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Diamond Problems

Basic Diamond (given two side numbers):

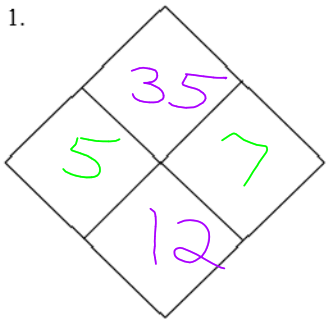
- The number in the top of the diamond is what the two side numbers multiply to be.
- The number in the bottom of the diamond is what the two side numbers add up to be.

Working Backwards Diamond (given one side number and either the top or bottom number):

- If given the top number, divide the top number by the side number and that will give you the other side number.
- If given the bottom number, subtract bottom number minus side number and that will give you the other side number.

Examples:

1.



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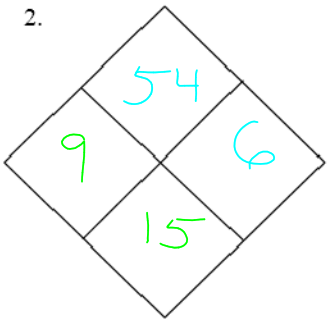

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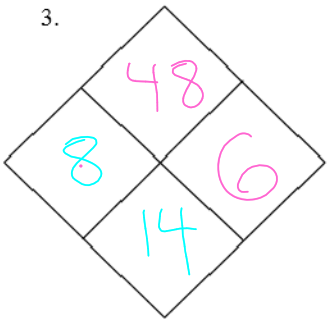

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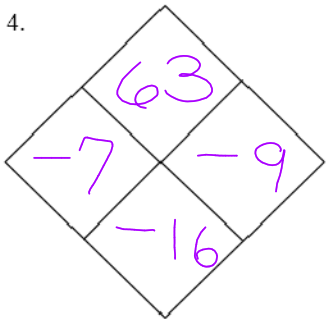

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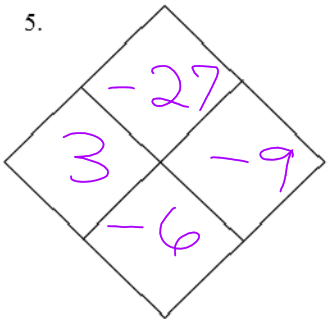

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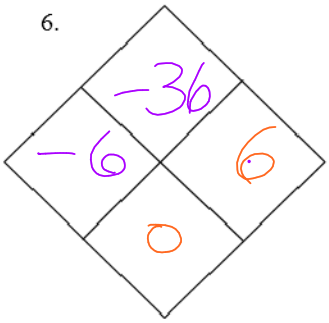

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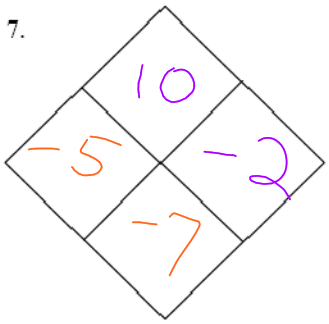

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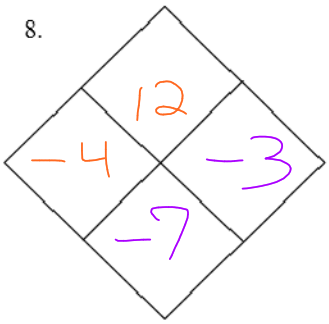

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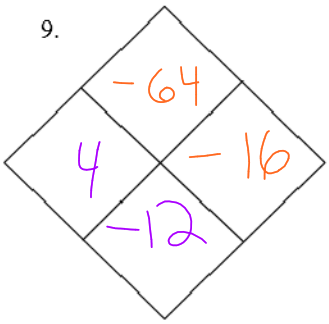


Mental Percents

Number	100%	50%	25%	10%	5%	1%
This is the number that we give you.	This is the entire original number.	Divide the original number or 100% answer by 2. (50% is half of 100%)	Divide the 50% answer by 2. (25% is half of 50%)	Go back to the original number and move the decimal point one place to the left.	Divide the 10% answer by 2. (5% is half of 10%)	Go back to the original number and move the decimal point two places to the left.

same ÷2 ÷2 ←1 ÷2 ←1

Number	100%	50%	25%	10%	5%	1%
200	200	100	50	20	10	2
$60	$60	$30	$15	$6	$3	$.60
$126	$126	$63	$31.50	$12.60	$6.30	$1.26
48	48	24	12	4.8	2.4	.48

Using a chart to answer questions:

Steps:

1. Figure out how to get the asked for percentage by using a combination of adding, subtracting, or multiples of the 100%, 50%, 25%, 10%, 5%, or 1%. Examples: For 75%, you would add 50% and 25% together. For 40%, you might do 4 times the 10% or 50% minus 10%.
2. Then use the answers in those percent boxes to get the final answer.

Examples:

1. 35% of 200

25% + 10%

50 + 20

= 70

2. 8% of $126

5% + 3(1%)

$6.30 + 3(1.26)

$10.08

3. 80% of 48

- 50% + 25% + 5%
- 50% + 3(10%)
- 8(10%)

24 + 12 + 2.4

= 38.4

Solving Equations

Steps:

1. Distribute (multiply anything inside the parentheses by the number outside them)
2. CLT (Combine Like Terms) on the same side of the equals sign.
3. Get all the variables (letters) on the same side of the equals sign.
4. Move the numbers to the opposite side of the equals sign.
5. Divide both sides by the number in front of the variable.

Examples:

1. $5x = 15$, $x = 3$

2. $x + 8 = 20$, $x = 12$

3. $7x + 6 = 2x + 21$, $5x + 6 = 21$, $5x = 15$, $x = 3$

4. $8x + 20 = 10x$, $20 = 2x$, $10 = x$

5. $5(x+3) + 1 = 2(3x+4) + 3x$, $5x + 15 + 1 = 6x + 8 + 3x$, $5x + 16 = 9x + 8$, $16 = 4x + 8$, $8 = 4x$, $2 = x$

6. $8 - (2x+3) + 12x = -3(x+5) + 7$, $8 - 2x - 3 + 12x = -3x - 15 + 7$, $10x + 5 = -3x - 8$, $13x + 5 = -8$, $13x = -13$, $x = -1$

7.

Domain/Range Tables

To complete a Domain/Range Table:

- The Domain is the first column, the *x* column. These are the values that will be given to you for each problem.
- The Range is the last column, the *y* column. These are the answers that you will be getting by plugging each *x*-value into the equation in the middle column.

Examples:

1.

x	$y=3x+2$	*y*
5	$3(5)+2$	17
9	$3(9)+2$	29
0	$3(0)+2$	2
7	$3(7)+2$	23
3	$3(3)+2$	11

2.

x	$y=x-4$	*y*
13	$13-4$	9
7	$7-4$	3
15	$15-4$	11
9	$9-4$	5
4	$4-4$	0

3.

x	$y=2x-5$	*y*
2	$2(2)-5$, $4-5$	-1
-7	$2(-7)-5$, $-14-5$	-19
-1	$2(-1)-5$, $-2-5$	-7
8	$2(8)-5$, $16-5$	11
3	$2(3)-5$, $6-5$	1

4.

x	$y=-x+7$	*y*
5	$-(5)+7$	2
-9	$-(-9)+7$, $9+7$	16
0	$-(0)+7$	7
13	$-(13)+7$	-6
-6	$-(-6)+7$	13

Multiplying

Steps:

1. Multiply the top number by the ones digit in the bottom number
2. Add a zero under the first answer
3. Multiply the top number by the tens digit in the bottom number
4. Add the two answers together

Examples:

1. $639 \times 27 = 4473 + 12780 = 17{,}253$

2. $174 \times 38 = 1392 + 5220 = 6{,}612$

3. ~~X~~

Long Division

Steps:

1. Divide – how many times does the outside number go into the inside number?
2. Multiply – write the number of times at the top and the answer below the inside number.
3. Subtract – subtract the bottom number from the top number.
4. Bring Down the next number.
5. Repeat until there are no more numbers to bring down.
6. Write the remainder.

Examples:

1. $4\overline{)7216}$ → 804; 4; 32; 32; 01; 0; 16; 16; 0

2. $7\overline{)6418}$ → 916 R.6; 63; 11; 7; 48; 42; 6

38	38	38	38	38	38	38	38	38
x 1	x 2	x 3	x 4	x 5	x 6	x 7	x 8	x 9
38	76	114	152	190	228	266	304	342

3. $38\overline{)7220}$ → 175; 38; 342; 380; 380; 0

4. $38\overline{)24137}$ → 635 R.7; 228; 133; 114; 197; 190; 7

Proportions

Steps:

1. Cross-Multiply: use ( ) for + or –
2. Distribute (Don't forget to distribute the negative if there is one)
3. Solve (See page 3)

Examples:

1. $\frac{16}{x} = \frac{4}{3}$

$4x = 48$

$x = 12$

2. $\frac{2}{2x+1} = \frac{4}{x+8}$

$2(x+8) = 4(2x+1)$

$2x + 16 = 8x + 4$

$-2x \quad\quad -2x$

$16 = 6x + 4$

$-4 \quad\quad -4$

$12 = 6x$

$2 = x$

3. $\frac{3}{x-5} = \frac{10}{x+2}$

$3(x+2) = 10(x-5)$

$3x + 6 = 10x - 50$

$-3x \quad\quad -3x$

$6 = 7x - 50$

$+50 \quad\quad +50$

$56 = 7x$

$8 = x$

4. $\frac{3x-9}{8} = \frac{x-3}{-4}$

$8(x-3) = -4(3x-9)$

$8x - 24 = -12x + 36$

$+12x \quad\quad +12x$

$20x - 24 = 36$

$+24 \quad\quad +24$

$\frac{20x}{20} = \frac{60}{20}$

$x = 3$

5. $\frac{4x}{3} = \frac{x+11}{-2}$

$3(x+11) = -8x$

$3x + 33 = -8x$

$-3x \quad\quad -3x$

$\frac{33}{-11} = \frac{-11x}{-11}$

$-3 = x$

Integers and Combining Like Terms

Adding and Subtracting Rules:

Steps:

1. Sign of the number goes on its left!
2. When signs are the same – add the numbers and keep the sign.
3. When signs are different – subtract the numbers and keep the sign of the bigger number.

pos. neg.

Examples:

1. same signs: $-3-9=-12$

2. different signs $-18+7=-11$

3. $8-12=-4$

$-6+11=5$

$7-8+15-13$

$-1+15-13$

$14-13$

1

Multiplying and Dividing Rules:

Steps:

1. Sign of the number goes on its left!
2. If the signs are same, the answer is positive.
3. If the signs are different, the answer is negative.

Examples:

1. $-3(-5)=15$

2. $7(-3)=-21$

3. $\frac{18}{-6}=-3$

Combining Like Terms (CLT):

Steps:

1. Put a box around your matching variable terms – include the sign on the left.
2. Circle the non-variable terms – include the sign on the left.
3. Add all the boxed terms together and then add all circled terms together.

Examples:

1. $-6x+2-x$

$-7x+2$

2. $4x-13+2-15x$

$-11x-11$

3.

Applications to Mental Percents

Answer each of the following applications to Mental Percents questions. Answers must be rounded to the nearest cent (hundredths).

Steps:

1. If the problem says you are buying more than 1 of an item, multiply the price by how many you are buying.
2. Find the percent of the price. (See page 2 or 11)
3. If it's a discount, subtract from the original price. If it's tip or tax, add to the original price.
4. Round all answers to the nearest cent (hundredth). (See page 11) Be sure to include $ signs on your answers.

Examples:

1. Mrs. Spiess went to Petco to get some Puppy Chow for her new puppy. A 20 pound bag of food cost $19 but she had a coupon for 20% off. How much did she have to pay for the food?

   Amount of Discount: $3.80

   Sales Price: $15.20

   10% of 19 → 1.90 → ×2 → 3.80

   19 − 3.80

2. Mrs. Woodruff went to buy 5 season passes to Six Flags. They offered a 25% discount if people buy 4 or more passes. Each pass costs $100. How much will she have to pay for 5 season passes?

   Total Original Cost for 5 season passes: $500 → 5($100)

   Amount of Discount for 5 season passes: $125 → 500 ÷ 4

   Sales Price for 5 season passes: $375 → 500 − 125

3. Mr. Loken and his wife went to dinner at Visconti's Ristorante in Folsom with the gift certificate the math department gave him at his retirement party. The bill was $72. Mr. Loken wanted to leave a 20% tip. How much would the bill be including tip?

   Amount of Tip: $14.40 → 2(7.20)

   Total Bill: $86.40 → 72 + 14.40

   tip = added tax

Percent Increase or Decrease

Find the percent of increase or decrease. Round % to the nearest tenth if necessary.

Steps:

1. Decide if the change is an increase (goes up) or decrease (goes down).
2. Subtract the smaller number from the bigger number. Don't forget a $ if it's money.
3. Use the percent formula $\frac{\text{is}}{of} = \frac{\%}{100}$ to find the percent.

$$\frac{\text{Difference (answer from step 2)}}{\text{original number}} = \frac{\%}{100}$$

4. Round % to the nearest tenth if necessary. Don't forget the % on your answer.

one after decimal

Examples:

1. John got a raise at Starbuck's from $8.75 an hour to $10.50 an hour. Find the percent increase or decrease.

   Is this an increase or decrease? increase How much? $1.75

   What is the percent of increase or decrease? 20%

   $\frac{1.75}{8.75} = \frac{x}{100}$

   $8.75x = 175$, $x = 20$

2. Ticket prices at the park for Six Flags are $61.99. If you buy your ticket online, they're $47.99. Find the percent increase or decrease for buying online instead of at the park.

   Is this an increase or decrease? decrease How much? $14

   What is the percent of increase or decrease? 22.6%

   $\frac{14}{61.99} = \frac{x}{100}$

   $61.99x = 1400$

   $x = 22.6$...

Percent Formula

Use the percent Formula $\frac{\text{is}}{\text{of}} = \frac{\%}{100}$ to solve the following. Round money answers to the nearest cent (hundredth), all others to the nearest tenth.

Steps:

1. Plug the %, is and of into the formula. Put an '*x*' for the missing one.
2. Cross-Multiply
3. Solve
4. Round money answers to the nearest cent (hundredths).
   Examples:
   45.863 would be $45.86
   16.5 would be $16.50
   8.875 would be $8.88

5. Round all other answers to the nearest tenth (if necessary).
   Examples:
   60.58% would be 60.6%
   17.523 would be 17.5

Examples:

1. 65% of 420 is 273.

$$\frac{x}{420} = \frac{65}{100}$$

2. 35 is 21.9% of 160

$$\frac{35}{160} = \frac{x}{100}$$

3. 135 out of 150 is 90%.

$$\frac{135}{150} = \frac{x}{100}$$

$$\frac{150x}{150} = \frac{13500}{150}$$

4. \$13 is 60% of \$21.67.

$$\frac{13}{x} = \frac{60}{100}$$

$$\frac{60x}{60} = \frac{1300}{60}$$

5. 5% of 120 = 6 (is = 6)

$$\frac{6}{x} = \frac{5}{100}$$

$$\frac{5x}{5} = \frac{600}{5}$$

6. What is 75% of \$125? \$93.75

$$\frac{x}{125} = \frac{75}{100}$$

Fractions

Reducing Fractions:

Steps:

1. Find a number that divides evenly into both top and bottom.
2. Keep dividing both numbers until nothing but 1 divides into both top and bottom.

Examples:

1. $\frac{12}{18} \div 6 = \frac{2}{3}$ $\div 6$ 2. $\frac{5}{10} \div 5 = \frac{1}{2}$ $\div 5$ 3. $\frac{36}{60} \div 6 = \frac{6}{10} \div 2 = \frac{3}{5}$ $\div 2$ $\div 6$

Turning improper fractions into mixed numbers:

Steps:

1. Divide the top number by the bottom. This is the whole number part of your answer.
2. The remainder is the top part of the fraction.
3. Keep the bottom part of the fraction as it started.
4. Reduce if necessary.

Examples:

1. 2. 3.

Turning mixed numbers into improper fractions:

Steps:

1. Multiply the whole number by the bottom number.
2. Add the top number to your answer from step 1.
3. Put that answer over the original bottom number.

Examples:

1. $5\frac{3}{4} = \frac{23}{4}$ (+ then ×) 2. $9\frac{4}{7} = \frac{67}{7}$ (63) 3. $3\frac{3}{8} = \frac{27}{8}$

Fractions

Multiplying and Dividing Fractions

Steps:

1. Turn mixed numbers into improper fractions.
2. When dividing flip the second fraction, then multiply
3. Cross cancel if possible
4. Multiply across the top and across the bottom
5. Simplify

Examples:

1. $\frac{6}{15} \cdot \frac{3}{8} = \frac{3}{20}$

2. $2\frac{5}{8} \cdot 3\frac{6}{8} = \frac{21}{8} \cdot \frac{30}{8} = \frac{315}{32}$

3. $6\frac{1}{4} \div 4\frac{3}{8} = \frac{25}{4} \div \frac{35}{8} = \frac{25}{4} \cdot \frac{8}{35} = \frac{10}{7}$

Adding and Subtracting Fractions with Like Denominators

Steps:

1. Turn mixed numbers into improper fractions
2. Add or subtract the top numbers (bottom numbers stay the same)
3. Simplify – reduce your answer and turn it into a mixed number if necessary

Examples:

1. $\frac{11}{16} + \frac{3}{16} = \frac{14}{16} = \frac{7}{8}$

2. $2\frac{5}{8} + 3\frac{6}{8} = \frac{21}{8} + \frac{30}{8} = \frac{51}{8} = 6\frac{3}{8}$

3. $4\frac{5}{16} - 2\frac{7}{16} = \frac{69}{16} - \frac{39}{16} = \frac{30}{16} = \frac{15}{8} = 1\frac{7}{8}$

Adding and Subtracting Fractions with unlike denominators - MUST have common denominators

Steps:

1. Turn mixed numbers into improper fractions
2. Get a common denominator - find the lowest common multiple or multiply them by each other.
3. Add or subtract the top numbers (bottom numbers stay the same)
4. Simplify – reduce your answer and turn it into a mixed number if necessary

Examples:

1. $\frac{5}{8} - \frac{1 \cdot 2}{4 \cdot 2} = \frac{5}{8} - \frac{2}{8} = \frac{3}{8}$

2. $5\frac{2 \cdot 2}{3 \cdot 2} + 1\frac{1 \cdot 3}{2 \cdot 3}$

$5\frac{4}{6} + 1\frac{3}{6}$

$\frac{34}{6} + \frac{9}{6} = \frac{43}{6} = 7\frac{1}{6}$

3. $3\frac{1 \cdot 2}{6 \cdot 2} - 1\frac{3 \cdot 3}{4 \cdot 3}$

$3\frac{2}{12} - 1\frac{9}{12}$

$\frac{38}{12} - \frac{21}{12} = \frac{17}{12} = 1\frac{5}{12}$

Scientific and Standard Notation

From Scientific Notation to Standard Form:

Steps:

1. For a positive exponent – move decimal to the right
2. For a negative exponent – more decimal to the left
3. Fill in holes with zeroes.

Examples:

1. 3.0538×10^{6} → 3.0538800 → 3053,800

2. 4.67×10^{-3} → .004.67 → .00467

3. 5.2795×10^{2} → 5.27.95 → 527.95

From Standard Form to Scientific Notation:

Steps:

1. Only 1 number to the left of the decimal!
2. Count how many times you move the decimal so there's only one number to the left – that will be your exponent
3. If the number is bigger than one, it's a positive exponent
4. If the number is less than one, it's a negative exponent

Examples:

1. 4,320,916 → 4320916. → 4.320916×10^{6}

2. 0.0642 → 0.06.42 → 6.42×10^{-2}

3. 1,899 → 1.899 → 1.899×10^{3}

Power Problems

Steps:

1. Do all exponents first.
   - $2^3 = 2 \cdot 2 \cdot 2 = 8$
   - **Anything** to the 0 power = 1. $3{,}854^0 = 1$
   - If the base is negative and it's in ( ):
     - An even exponent gives a positive answer: $(-3)^2 = 9$
     - An odd exponent gives a negative answer: $(-3)^3 = -27$
   - If the base is negative and there are no ( ), the answer is always negative. $-3^2 = -9$ $-3^3 = -27$
2. After exponents, do any addition or subtraction.

Examples:

1. $6^2 = 36$
2. $-4^3 = -64$
3. $(-5)^2 = 25$
4. $(-2)^3 = -8$
5. $16^0 = 1$
6. $8^2 - (-3)^2$ $64 - 9 = 55$
7. $5^3 + (-1)^2$ $125 + 1$ 126
8. $-3^2 + 10^0 - 2^3$ $-9 + 1 - 8$ $-8 - 8$ -16

Exponent Rules

Rules:

- $x^0 =$ 1 — Anything to the 0 power is 1.
- $x^1 =$ x — Anything to the 1st power equals itself.
- $x^2 \cdot x^3 =$ $x^{2+3} = x^5$ — Keep base the same. Add exponents.
- $(x^3)^4 =$ $x^{3 \cdot 4} = x^{12}$ — Keep base the same. Multiply exponents.
- $\frac{x^8}{x^4} =$ $x^{8-4} = x^4$ — Keep base the same. Subtract exponents. (top – bottom)
- $x^{-2} =$ $\frac{1}{x^2}$ — If the answer has a negative exponent, put a 1 over the answer, and make the exponent positive.

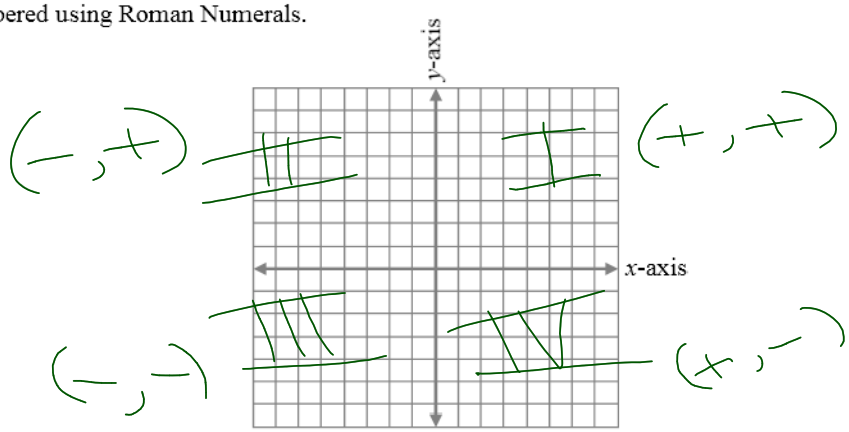
Examples:

1. $x^6 \cdot x^{-4} = x^{6+-4} = x^2$
2. $(x^4)^0 = x^{4 \cdot 0} = x^0 = 1$
3. $\frac{x^{-3}}{x^1} = x^{-3-1} = x^{-4} = \frac{1}{x^4}$
4.
5.
6.
7.
8.
9.

Graphing Points

Information about a Coordinate Graphing Grid:

- The horizontal axis (the one going from left to right) is the *x*-axis. Negative numbers are on the left and positive numbers are on the right.
- The vertical axis (the one going up and down) is the *y*-axis. Negative numbers are on the bottom and positive numbers are on the top.
- Where the two axes meet is called the origin. The origin is the point (0, 0).
- The two axes divide the grid into four quadrants. The first quadrant is in the upper right hand corner and then it is numbered counter-clockwise from there. These are usually numbered using Roman Numerals.



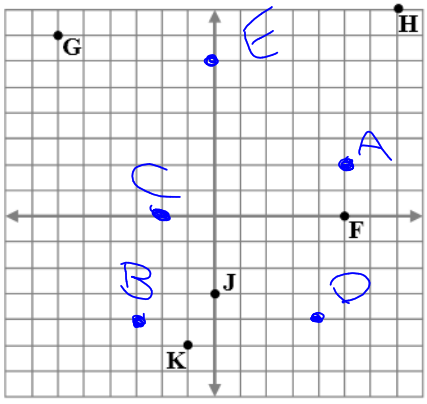
How to graph/name points: (*x*-coordinate, *y*-coordinate) (x, y)

Steps:

1. The first number listed in the parentheses is the *x*-coordinate and is the first movement you make. If it's positive, then you move that many places to the right. If it's negative, then you move that many place to the left.
2. The second number listed in the parentheses is the *y*-coordinate and is the second movement you make. If it's positive, then you move that many places up. If it's negative, then you move that many places down.
3. After making your two movements, then you place a dark dot on that grid mark and label the point with the corresponding letter. Make sure you count grid marks and not boxes.

Examples:

1. A(5, 2)
2. B(−3, −4)
3. C(−2, 0)
4. D(4, −4)
5. E(0, 6)



Examples:

6. F (5, 0)
7. G (−6, 7)
8. H (7, 8)
9. J (0, −3)
10. K (−1, −5)

Graphing Lines

Using domain/range tables to graph a line:

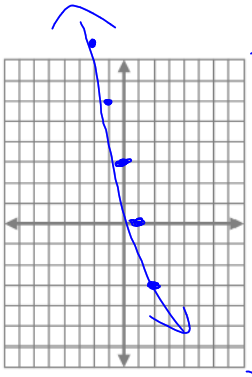
Steps:

1. Fill out the domain/range table (see page 4).
2. Use the x and y-values to graph each point (see page 17). Some points might go off the grid; only graph the ones that stay on the grid.
3. Connect the points together to form a line.

❖ If the points do not line up in a line, then you have either calculated a y-value incorrectly or graphed a point incorrectly.

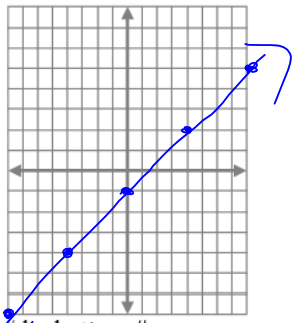
Examples:

x	$y=-3x+3$	y
-2	$-3(-2)+3$	9
-1	$-3(-1)+3$	6
0	$-3(0)+3$	3
1	$-3(1)+3$	0
2	$-3(2)+3$	-3



x	$y=\frac{3}{4}x-1$	y
8	$\frac{3}{4}(8)-1$	5
4	$\frac{3}{4}(4)-1$	2
0	$\frac{3}{4}(0)-1$	-1
-4	$\frac{3}{4}(-4)-1$	-4
-8	$\frac{3}{4}(-8)-1$	-7

$\frac{3}{4}(\frac{4}{1})=3$ $\frac{3}{4}\cdot\frac{8}{1}$



$\frac{3}{4}(\frac{-8}{1})$

For a fraction, divide top # by bottom # and then multiply by the x-value.

Graphing a line from just the equation: $(y = mx + b)$

Steps:

1. Graph the y-intercept (b) first. That's the number without the x. Start from the origin and move that many units upward if it's positive or move that many units downward if it's negative. This is where your first point goes. If there is not a number, then the y-intercept is 0 and you start by putting a point at the origin.
2. From that point, plot the slope (m) several times (until you run out of room on the grid). Remember the top number represents the rise and the bottom number represents the run. If the slope is positive, start by going up and then right. If the slope is negative, start by ~~going up and then left.~~ go down and right

Examples:

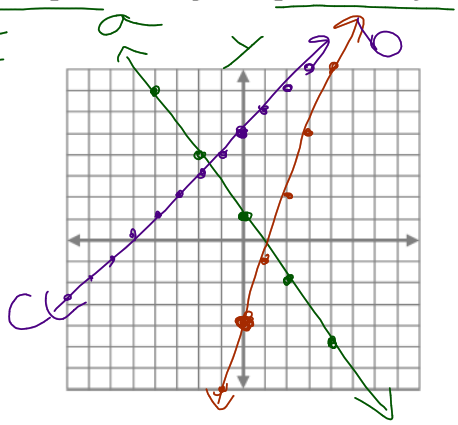
Slope: put whole # over one

Line "a" $y=-\frac{3}{2}x+1$

Line "b" $y=\frac{3}{1}x-4$

Line "c" $y=\frac{-1}{1}x+5$

Line "d"



Slope – General Information

$$slope = \frac{rise}{run} = \frac{vertical\ change}{horizontal\ change}$$

The direction a line is leaning can help you know whether the line has a positive, negative, zero, or undefined slope. Draw a line for each description listed below:

- positive slope:

$m = \frac{3}{5}$

- negative slope:

$m = \frac{-1}{3}$

- 0:

$m = \frac{0}{n} = 0$ (horizontal)

- Undefined:

$m = \frac{n}{0}$ = undefined (vertical)

Slope – From a Graph with a Slope Triangle

Steps:

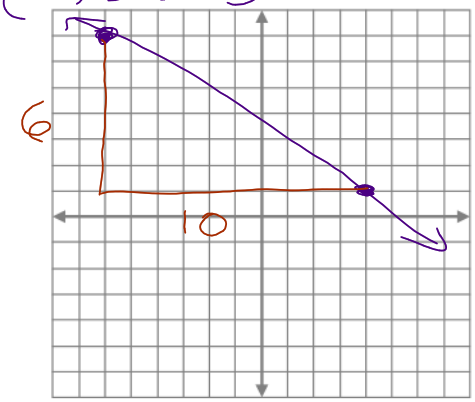
1. Graph the two given points (see page 17).
2. Draw a slope triangle connecting two points on the line.
3. Count and label the sides of the triangle.
4. Write the slope as a reduced fraction (not a mixed number).

$$slope = \frac{rise}{run} =$$

Examples:

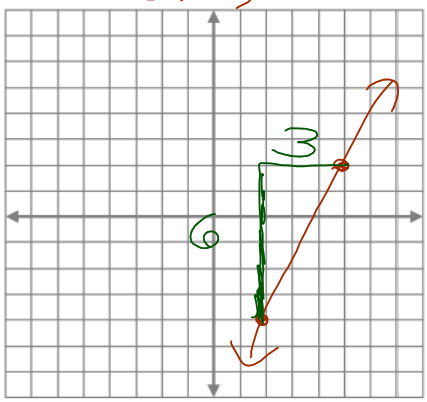
1. and $-\frac{6}{10} = -\frac{3}{5}$

(-6, 7) (4, 1)



2. and $\frac{6}{3} = \frac{2}{1}$ or 2

(5, 2) (2, -4)



Slope – Using the Formula

- Find the slope of a line given two points. The points are in the form (x_1, y_1) *and* (x_2, y_2).
- The slope formula is $m = \frac{y_2 - y_1}{x_2 - x_1}$
- Answers from slope problems should be left as reduced fractions (not mixed numbers).

Steps:

1. Plug the values into the formula: $m = \frac{y_2 - y_1}{x_2 - x_1} =$
2. Add or subtract the top numbers and add or subtract the bottom numbers.
3. Reduce the fraction if necessary (DO NOT change to a mixed number).

Examples:

1. $(-3, 6)\ (2, -4)$ (x_1, y_1 x_2, y_2)

$$m = \frac{-4-6}{2+3} = \frac{-10}{5} = -\frac{2}{1} \text{ or } -2$$

2. $(-2, 3)\ (-6, -3)$ (x_1, y_1 x_2, y_2)

$$m = \frac{-3-3}{-6+2} = \frac{-6}{-4} = \frac{3}{2}$$

3. $(2, 6)\ (7, 6)$ (x_1, y_1 x_2, y_2)

$$m = \frac{6-6}{7-2} = \frac{0}{5} = 0$$

4. $(-1, 11)\ (-1, 4)$ (x_1, y_1 x_2, y_2)

$$m = \frac{4-11}{-1+1} = \frac{-7}{0}$$

= undefined

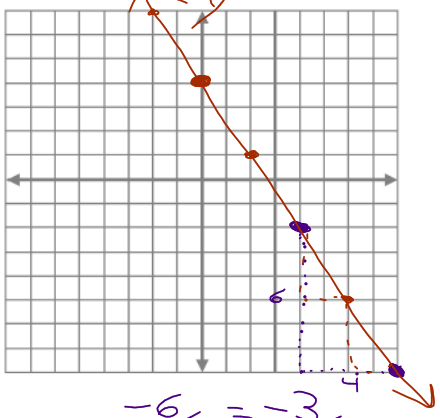
Equation of a Line from Two Points

Steps:

1. Graph the given points (see page 17).
2. Find the slope (m) by using the slope triangle or the slope formula (see pages 20-21). Remember to reduce the slope if necessary.
3. Start at one of your points and keep doing the slope until you find the y-intercept (b) (where the line will cross the y-axis).
4. Write the equation in slope-intercept form: $y = mx + b$

Examples:

1. (4, -2) (8, -8)

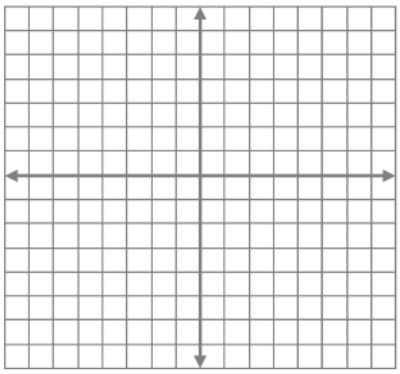


slope = $-6/4 = -3/2$

y-intercept = 4

equation of line: $y = -\frac{3}{2}x + 4$

2.



slope = _____

y-intercept = _____

equation of line: _____

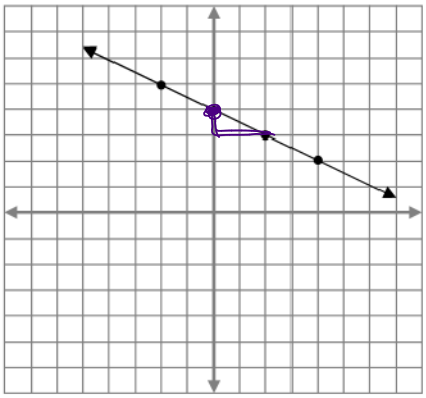
Equation of a Line from a Graph

Steps:

1. Find the slope (m) between two of the grid points by using a slope triangle or the slope formula (see pages 20-21). Remember to reduce the slope if necessary.
2. Start at one of your points and keep doing the slope until you find the y-intercept (b) (where the line will cross the y-axis).
3. Write the equation in slope-intercept form: $y = mx + b$

Examples:

1.

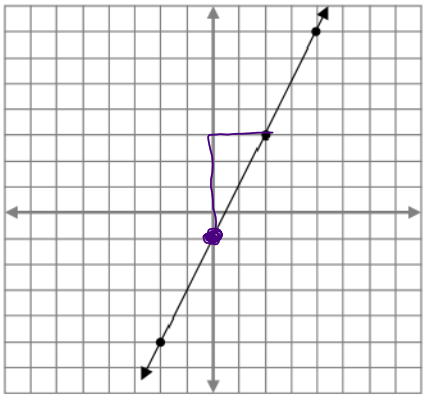


slope = $-\frac{1}{2}$

y-intercept = 4

equation of line: $y = -\frac{1}{2}x + 4$

2.



slope = $\frac{4}{2} = 2$

y-intercept = -1

equation of line: $y = 2x - 1$

System of Equations

Steps:

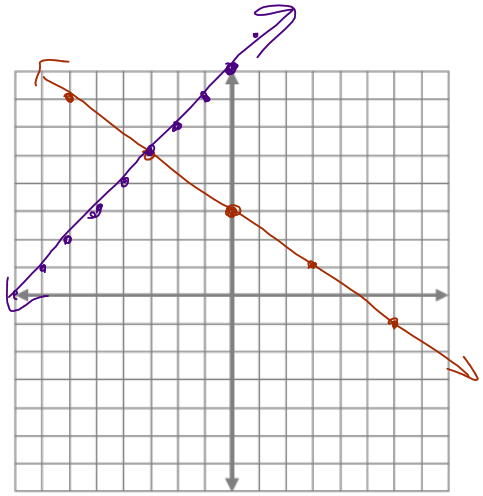
1. Graph both lines (see page 18).
2. Name the point where the two lines cross each other. Make sure you put parentheses around the coordinates. (see page 17)

Example:

Point of intersection: $(-3, 5)$ (x, y)

$y = -\frac{2}{3}x + 3$

$y = x + 8$



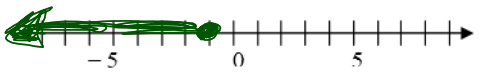
Inequalities: Graphing and Solving

Steps for graphing:

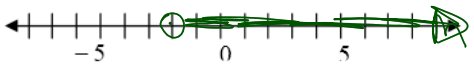
1. Make sure the variable is on the left. If it's not, rotate the inequality:
   $3 < x$ *becomes* $x > 3$ $\quad$ $5 > x$ *becomes* $x < 5$
2. Put a circle above the number on the number line:
   For $<$ *or* $>$ put an open circle: ○
   For $\leq$ *or* $\geq$ put a closed circle: ●
3. Shade the number line:
   For $x <$ *and* $x \leq$ shade to the left
   For $x >$ *and* $x \geq$ shade to the right

Examples:

1. $x \leq -1$



2. $-2 < x$
   $x > -2$



Steps for solving:

1. Solve the inequality the same as you do equations. (See page 3)
2. Be sure to keep the inequality sign facing the same way as you bring it down.
3. On the last step, if you multiply or divide both sides by a negative number (the number in front of the variable), you FLIP the inequality sign.

$$-3x \leq 9$$

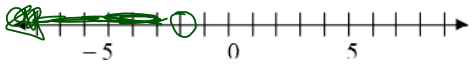
$$\frac{-3x}{-3} \leq \frac{9}{-3}$$

$$x \geq -3$$

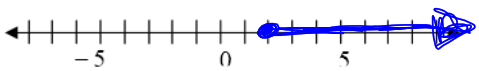
4. If the variable is on the right, rotate the inequality to get it on the left. (See step 1 above under graphing.)

Examples:

1. $-15 > 3(2x-1)$
   $-15 > 6x - 3$
   $+3 \quad +3$
   $-12 > 6x$
   $\frac{-12}{6} > \frac{6x}{6}$
   $-2 > x$ $\quad x < -2$



2. $-2(5x-4) \leq -12$
   $-10x + 8 \leq -12$
   $-8 \quad -8$
   $\frac{-10x}{-10} \leq \frac{-20}{-10}$
   $x \geq 2$



PEMDAS

Steps:

P – Parenthesis ( )
E – Exponents and Square Roots
M/D – Multiply and Divide from left to right
A/S – Add and Subtract from left to right

*Show every step so you don't make mistakes!

Examples:

1. $36 \div 9 \cdot 2 - 10$

$4 \cdot 2 - 10$

$8 - 10$

-2

2. $(16 - (8 - 10)) \div 6 + 3$

$(16 + (+2)) \div 6 + 3$

$18 \div 6 + 3$

$3 + 3$

6

3. $16 \div 4(2-4)^2$

$16 \div 4(-2)^2$

$16 \div 4 \cdot (4)$

$4 \cdot (4)$

16

4. $6 \div 2(18 - 3^2) - 6 + 9$

$6 \div 2(18 - 9) - 6 + 9$

$6 \div 2(9) - 6 + 9$

$3 \cdot (9) - 6 + 9$

$27 - 6 + 9$

$21 + 9$

30

5. $$\frac{-10^2 \div 5}{2 + (+3)} = \frac{-100 \div 5}{5}$$

$$= \frac{-20}{5}$$

$$= -4$$

Evaluating Formulas

Steps:

1. Plug in what you know.
2. Solve using PEMDAS. (see page 26)

Examples:

1. $P = 2l + 2w$ when $l = 12$ and $w = 8$

$P = 2(\ ) + 2(\ )$

$P = 2(12) + 2(8)$

$24 + 16$

40

2. $A = \frac{1}{2}h(b_1 + b_2)$ when $h = 18$, $b_1 = 6$, and $b_2 = 14$

$A = \frac{1}{2}(18)(6 + 14)$

$A = \frac{1}{2}(18)(20)$

$A = 9(20)$

$A = 180$

3. $2x^2 - 4x + 3$ when $x = -3$

$2(-3)^2 - 4(-3) + 3$

$2(9) - 4(-3) + 3$

$18 + 12 + 3$

33

Decimals

Adding and Subtracting:

Steps:

1. Decimals that are out of sight are on the right.
2. Decimals MUST be lined up when you stack the numbers.
3. Add zeroes for place holders as needed.

Examples:

1. 2.

Multiplying:

Steps:

1. Multiply like normal (see page 5) – don't worry about the decimals until the end.
2. Count how many numbers are after the decimal(s) in the original numbers.
3. Starting at the right, count over that many places to the left and insert the decimal there.

Examples:

1. 2.

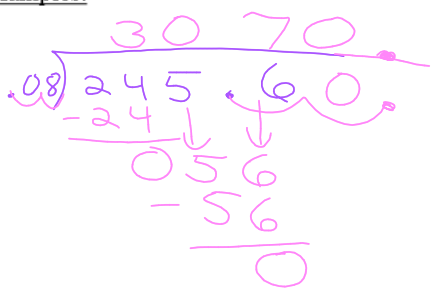
Decimals

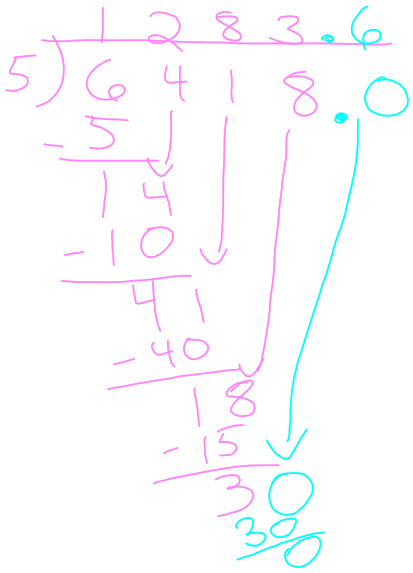
Dividing:

Steps:

1. Move the decimal in the outside number to the right (get it out of sight).
2. Move the decimal in the inside number the same amount of times to the right.
3. Bring the decimal up, so it will be in the right spot in your answer.
4. Divide like normal.
5. Add zeroes to the end and bring them down until you get a "pretty" answer.

Examples:

1. 

2. 

Place Value and Rounding

5	,	3	7	6	,	4	1	2	,	5	8	7	.	0	9	8	4
billions		hundred millions	ten millions	millions		hundred thousands	ten thousands	thousands		hundreds	tens	ones (whole #)		tenths	hundredths	thousandths	ten thousandths

hundred thousandths

Steps:

1. Find your place (tens or hundreds or tenths, etc. – circle that number)
2. Look RIGHT next door (underline that number)
3. 5 or greater add one more (to circled number)
4. 4 or less stays the same
5. Numbers behind, zero's your name (change numbers to zero – not necessary behind the decimal point)

Examples:

Round the given number to the indicated place value:

5,213.768 (tenths): 5,213.8

64321.543 (hundreds): 64,300

12,493,516.3 (millions): 12,000,000

1,356.94 (whole number): 1,357

17.1956 (hundredths): 17.20

Fractions⇔Decimals⇔Percents

Change the following fractions to a decimal. Round answers to the nearest tenth, if necessary.

Steps:

1. With a calculator, divide the top number of the fraction by the bottom number of the fraction.
2. Write the answer, rounded to the nearest tenth. If it's a mixed number, then leave the whole number part to the left of the decimal.

Examples:

1. $\frac{8}{22} = 0.4$

2. $4\frac{5}{8} = 4.6$ (4.625)

Complete the following table. (Do not round decimals in these tables.)

Steps:

- Reduced Fraction to Decimal: divide top number by bottom number
- Decimal to Percent: move decimal point two places to the right (add 0 if needed)
- Percent to Decimal: move decimal point two places to the left
- Percent to Reduced Fraction: put percent number over 100 and then reduce

Examples: ☆No Rounding☆

Reduced Fraction	Decimal	Percent
$\frac{3}{8}$	0.375	37.5%
$\frac{40}{100} = \frac{4}{10} = \frac{2}{5}$	0.4	40%
$\frac{75}{100} = \frac{3}{4}$	0.75	75%

Square Roots and Absolute Value

Square Roots:
List the perfect squares below, from 1^2 to 15^2.

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225

Represent each square root as a decimal rounded to the nearest tenth.

Steps:

1. Depending on your calculator, type the $\sqrt{\ }$ symbol and then the number that's under the symbol or type the number first and then press the $\sqrt{\ }$ symbol.
2. Write the answer rounded to the nearest tenth.

Examples:

1. $\sqrt{47} = 6.9$ 2. $\sqrt{85} = 9.2$

Absolute Value:

- The absolute value of a number is its distance from 0 to that number. Since distance is always positive, the answer coming out of the absolute value symbol should always be positive.

Steps:

1. Work out the problem inside the absolute value symbol following order of operations (see page 26)
2. Then take the absolute value of that number. Write only the number and lose the absolute value symbol.

Examples:

1. $|-7-5| = |-12| = 12$ 2. $|-5| - |7| = 5 - 7 = -2$

Examples: Use order of operations (PEMDAS) to evaluate each of the following. (see page 26)

1. $4^2 - 2 \cdot |\sqrt{25} - 4 \div 2 \cdot 4|$

$16 - 2 \cdot |5 - 2 \cdot 4|$

$16 - 2 \cdot |5 - 8|$

$16 - 2 \cdot 3$

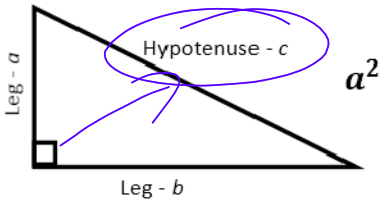
$16 - 6$

10

2.

Pythagorean Theorem

- The legs of a right triangle meet to form the right angle.
- The side across from the right angle is the hypotenuse.
- The hypotenuse is the longest side of a right triangle.



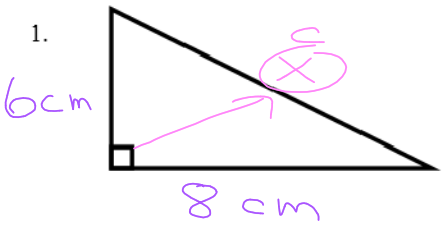
$$a^2 + b^2 = c^2$$

Steps:

1. Label the sides of the triangle a, b, and c. It doesn't matter which leg is a or b, but the hypotenuse (side across from the right angle) must be c.
2. Plug a, b, and c into the equation: $a^2 + b^2 = c^2$. Leave the unknown side a variable.
3. Square the numbers.
4. Add or subtract to get the variable alone. same side
5. Take the square root ($\sqrt{\ }$) of both sides.
6. Round answer to the nearest tenth if necessary. Include units on your answer. Example: 4.875 = 4.9 ft.

Examples:

1.



$a^2 + b^2 = c^2$

$6^2 + 8^2 = x^2$

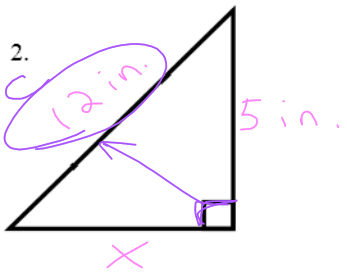
$36 + 64 = x^2$

$\sqrt{100} = \sqrt{x^2}$

$10 = x$

10 cm

2.



$5^2 + x^2 = 12^2$

$25 + x^2 = 144$

$-25 \quad -25$

$\sqrt{x^2} = \sqrt{119}$

$x = 10.9$ in.

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Steps:

1. Plug a, b, and c into the equation.
2. Evaluate using PEMDAS:
   - Find $-b$, which means the opposite of b (–4 becomes 4, 6 becomes –6)
   - Multiply $2a$
   - Evaluate $b^2 - 4ac$ → b^2 ALWAYS POSITIVE
   - Take the $\sqrt{b^2 - 4ac}$. Round the answer to the nearest hundredth if necessary.
   - Write 2 equations: one with a +, the other with a – in the middle.
   - Add, then divide the first equation
   - Subtract, then divide the second equation
   - If the $\sqrt{\ }$ is a whole number, the answer will be an integer or a reduced fraction.
     If the $\sqrt{\ }$ is a decimal, round all answers to the nearest hundredth.

Examples:

1. $a=2 \quad b=-5 \quad c=3$

$$x = \frac{5 \pm \sqrt{(-5)^2 - 4(2)(3)}}{2(2)}$$

$$= \frac{5 \pm \sqrt{25-24}}{4}$$

$$= \frac{5 \pm \sqrt{1}}{4}$$

$$= \frac{5 \pm 1}{4} \qquad \frac{5+1}{4} = \frac{6}{4} = \frac{3}{2} \qquad \frac{5-1}{4} = \frac{4}{4} = 1$$

2. $a=1 \quad b=3 \quad c=-6$

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(1)(-6)}}{2(1)}$$

$$= \frac{-3 \pm \sqrt{9+24}}{2}$$

$$= \frac{-3 \pm \sqrt{33}}{2}$$

$$= \frac{-3 \pm 5.74}{2}$$

$$\frac{-3+5.74}{2} \qquad \frac{-3-5.74}{2}$$

$$\frac{2.74}{2} \qquad \frac{-8.74}{2}$$

$$1.37 \qquad -4.37$$