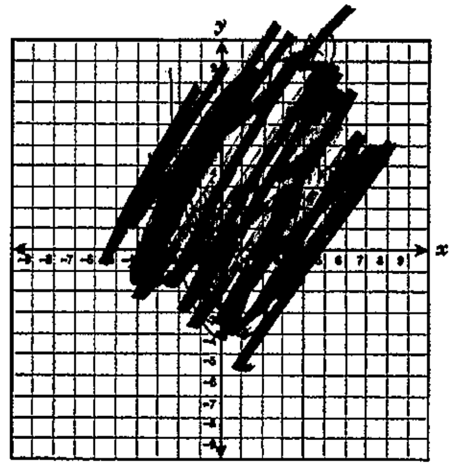
c. How do $g(x)$ and $h(x)$ compare to $f(x)$?
g(x) is f(x) shifted down 9
h(x) is g(x) shifted down 9 and left 2

d. Look back at the functions above and identify the x-intercepts of $g(x)$. What are they?
$g(x): (x-3)(x+3) = 0$
$x = 3 \quad x = -3 \quad (3,0)\ (-3,0)$

e. What are the coordinates of the points corresponding to the x-intercepts in $g(x)$ in each of the other functions? How do these coordinates compare to one another?
$f(x): (-3, 9), (3, 9)$
$h(x): (-3, -8)\ (3, 16)$

8a. Graph each of the quadratic functions.

$$f(x) = x^2$$
$$g(x) = x^2 - 4$$
$$h(x) = (x-1)^2 - 4$$



b. How do the functions compare to each other?.

[redacted]

c. How do $g(x)$ and $h(x)$ compare to $f(x)$?

[redacted]

d. Look back at the functions above and identify the x-intercepts of $g(x)$. What are they?

[redacted]

e. What are the coordinates of the points corresponding to the x-intercepts in $g(x)$ in each of the other functions? How do these coordinates compare to one another?

[redacted]

9. How can the transformations that occur to the function $f(x) = x^2$ be used to determine where the x-intercepts of the function's image will be?

$f(x) = (x+a)^2 + b$

x-intercepts: $(\sqrt{-b} - a, 0), (-\sqrt{-b} - a, 0)$

Go

Topic: Function Notation and Evaluating Functions

Use the given functions to find the missing values. (Check your work using a graph.)

10. $f(x) = x^2 + 4x - 12$

a. $f(0) =$ [redacted]

b. $f(2) =$ [redacted]

c. $f(x) = 0, \quad x =$ [redacted]

d. $f(x) = 20, \quad x =$ [redacted]

11. $g(x) = (x-5)^2 + 2$

a. $g(0) =$ 27

b. $g(5) =$ 2

c. $g(x) = 0, \quad x =$ NO SOLUTION

d. $g(x) = 16, \quad x =$ $5 \pm \sqrt{14}$

$g(0) = (0-5)^2 + 2 = 25 + 2 = 27$

$g(5) = (5-5)^2 + 2$

$0 = (x-5)^2 + 2$

$\sqrt{-2} = \sqrt{(x-5)^2}$

$16 = (x-5)^2 + 2$

$\sqrt{14} = \sqrt{(x-5)^2}$

$\pm\sqrt{14} = x - 5$

$x = 5 \pm \sqrt{14}$

Ready, Set, Go!

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Topic: Finding x-intercepts for linear equations.

1. Find the x-intercept of each equation below. Write your answer as an ordered pair. Consider how the format of the given equation either facilitates for inhibits your work.

a. $3x + 4y = 12$ $(4, 0)$

$3x + 4(0) = 12$

$3x = 12$

$x = 4$

b. $y = 5x - 3$ [redacted]

c. $y - 5 = -4(x + 1)$ $(\frac{1}{4}, 0)$

$y - 5 = -4(x + 1)$

$0 - 5 = -4x - 4$

$\frac{-1}{-4} = \frac{-4x}{-4}$ $x = \frac{1}{4}$

d. $y = -4x + 1$ [redacted]

e. $y - 6 = 2(x + 7)$ $(-10, 0)$

$0 - 6 = 2x + 14$

$\frac{-20}{2} = \frac{2x}{2}$ $x = -10$

f. $5x - 2y = 10$ [redacted]

2. Which of the linear equation formats above facilitates your work in finding x-intercepts? Why?

STANDARD FORM IS GENERALLY THE EASIEST FOR FINDING X-INTERCEPTS

3. Using the same equations from question 1, find the y-intercepts. Write your answers as ordered pairs

a. $3x + 4y = 12$ $(0, 3)$

$3(0) + 4y = 12$

$y = 3$

b. $y = 5x - 3$ [redacted]

c. $y - 5 = -4(x + 1)$ [redacted]

d. $y = -4x + 1$ [redacted]

e. $y - 6 = 2(x + 7)$ $(0, 20)$

$y - 6 = 2(7)$

$y = 14 + 6 = 20$

f. $5x - 2y = 10$ [redacted]

4. Which of the formats above facilitate finding the y-intercept? Why?

SLOPE-INTERCEPT FORM IS THE EASIEST FOR FINDING Y-INTERCEPTS.

Set

Topic: Solve Quadratic Equations, Connecting Quadratics with Area

For each of the given quadratic equations, (a) describe the rectangle the equation fits with. (b) What constraints have been placed on the dimensions of the rectangle?

5. $x^2 + 7x - 170 = 0$

$(x+17)(x-10) = 0$

$x = 10$ $\cancel{x = -17}$

Constraints $x > 10$

6. $x^2 + 15x - 16 = 0$

[redacted]

7. $x^2 + 2x - 35 = 0$

$\cancel{(x+7)}(x-5) = 0$

$x = 5$

$x > 5$

8. $x^2 + 10x - 80 = 0$

[redacted]

Solve the quadratic equations below.

9. $x^2 + 7x - 170 = 0$

$(x+17)(x-10) = 0$

$x = -17$

$x = 10$

10. $x^2 + 15x - 16 = 0$

[redacted]

11. $x^2 + 2x - 35 = 0$

$(x+7)(x-5) = 0$

$x = -7$

$x = 5$

12. $x^2 + 10x - 80 = 0$

[redacted]

Go

Topic: Factoring Expressions

Write each of the expressions below in factored form.

13. $x^2 - x - 132$

$(x-12)(x+11)$

14. $x^2 - 5x - 36$

[redacted]

15. $x^2 + 5x + 6$

$(x+3)(x+2)$

16. $x^2 + 13x + 42$

[redacted]

17. $x^2 + x - 56$

$(x+8)(x-7)$

18. $x^2 - x$

[redacted]

19. $x^2 - 8x + 12$

$(x-6)(x-2)$

20. $x^2 - 10x + 25$

[redacted]

21. $x^2 + 5x$

$x(x+5)$

Need Assistance? Check out these additional resources:

https://www.khanacademy.org/math/trigonometry/polynomial_and_rational/quad_factoring/v/factoring-quadratic-expressions

Name: Solving Quadratic and Other Equations | 3.7

Ready, Set, Go!

Ready

Topic: Symmetry and Distance

The given functions provide the connection between possible areas, $A(x)$, that can be created by a rectangle for a given side length, x, and a set amount of perimeter. You could think of it as the different amounts of area you can close in with a given amount of fencing as long as you always create a rectangular enclosure.

1. $A(x) = x(10 - x)$

Find the following:

a. $A(3) = 21$ b. $A(4) = 24$

$A(3) = 3(7)$ $A(4) = 4(10-4)$

c. $A(6) = 24$ d. $A(x) = 0$ $x = 0, 10$

$A(6) = 6(10-6)$ $A(x) = 0 = x(10-x)$

e. When is A(x) at its maximum? Explain or show how you know.

(5, 25) 5 is halfway between 4 and 6 or between 0 and 10 $A(5) = 5(10-5) = 25$

2. $A(x) = x(50 - x)$

Find the following:

a. A(10) = [redacted] b. A(20) = [redacted]

c. A(30) = [redacted] d. $A(x) = 0$ [redacted]

e. When is A(x) at its maximum? Explain or show how you know.

[redacted]

3. $A(x) = x(75 - x)$

Find the following:

a. $A(20) = 1,100$ b. $A(35) = 1,400$

$A(20) = 20(75-20)$ $A(35) = 35(75-35)$

c. $A(40) = 1,400$ d. $A(x) = 0$

$A(40) = 40(75-40) = 40(35)$ $0 = x(75-x)$ $x = 0$ $x = 75$

e. When is A(x) at its maximum? Explain or show how you know.

$0 \leftrightarrow 75$ $\frac{75}{2}$ (37.5, 1,406.25)

$A(37.5) = 37.5(75-37.5)$

4. $A(x) = x(48 - x)$

Find the following:

a. A(10) = [redacted] b. A(20) = [redacted]

c. A(28) = [redacted] d. $A(x) = 0$ [redacted]

e. When is A(x) at its maximum? Explain or show how you know.

[redacted]

Set

Topic: Solving Quadratic Equations Efficiently

For each of the given quadratic equations find the solutions using an efficient method. State the method you are using as well as the solutions. You must use at least three different methods.

5. $x^2 + 17x + 60 = 0$

$(x+12)(x+5) = 0$

$\boxed{x = -12,\ x = -5}$

6. $x^2 + 16x + 39 = 0$

[redacted]

7. $x^2 + 7x - 5 = 0$

$x = \dfrac{-7 \pm \sqrt{7^2 - 4(1)(-5)}}{2(1)}$

$x = \dfrac{-7 \pm \sqrt{49+20}}{2}$ $\boxed{x = \dfrac{-7 \pm \sqrt{69}}{2}}$

8. $3x^2 + 14x - 5 = 0$

[redacted]

9. $x^2 - 12x = -8$

$x^2 - 12x + 36 = -8 + 36$

$\sqrt{(x-6)^2} = \sqrt{28}$

$x - 6 = \pm 2\sqrt{7}$ $\boxed{x = 6 \pm 2\sqrt{7}}$

10. $x^2 + 6x = 7$

[redacted]

Summarize the process for solving a quadratic by the indicated strategy. Give examples along with written explanation, also indicate when it is best to use this strategy.

11. Completing the Square

Completing the square is most easily done with #9, #10. $a = 1$ b is even. Get $c = \left(\frac{b}{2}\right)^2$

12. Factoring

[redacted]

13. Quadratic Formula

when factoring and completing the square will not work, use the formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Go

Topic: Graphing quadratics and finding essential features of the graph. Solving systems of equations.

Graph the quadratic function and supply the desired information about the graph.

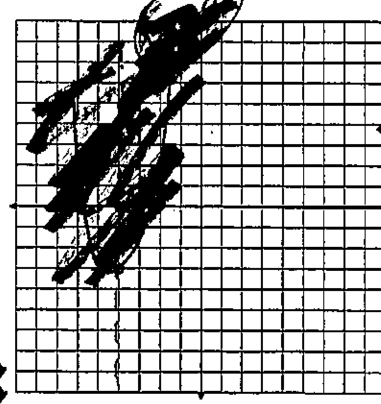
14. $f(x) = x^2 + 8x + 13$

a. Line of symmetry: [redacted]

b. x-intercepts: [redacted]

c. y-intercept: [redacted]

d. vertex: [redacted]



15. $f(x) = x^2 - 4x - 1$

a. Line of symmetry:

$x = 2$

b. x-intercepts:

$(2+\sqrt{5}, 0)$ $(2-\sqrt{5}, 0)$

c. y-intercept:

$(0, -1)$

d. vertex:

$V(2, -5)$

$x^2 - 4x + \underline{4} = 1 + 4$

$\left(\frac{-4}{2}\right)^2$

$(x-2)^2 = 5$

$(x-2)^2 - 5 = 0$

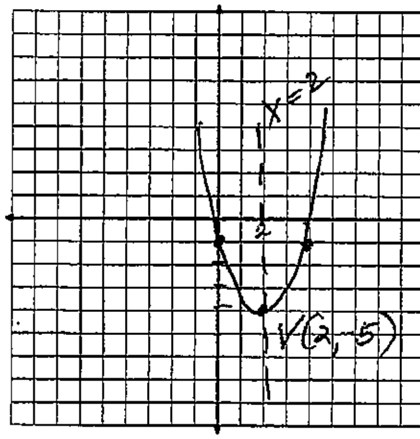
$y = 0 - 4(0) - 1$

$x = 0 \quad y = -1$

$\sqrt{(x-2)^2} = \sqrt{5}$

$x - 2 = \pm\sqrt{5}$

$x = 2 \pm \sqrt{5}$



$x = 4$

$y = 4^2 - 4(4) - 1$

$= 16 - 16 - 1$

$= -0 - 1 =$

-1

Solve each system of equations using an algebraic method and check your work!

16.

$$-\begin{cases} 3x + 5y = 15 \\ 3x - 2y = 6 \end{cases}$$

[redacted]

17.

$$\begin{cases} y = -7x + 12 \\ y = 5x - 36 \end{cases}$$

$-7x + 12 = 5x - 36$

$+7x + 36 \quad +7x + 36$

$\frac{48}{12} = \frac{12x}{12}$ $\quad x = 4$

$y = -7(4) + 12$

$y = -28 + 12$ $\quad y = -16$

$\boxed{(4, -16)}$

18.

$$\begin{cases} y = 2x + 12 \\ y = 10x - x^2 \end{cases}$$

[redacted]

19.

$$\begin{cases} y = 24x - x^2 \\ y = 8x + 48 \end{cases}$$

$24x - x^2 = 8x + 48$

$x^2 - 16x + 48 = 0$

$(x - 12)(x - 4) = 0$

$x = 12 \qquad x = 4$

$y = 8(12) + 48 \qquad y = 8(4) + 48$

$= 96 + 48 \qquad = 32 + 48$

$y = 144 \qquad = 80$

$\boxed{(12, 144)}$ $\quad \boxed{(4, 80)}$

Name: Solving Quadratic and Other Equations | 3.8

Ready, Set, Go!

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Ready

Topic: Simplifying radicals

Simplify each of the radicals below.

1. $\sqrt{8} = \sqrt{4 \cdot 2} = \sqrt{4} \cdot \sqrt{2}$ $2\sqrt{2}$
2. $\sqrt{18} =$ [redacted]
3. $\sqrt{32} = \sqrt{16 \cdot 2}$ $4\sqrt{2}$
4. $\sqrt{20} =$ [redacted]
5. $\sqrt{45} = \sqrt{9 \cdot 5}$ $= 3\sqrt{5}$
6. $\sqrt{80} =$ [redacted]

7. What is the connection between the radicals above? Explain.

Questions #1 – 3 have $\sqrt{2}$
#4 – 6 have $\sqrt{5}$

Set

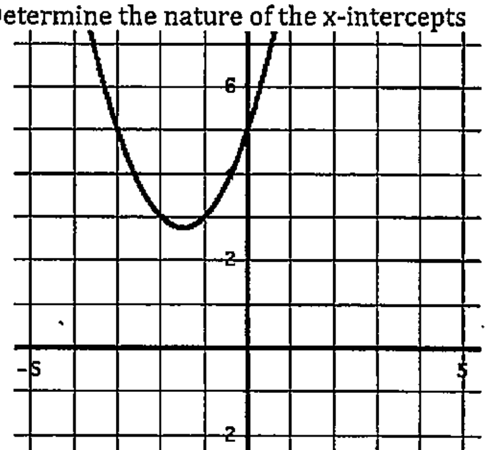
Topic: Determine the nature of the x-intercepts for each quadratic below.

Given the quadratic function, its graph or other information below determine the nature of the x-intercepts (what type of number it is). Explain or show how you know.
(Whole numbers "$\mathbb{W}$", Integers "$\mathbb{Z}$", Rational "$\mathbb{Q}$", Irrational "$\overline{\mathbb{Q}}$", or finally, "not Real")

8. Determine the nature of the x-intercepts.

[redacted]

9. Determine the nature of the x-intercepts



NOT REAL NO X-INTERCEPTS

10. Determine the nature of the x-intercepts.

$f(x) = x^2 + 4x - 24$

[redacted]

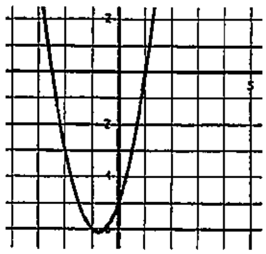
11. Determine the nature of the x-intercepts.

$g(x) = (2x - 1)(5x + 2)$

$g(x) = 10x^2 - 5x + 4x - 2 \quad 10x^2 - x - 2 = f(x)$

Q: Rational

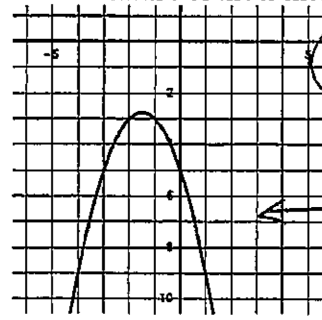
12. ~~Determine~~ the nature of the x-intercepts.



[redacted]

$f(x) = 2x^2 + 3x - 5$

13. Determine the nature of the x-intercepts.



NOT REAL

14. Determine the nature of the x-intercepts.

$r(t) = t^2 - 8t + 16$

[redacted]

15. Determine the nature of the x-intercepts.

$h(x) = 3x^2 - 5x + 9$

NOT REAL

Determine the number of roots that each polynomial will have.

16. $x^5 + 7x^3 - x^2 + 4x - 21$ [redacted]

17. $4x^3 + 2x^2 - 3x - 9$ roots : 3

18. $2x^7 + 4x^5 - 5x^2 + 16x + 3$ [redacted]

Go

Topic: Finding x-intercepts for quadratics using factoring and quadratic formula.

If the given quadratic function can be factored then factor and provide the x-intercepts. If you cannot factor the function then use the quadratic formula to find the x-intercepts.

19. $A(x) = x^2 + 4x - 21$

$(x+7)(x-3)$

$x = -7, \quad x = 3$

$\boxed{(-7, 0) \quad (3, 0)}$

20. $B(x) = 5x^2 + 16x + 3$

[redacted]

21. $C(x) = x^2 - 4x + 1$

$x = \dfrac{+4 \pm \sqrt{16 - 4(1)1}}{2(1)}$

$= \dfrac{+4 \pm \sqrt{12}}{2}$

$= 2 \pm \dfrac{2\sqrt{3}}{2}$

22. $D(x) = x^2 - 16x + 4$

[redacted]

23. $E(x) = x^2 + 3x - 40$

$(x+8)(x-5)$

$x = -8 \quad x = 5$

$\boxed{(-8, 0) \quad (5, 0)}$

24. $F(x) = 2x^2 - 3x - 9$

[redacted]

25. $G(x) = x^2 - 3x$

$x(x-3)$ $\boxed{(0,0) \quad (3,0)}$

$\boxed{x = 0, \quad x = 3}$

26. $H(x) = x^2 + 6x + 8$

[redacted]

27. $K(x) = 3x^2 - 11$

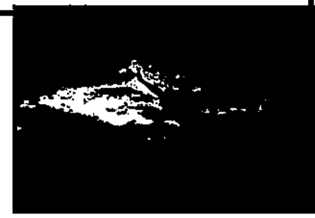
$\boxed{\left(\dfrac{\sqrt{33}}{3}, 0\right) \quad \left(-\dfrac{\sqrt{33}}{3}, 0\right)}$

Need Assistance? Check out these additional resources:

https://www.khanacademy.org/math/algebra/quadratics/quadratic_formula/v/quadratic-formula-1

Name: Solving Quadratic and Other Equations | 3.9

Ready, Set, Go!



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Ready

Topic: Classifying numbers according to set.

Classify each of the numbers represented below according to the sets to which they belong. If a number fits in more than one set then list all that apply.
(Whole numbers "𝕎", Integers "ℤ", Rational "ℚ", Irrational "$\bar{\mathbb{Q}}$", Real "ℝ", Complex "ℂ")

1. π $\bar{Q}$
2. -13 [redacted]
3. $\sqrt{-16}$ C
4. 0 [redacted]
5. $\sqrt{75}$ $\bar{Q}$
6. $\frac{9}{3}$ [redacted]
7. $\sqrt{\frac{4}{9}}$ Q
8. $5+\sqrt{2}$ [redacted]
9. $\sqrt{-40}$ C

Set

Topic: Simplifying radicals, imaginary numbers

Simplify each radical expression below.

10. $3+\sqrt{2}-7+3\sqrt{2}$

[redacted]

11. $\sqrt{5}-9+8\sqrt{5}+11-\sqrt{5}$

$(-9+11)+(\sqrt{5}+8\sqrt{5}-\sqrt{5})$

$2+8\sqrt{5}$

12. $\sqrt{12}+\sqrt{48}$ [redacted]

13. $\sqrt{8}-\sqrt{18}+\sqrt{32}$

$2\sqrt{2}-3\sqrt{2}+4\sqrt{2}$

$3\sqrt{2}$

14. $11\sqrt{7}-5\sqrt{7}$

[redacted]

15. $7\sqrt{7}+5\sqrt{3}-3\sqrt{7}+\sqrt{3}$

$(7\sqrt{7}-3\sqrt{7})+(5\sqrt{3}+\sqrt{3})$

$4\sqrt{7}+6\sqrt{3}$

Simplify. Express as a complex number using "*i*" if necessary.

16. $\sqrt{-2}\cdot\sqrt{-2}$ [redacted]

17. $7+\sqrt{-25}$

$7+5i$

18. $(4i)^2$ [redacted]

19. $i^2\cdot i^3\cdot i^4$

$(-1)(-i)i$

$(-1)(-i)$

i^9

$(i^2)^4\cdot i$

$(-1)^4\cdot i$

$1\cdot i = i$

20. $(\sqrt{-4})^3$

[redacted]

21. $(2i)(5i)^2$

$2i\cdot 25i^2$

$50(-1)i$

$-50i$

Solve each quadratic equation over the set of complex numbers.

22. $x^2 + 100 = 0$

[redacted]

23. $t^2 + 24 = 0$

$\sqrt{t^2} = \sqrt{-24}$

$t = \pm 2\sqrt{6}\,i$

$t = \pm 2i\sqrt{6}$

24. $x^2 - 6x + 13 = 0$

[redacted]

25. $r^2 - 2r + 5 = 0$

$\cancel{(r\quad)(r\quad)}$

$r = \dfrac{+2 \pm \sqrt{4 - 4(1)(5)}}{2}$

$r = \dfrac{2 \pm \sqrt{-16}}{2}$

$r = \dfrac{2 \pm 4i}{2}$

$r = 1 \pm 2i$

Go

Topic: Solve quadratic equations.

Use the discriminant to determine the nature of the roots to the quadratic equation.

26. $x^2 - 5x + 7 = 0$

[redacted]

27. $x^2 - 5x + 6 = 0$

$\sqrt{25 - 4(6)}$

$\sqrt{25 - 24} = 1;\ W$

28. $2x^2 - 5x + 5 = 0$

[redacted]

29. $x^2 + 7x + 2 = 0$

$\sqrt{49 - 4(1)(2)}$

$\sqrt{49 - 8} = \sqrt{41}\ Q$

30. $2x^2 + 7x + 6 = 0$

[redacted]

31. $2x^2 + 7x + 7 = 0$

$\sqrt{49 - 4(2)(7)}$

$\sqrt{49 - 56} = \sqrt{-7}\ C$

32. $2x^2 - 7x + 6 = 0$

[redacted]

33. $2x^2 + 7x - 6 = 0$

$\sqrt{49 - 4(2)(-6)}$

$\sqrt{49 + 48} = \sqrt{97}\ Q$

34. $x^2 + 6x + 9 = 0$

[redacted]

Solve the quadratic equations below using an appropriate method.

35. $m^2 + 15m + 56 = 0$

$(m+8)(m+7) = 0$

$m = -8, -7$

36. $5x^2 - 3x + 7 = 0$

[redacted]

37. $x^2 - 10x + 21 = 0$

$(x-7)(x-3) = 0$

$x = 7, 3$

38. $6x^2 + 7x - 5 = 0$

[redacted]

Ready, Set, Go!

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Ready

Topic: Attributes of quadratics and other functions

1. Summarize what you have learned about quadratic functions to this point. In addition to your written explanation provide graphs, tables and examples to illustrate what you know. ANSWERS WILL VARY

2. In prior work you have learned a great deal about both linear and exponential functions. Compare and contrast linear and exponential functions with quadratic functions. What similarities if any are there and what differences are there between linear, exponential and quadratic functions?

[redacted]

Set

Topic: Operations on different types of numbers

3. The Natural numbers, $\mathbb{N}$, are just that the numbers that come naturally or the counting numbers. As any child first learns numbers they learn 1, 2, 3, ... What operations on the Natural numbers would cause the need for other types of numbers? What operation on Natural numbers create a need for Integers or Rational numbers and so forth. (Give examples and explain.)

SUBTRACTION OF NATURAL NUMBERS CREATES A NEED FOR THE INTEGERS. DIVISION OF NATURAL NUMBERS CREATES THE NEED FOR RATIONAL NUMBERS.

In each of the problems below use the given items to determine whether or not it is possible *always, sometimes* or *never* to create a new element* **that is in the desired set.**

4. Using the operation of addition and elements from the Integers, $\mathbb{Z}$, [always, sometime, never] an element of the Irrational numbers, $\bar{\mathbb{Q}}$, will be created. Explain.

[redacted]

5. Consider the equation $a - b = c$, where $a \in \mathbb{N}$ and $b \in \mathbb{N}$, c will be an Integer, $\mathbb{Z}$ [always, sometimes, never]. Explain.

ALWAYS. IF BOTH A AND B ARE INTEGERS, SUBTRACTING ONE FROM THE OTHER WILL EITHER BE A POSITIVE OR NEGATIVE WHOLE NUMBER (AN INTEGER)

6. Consider the equation $a \div b = c$, where $a \in \mathbb{Z}$ and $b \in \mathbb{Z}$, then is $c \in \mathbb{Z}$ [sometimes, always, never]. Explain.

[redacted]

**The numbers in any given set of numbers may be referred to as elements of the set. For example, the Rational number set, $\mathbb{Q}$, contains elements or numbers that can be written in the form $\frac{a}{b}$, where a and b are integer values ($b \neq 0$).*

7. Using the operation of subtraction and elements from the Irrationals, $\overline{\mathbb{Q}}$, an element of the Irrational numbers, $\overline{\mathbb{Q}}$, will be created [always, sometime, never]. Explain.

ALWAYS / SOMETIMES. IF THE SAME IRRATIONAL NUMBER IS SUBTRACTED FROM ITSELF, YOU WILL GET A WHOLE NUMBER. HOWEVER, THIS IS THE ONLY EXAMPLE OF SUBTRACTING IRRATIONAL NUMBERS THAT WILL NOT GIVE YOU ANOTHER IRRATIONAL NUMBER.

8. If two Complex numbers, $\mathbb{C}$, are subtracted the result will [always, sometimes, never] be a Complex number, $\mathbb{C}$. Explain.

[redacted]

Go

Topic: Solving all types of Quadratic Equations, Simplifying Radicals

Make a prediction as to the nature of the solutions for each quadratic (Real, Complex, Integer, etc.) then solve each of the quadratic equations below using an appropriate and efficient method. Give the solutions and compare to your prediction.

9. $-5x^2 + 3x + 2 = 0$

$X = \frac{-3 \pm \sqrt{9-4(-5)(2)}}{2(-5)}$

Prediction:

$X = \frac{-3 \pm \sqrt{9+40}}{-10}$

Solutions:

$X = \frac{-3 \pm \sqrt{49}}{-10}$

$X = \frac{-3 \pm 7}{-10}$, $X = \frac{4}{-10} = -\frac{2}{5}$, $X = 1$

10. $x^2 + 3x + 2 = 0$

Prediction: [redacted]

Solutions:

11. $x^2 + 3x - 12 = 0$

$X = \frac{-3 \pm \sqrt{9-4(1)(-12)}}{2}$

Prediction:

$X = \frac{-3 \pm \sqrt{9+48}}{2}$

Solutions:

$X = \frac{-3 \pm \sqrt{57}}{2}$

12. $4x^2 - 19x - 5 = 0$

Prediction: [redacted]

Solutions:

Simplify each of the radical expressions. Use rational exponents if desired.

13. $\sqrt[4]{81x^8y^{12}}$

$\sqrt[4]{81}\ \sqrt[4]{x^8}\ \sqrt[4]{y^{12}}$

$3x^2y^3$

14. $\sqrt{\frac{a^7b^{10}}{a^3}}$

[redacted]

15. $\sqrt[5]{625x^{12}}$

$\sqrt[5]{625}\ \sqrt[5]{x^{12}}$

$\sqrt[5]{5^4}\ \sqrt[5]{x^{12}} = 5^{\frac{4}{5}} \cdot x^{\frac{12}{5}}$

16. $(\sqrt{n})^5$

[redacted]

17. $\sqrt[3]{-27}$

$3i$

18. $(\sqrt{8})(\sqrt{3^2})(2)$

[redacted]

Fill in the table so each expression is written in radical form and with rational exponents.

	Radical Form	Exponential Form
19.	$\sqrt[4]{8^3}$	$8^{3/4}$
20.	[redacted]	$256^{\frac{3}{4}}$
21.	$\sqrt[4]{2^7 \bullet 4^5}$	[redacted]
22.	[redacted]	$16^{\frac{3}{2}} \bullet 4^{\frac{1}{2}}$
23.	$\sqrt[10]{x^{23}y^{31}}$	$x^{23/10}\ y^{31/10}$
24.	$\sqrt[5]{64a^9b^{18}}$	[redacted]