

Algebra 1

Practice Test

Answer Key

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Answer Key**Part 1: Multiple Choice**

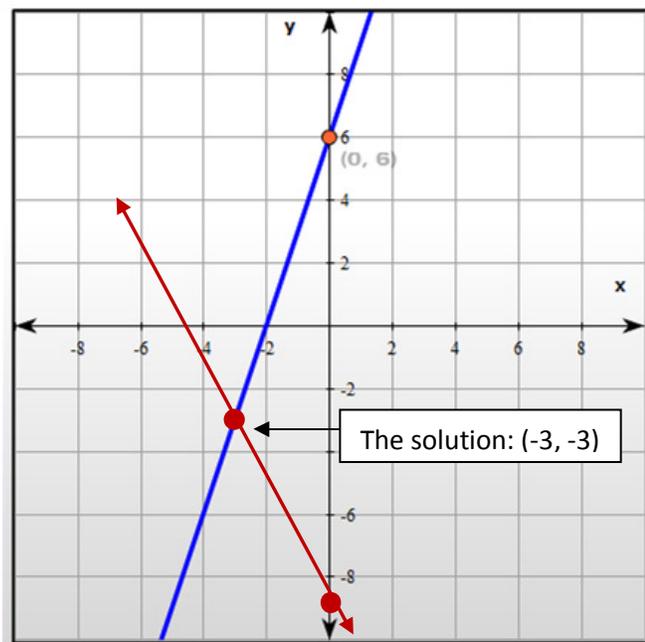
1. B
2. A
3. C
4. C
5. B
6. C
7. D
8. A
9. A
10. C
11. A
12. C
13. B
14. B
15. B
16. D
17. A
18. C
19. C
20. A

Part 2: Short Answer

21. There is a maximum point. The vertex is $(-2, -2)$

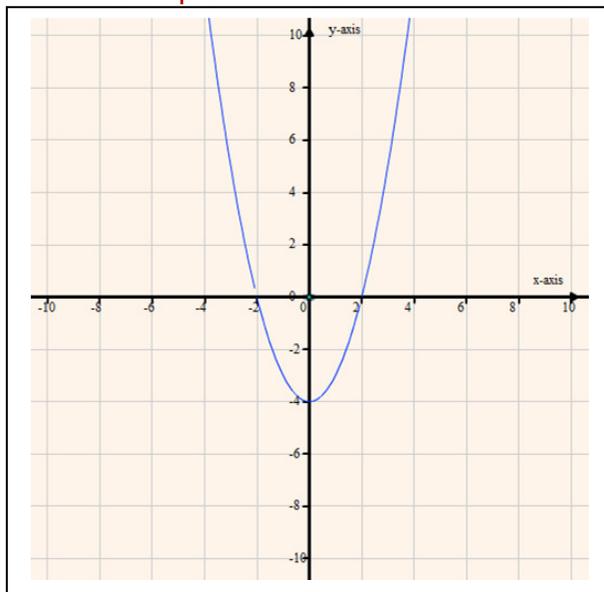
22. The factors are: $(4x+1)(2x-3)$

23. The solution is $(-3, -3)$



24. $x = 1.6$ and $x = -5.6$

25. x intercepts: $x=2$ and $x = -2$ vertex: $(0, -4)$



26. $x^2 - 14x + 49$

27. The discriminant is 1. There are 2 rational solutions.

Part 3: Extended Response

28. Wireless Plus: $y = .10x + 65$

New Age Phone: $y = .20x + 35$

For 300 gigabytes over the monthly limit, the 2 plans will charge the same amount (\$95)

For 200 gigabytes over the monthly limit, New Age Phones is the better value. They only charge \$75 versus Wireless Plus who charges \$85.

29. The equation that can be used to predict the profit is:
 $Y = 2758.89 + 35700$. In the year 2011, the profit will be \$93636.69. The y-intercept represents the profit for year 0, which in this case is 1990.

30. The candy store must sell 2115 boxes of candy in order to maximize its profit. The maximum profit would be \$5017.31

31. The width of the rectangle is 26 units.

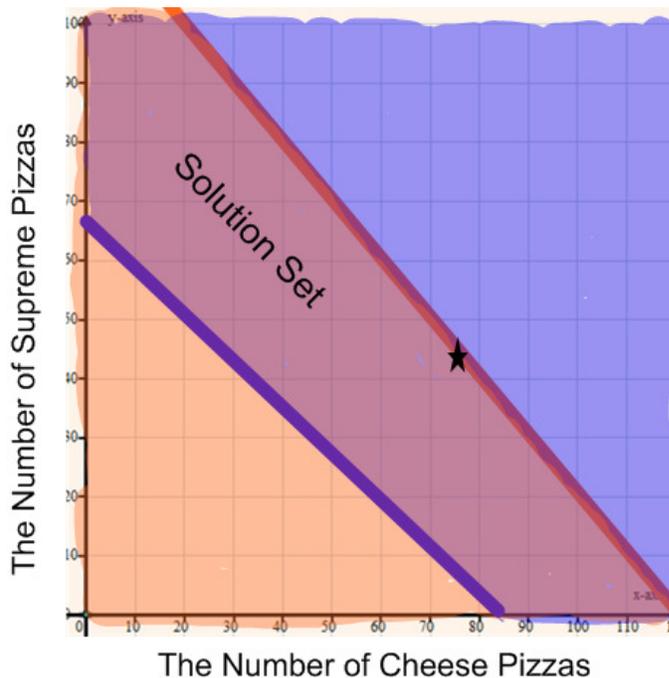
32. The system of inequalities that represents this situation is:

Let x = number of cheese pizzas

Let y = number of supreme pizzas

$12x + 15y \geq 1000$ (purple line and shading)

$x + y \leq 120$ (orange line and shading)



If 75 cheese pizzas were sold, then up to 45 supreme pizzas could be sold in order to make at least \$1000.

Algebra Practice Test Analysis Sheet

Directions: For any problems, that you got wrong on the answer sheet, circle the number of the problem in the first column. When you are finished, you will be able to see which Algebra units you need to review before moving on. (If you have more than 2 circles for any unit, you should go back and review the examples and practice problems for that particular unit!)

Problem Number	Algebra Unit
1,17	Unit 1: Solving Equations
2, 15	Unit 2: Graphing Equations
6,19, 29	Unit 3: Writing Equations
2, 12, 23, 28	Unit 4: Systems of Equations
3, 4, 13, 32	Unit 5: Inequalities
11, 21	Unit 6: Relations & Functions
7, 14	Unit 7: Exponents & Monomials
8, 16, 26,31	Unit 8: Polynomials
10, 18, 22	Unit 9: Factoring (Polynomials)
5, 9, 20, 24, 25, 27, 30	Unit 10: Quadratic Equations

Algebra Practice Test Step-by-Step Solutions

Part 1: Directions: For questions 1-20, circle the correct answer on your answer sheet.

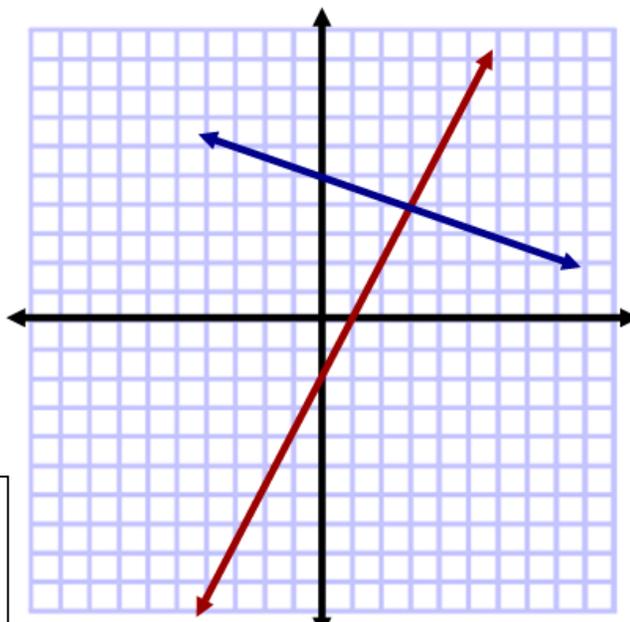
1. Solve for x: $2(x+7) - 3(2x-4) = -18$

- A. $x = 5$
- B. $x = 11$**
- C. $x = -11$
- D. $x = -5$

$2(x+7) - 3(2x-4) = -18$	Original Problem
$2x + 14 - 6x + 12 = -18$	Distribute the 2 and the -3 throughout the parenthesis.
$2x - 6x + 14 + 12 = -18$	Write like terms together.
$-4x + 26 = -18$	Combine like terms.
$-4x + 26 - 26 = -18 - 26$	Subtract 26 from both sides.
$-4x = -44$	Simplify: $-18-26 = -44$
$-4x/-4 = -44/-4$	Divide by -4 on both sides.
$x = 11$	$x = 11$ is the final answer.

2. Which system of equations is represented on the graph?

- A.** $y = 2x - 2$
 $y = -1/3x + 5$
- B. $y = 1/2x - 2$
 $y = 1/3x + 5$
- C. $y = 2x - 2$
 $y = 1/3x + 5$
- D. $y = -2x - 2$
 $y = -1/3x + 5$



Since all of the answer choices are written in slope intercept form, we can identify the slope and y-intercept for each line and then write an equation for each line.

Slope Intercept Form: $y = mx + b$ (m =slope, b = y-intercept)

Red Line: Slope (m) = 2 y-intercept (b) = -2
Equation: $y = 2x - 2$

Blue Line: Slope (m) = $-1/3x$ y-intercept (b) = 5
Equation: $y = -1/3x + 5$

A is the correct answer choice.

TIP: You know the red line has a positive slope because it's rising from left to right. The blue line has a negative slope because it's falling from left to right. Therefore, we can eliminate answer choices B, C, and D because B and C have two equations with both positive slopes and letter D has two equations with both negative slopes. The only answer choice with a positive and a negative slope is A.

3. Solve the following inequality: $-20 < 4 - 2x$

A. $8 > x$

B. $8 < x$

C. $12 > x$

D. $12 < x$

$-20 < 4 - 2x$

Original Problem

$-20 - 4 < 4 - 4 - 2x$

Subtract 4 from both sides to isolate the variable on one side of the equation.

$-24 < -2x$

Simplify: $-20 - 4 = -24$

$-24 / -2 < -2x / -2$

Divide by -2 on both sides of the equation.

$12 > x$

Simplify: $-24 / -2$ AND Remember: Whenever you multiply or divide by a negative number when working with an inequality, you must reverse the symbol! Therefore, the less than symbol is reversed to a greater than symbol because I divided by -2 on both sides. (This only applies to multiplication and/or division by a negative number when working with inequalities.)

The correct answer is C: $12 > x$

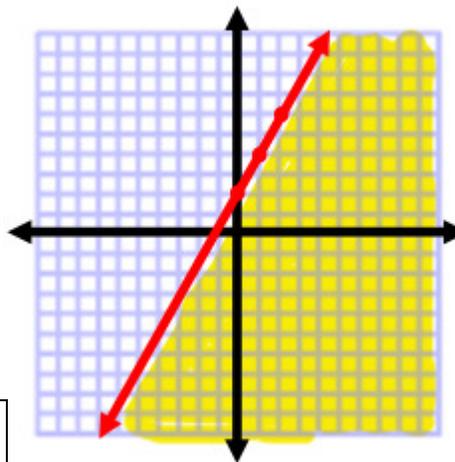
4. Which inequality is graphed ?

A. $y \geq 2x + 2$

B. $y < 2x + 2$

C. $y \leq 2x + 2$

D. $y \leq -2x + 2$



We know that the slope is positive because the line is rising from left to right, so we can eliminate letter D since its slope is negative 2. $y \leq -2x + 2$

We also know that the line graphed is a solid line. This means that the symbol used must be \leq or \geq . (If the line were dotted, then the symbol would be $<$ or $>$). Therefore, we can eliminate letter B.

We have choices A and C to choose from and both equations are the same. Therefore, we need to figure out which sign is correct by analyzing the shaded portion of the graph. We shade the portion of the graph that contains solutions to the inequality, so let's pick a point in the shaded region. (0,0) is the easiest point to substitute and it's in the shaded region. Let's substitute (0,0) into the equation and see which symbol produces a true statement.

$0 \underline{\quad} 2(0) + 2$

$0 \underline{\leq} 2$

Since the left side = 0 and the right side equals 2, we know that 0 is less than 2. Therefore, we must use the less than or equal to symbol. This means that letter C is the correct answer choice.

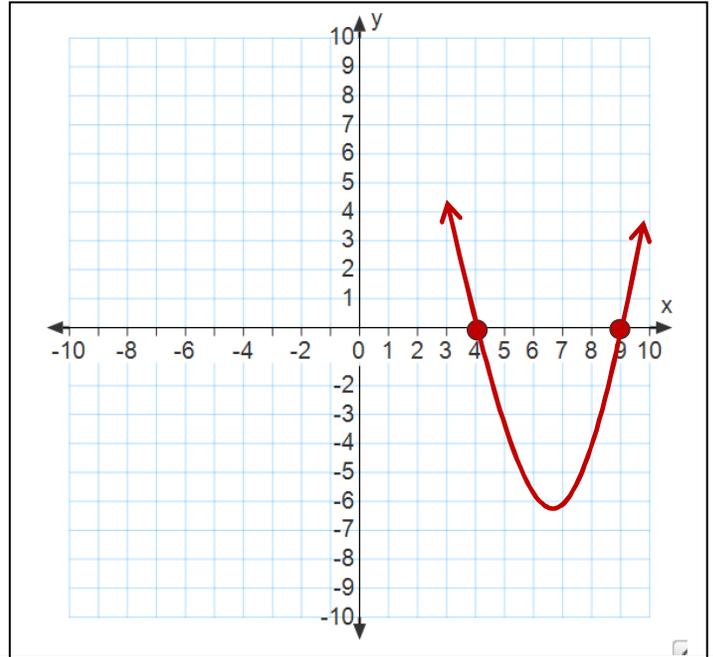
5. Which equation is represented on the graph?

A. $y = x^2 + 13x + 36$

B. $y = x^2 - 13x + 36$

C. $y = x^2 + 5x - 36$

D. $y = x^2 - 5x + 36$



We know that since there is a parabola graphed that this is a quadratic equation. From looking at the graph we know that the x-intercepts are 4 and 9. The x-intercepts always have a y coordinate of 0.

We also know that when we let $y = 0$, we can factor the equation and use the zero product property to find the x-intercepts. Therefore, we will work backwards.

$$0 = (x - 4)(x - 9)$$

(Using the zero product property, we would have $x - 4 = 0$ and $x - 9 = 0$)

So, $x = 4$ and $x = 9$. This proves that this equation would be correct since these are the x-intercepts.

Since the factors are $(x-4)(x-9)$, let's multiply to see what the original equation would be:

Using foil: $(x-4)(x-9)$

$$x(x) + x(-9) + -4(x) + (-4)(-9)$$

$$x^2 - 9x - 4x + 36$$

$$x^2 - 13x + 36 \quad \text{Therefore, the correct choice is B.}$$

6. John has mowed 3 lawns. If he can mow 2 lawns per hour, which equation describes the number of lawns, m , he can complete after h , more hours?

A. $m + h = 5$

B. $h = 2m + 3$

C. $m = 2h + 3$

D. $m = 3h + 2$

The first thing you should recognize is the key word for slope, per. Since John can mow 2 lawns per hour, we know that this is the slope (m). Also, since the problem states per hour, we know that the variable associated with the slope is h . At this point, I realize that the only problem that has, $2h$ is letter b.

Let's see if it makes sense. He has also mowed 3 lawns, this is a constant so this would be the y-intercept. Therefore, we have:

$m = 2h + 3$. This means that the number of lawns mowed (m) equals 2 lawns per hour + the 3 lawns that he already mowed. Yes, it makes sense, so the correct response is letter C.

7. Simplify: $(-3a^2b^2)(4a^5b^3)^3$

$$(-3a^2b^2)(4a^5b^3)^3$$

Original Problem

$$(-3a^2b^2)(64a^{15}b^9)$$

Complete Power of a Power first. (Multiply exponents when raising a power to a power.)

$$-192a^{17}b^{11}$$

Multiply: When multiplying powers you add the exponents.

The answer is: D

A. $-192a^8b^5$

C. $-12a^8b^5$

B. $-12a^{17}b^{11}$

D. $-192a^{17}b^{11}$

8. Multiply: $(2x+5)(3x^2 - 2x - 4)$

We must use the extended distributive property in order to multiply.

First distribute $2x$, then we will distribute 5 .

$$\begin{array}{cccccc} 2x(3x^2) & + & 2x(-2x) & + & 2x(-4) & + & 5(3x^2) & + & 5(-2x) & + & 5(-4) \\ \downarrow & & \downarrow \\ 6x^3 & & -4x^2 & & -8x & & +15x^2 & & -10x & & -20 \end{array}$$

$$6x^3 - 4x^2 + 15x^2 - 8x - 10x - 20$$

Rewrite with like terms together.

$$6x^3 + 11x^2 - 18x - 20$$

Combine like terms and this is the final answer.

The answer is: A

A. $6x^3 + 11x^2 - 18x - 20$

C. $21x^2 + 22x - 20$

B. $6x^3 + 19x^2 + 18x + 20$

D. $6x^3 + 15x^2 + 6x + 12$

9. Which polynomial cannot be factored?

The easiest way to determine whether or not a polynomial can be factored is to find the discriminant. If the discriminant is a perfect square, then the polynomial can be factored. If the discriminant is negative or not a perfect square, then it cannot be factored. So, we are looking for the polynomial that has a negative or non-perfect discriminant. The formula for the discriminant is: $b^2 - 4ac$ when given: $ax^2 + bx + c$. We'll need to pick an answer choice and check:

A. $3x^2 - 14x - 8$

$$a = 3 \quad b = -14 \quad c = -8$$

$$\text{Discriminant: } (-14)^2 - 4(3)(-8) = 292$$

TIP: Just to check, if you find the discriminant for B, C, and D, you will find them all to be perfect squares.

Since the discriminant is not a perfect square,

this must be the answer.

A. $3x^2 - 14x - 8$

C. $3x^2 - 14x + 8$

B. $3x^2 - 10x - 8$

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

10. What is the greatest common factor of: $12a^4b^2 - 3a^2b^5$?

A. $12a^2b^2$

B. $3a^4b^5$

C. $3a^2b^2$

D. $12a^4b^5$

We must find the greatest common factor for each part: the numerals, the a terms and the b terms.

The greatest common factor of 12 and 3 is **3**.

The greatest common factor of a^4 and a^2 is **a^2**

The greatest common factor of b^2 and b^5 is **b^2** .

Therefore the greatest common factor is: $3a^2b^2$

11. Given $f(x) = 5x - 4$, find the value of x if $f(x) = 31$

The problem says that $f(x) = 31$, so we must first substitute 31 for $f(x)$ in this function.

$$f(x) = 5x - 4$$

$$31 = 5x - 4$$

$$31 + 4 = 5x - 4 + 4$$

$$35 = 5x$$

$$35/5 = 5x/5$$

$$x = 7$$

Substitute 31 for $f(x)$. Now solve for x .

Add 4 to both sides.

$$\text{Simplify: } 31 + 4 = 35$$

Divide by 5 on both sides.

$x = 7$ is the final answer.

- A. 7
B. 27/5

- C. 151
D. -7

12. Which answer best describes the number of solutions for the following system of equations?

$$4x + y = 5$$

$$8x + 2y = -6$$

First we need to solve the system of equations in order to determine how many solutions it will have. Since we don't have graph paper to graph the system, we will need to use the substitution method or linear combinations (the addition method). I am going to solve the first equation for y and use the substitution method.

$$4x + y = 5 \rightarrow 4x - 4x + y = -4x + 5$$

Solve for y by subtracting $4x$ from both sides.

$$y = -4x + 5 \quad \text{and} \quad 8x + 2y = -6$$

We can now substitute $-4x + 5$ for y into the second equation.

$$8x + 2(-4x + 5) = -6$$

Substitute $-4x + 5$ for y into the second equation.

$$8x - 8x + 10 = -6$$

Distribute the 2 throughout the parenthesis.

$$10 = -6$$

Since I have $8x - 8x$ (which equals 0) on the left side, I am left with $10 = -6$

This statement is not a true statement and I must stop here. **Since this statement is not true, this means that there are no solutions to this system of equations. (These two lines are parallel)**

(If there were no variable at the end, but it was a true statement then the system would have infinitely many solutions.) If you ended up with $x = \underline{\quad}$ (a number), then there would be one solution.

- A. 1 solution

- C. no solutions**

- B. 2 solutions

- D. infinitely many solutions

13. Which graph best represents the solution set of: $15 - 2(x+3) < -7$?

We must first solve the inequality in order to determine which graph best represents the solution set.

$$15 - 2(x+3) < -7$$

Original problem

$$15 - 2x - 6 < -7$$

Distribute the -2 throughout the parenthesis.

$$15 - 6 - 2x < -7$$

Rewrite with like terms together on the left hand side.

$$9 - 2x < -7$$

Simplify: $15 - 6 = 9$

$$9 - 9 - 2x < -7 - 9$$

Subtract 9 from both sides.

$$-2x < -16$$

Simplify: $-7 - 9 = -16$

$$-2x / -2 < -16 / -2$$

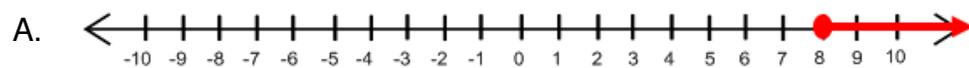
Divide by -2 on both sides

$$x > 8$$

Simplify: $-16 / -2 = 8$ Remember: You must reverse the inequality symbol when you multiply or divide by a negative number. (We divided by -2).

Note: Since our inequality symbol is $<$, we know that we must have an open circle on the graph.

(Only \leq or \geq requires a closed circle). Therefore, we can eliminate A and C. **Since x is greater than 8, letter B is the correct choice.** If you didn't know how to solve you could have substitute a number from the solution set into the inequality to determine if it was a true statement. However, this method only works for multiple choice questions.



14. Simplify:

$$\frac{2a^2b^4}{a^3b^2} \cdot \left(\frac{2a^2b}{3a^4b^5}\right)^{-2}$$

First I'm going to make sure that I have all positive exponents by taking the reciprocal of the of second set of parenthesis, since its exponent is negative.

$$\frac{2a^2b^4}{a^3b^2} \cdot \left(\frac{3a^4b^5}{2a^2b}\right)^2$$

Now we'll raise the power to a power. (The second set of parenthesis)

$$\frac{2a^2b^4}{a^3b^2} \cdot \left(\frac{9a^8b^{10}}{4a^4b^2}\right)$$

When you raise a power to a power, you must multiply the exponents.

$$\frac{18a^{10}b^{14}}{4a^7b^4}$$

Multiply the two quantities. When you multiply powers, you add the exponents.

$$\frac{9a^3b^{10}}{2}$$

Simplify: $18/4 = 9/2$. When you divide powers, you subtract the exponents. This is the final answer. (B)

A. $\frac{8}{9a^5b^6}$

C. $3a^3b^{10}$

B. $\frac{9a^3b^{10}}{2}$

D. $9a^3b^{10}$

15. Judy had \$35 in her savings account in January. By November she had \$2500 in her account. What is Judy's rate of change between January and November?

A. \$253.50 per month

C. \$ 211.25 per month

B. \$ 246.50 per month

D. None of the Above

Since we are looking for rate of change (which is the slope), we can write two ordered pairs and use the slope formula to find the rate of change. We'll let x = the month and y = the amount in the account.

January: (1, 35)

November: (11, 2500)

Now use the slope formula:

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{2500 - 35}{11 - 1} = \frac{2465}{10} = 246.5$$

Judy's rate of change is \$246.50 per month.

16. Simplify: $(3x^4 + 3x^2 - x + 5) - 3(x^4 + x^3 - 2x^2 - 6)$

Since this is a subtraction problem, it's best to first rewrite it as an addition problem.

$$3x^4 + 3x^2 - x + 5 - 3x^4 - 3x^3 + 6x^2 + 18$$

Now you can use the vertical method or the horizontal method. I will continue with the horizontal method by rewriting like terms together.

$$3x^4 - 3x^4 - 3x^3 + 3x^2 + 6x^2 - x + 5 + 18$$

$$\mathbf{-3x^3 + 9x^2 - x + 23}$$

Combine like terms. This is the final answer.

A. $6x^4 + 3x^3 + 5x^2 - x - 13$

B. $3x^3 + 3x^2 - x - 13$

C. $3x^4 - 3x^3 + 9x^2 - x + 23$

D. $-3x^3 + 9x^2 - x + 23$

17. Which is not a related fact of the equation: $x - 4 = -12$

A. $x - 12 = -4$

C. $x = -12 + 4$

B. $x + 12 = 4$

D. $12 + x = 4$

Remember we can move terms around in an equation by adding or subtracting to both sides. So, we must make sure that the proper steps were taken when rewriting each of these equations.

A. In order to get $x - 12$, we would have to subtract 12 from both sides, but that wouldn't work because we would be left with a different equation: $x - 4 - 12 = -12 - 12$ would yield: $x - 16 = -24$, so this is probably the correct answer, but let's check the rest.

B. In order to get $x + 12 = 4$, we would have to add 12 to both sides and then add 4 to both sides. This would work since adding 4 is the opposite of minus 4, and adding 12 is the opposite of -12.

C. In order to get $x = -12 + 4$, we would need to add 4 to both sides. This works: $x - 4 + 4 = -12 + 4$

$$x = -12 + 4$$

D. $12 + x = 4$ is the same as letter B, $x + 12 = 4$; this is the commutative property being used. Since we determined that letter B was correct, then letter D is correct also.

This proves that A is the correct answer.

18. Simplify: $\frac{x^2 - x - 6}{x^2 - 2x - 8}$

In order to simplify this expression, we need to factor the numerator and denominator and look for any common factors.

First let's factor the numerator. We need to think of two numbers whose product is -6 and whose sum is -1. (-3 & 2)

$$\begin{aligned} x^2 - x - 6 &= (x-3)(x+2) \\ x^2 - 2x - 8 &= (x-4)(x+2) \end{aligned}$$

(To factor this expression we needed two numbers whose product is -8 and whose sum is -2. (-4 & 2))

$$\frac{\cancel{(x-3)}\cancel{(x+2)}}{\cancel{(x-4)}\cancel{(x+2)}}$$

Notice how we have the same factors in the numerator and the denominator (x+2). These simplify to 1, and cancel out.

We are left with our simplified answer: $\frac{x-3}{x-4}$

The correct answer is letter C.

A. $\frac{x+3}{x+4}$

C. $\frac{x-3}{x-4}$

B. $\frac{-x-6}{-2x-8}$

D. $\frac{x+2}{x-4}$

19. Terri has \$60 to spend at the carnival. It will cost her \$5 to enter the carnival and \$1.25 per ride. The solution to which inequality represents the number of possible rides, r that Terri can ride?

We need to look for key words when writing equations or inequalities for a word problem.

The highlighted information represents the key information that we need. We know that Terri has \$60 to spend. This means that that the most she can spend the \$60, so our inequality symbol must be less than or equal to.

We also know that it costs \$5 to enter. This is a flat rate (most likely the y-intercept)

Then we know that it costs 1.25 per ride. The key word per represents slope. This is the rate or slope in the inequality.

So, we have enough information to write an equation in slope intercept form. $y = mx + b$ OR

Think of the story:

It cost \$1.25 per ride (r) + \$5 to get in. This must be less than or equal to \$60 that she has to spend.

$$1.25r + 5 \leq 60 \quad \text{This is answer choice C.}$$

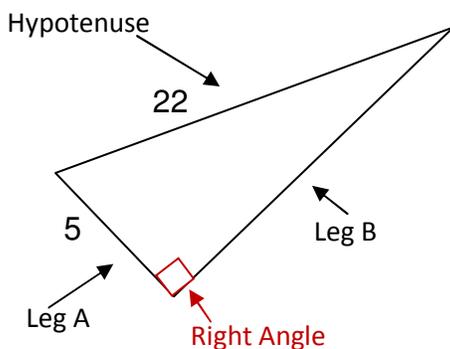
A. $5r + 1.25 \leq 60$

B. $60 - 1.25r = 5$

C. $1.25r + 5 \leq 60$

D. $5r + 1.25 \geq 60$

20. Given the following right triangle, find the length of the missing side.



This is a right triangle, so we can use the Pythagorean Theorem to find the length of the missing side. The Pythagorean Theorem is:

$$A^2 + B^2 = C^2 \quad \text{Where A and B are the legs and C is the hypotenuse.}$$

We know from the diagram that $A=5$, $B = \text{unknown}$ and $C = 22$. We can substitute the values for A and C into the Pythagorean Theorem Formula and solve for B.

$$A^2 + B^2 = C^2$$

$$5^2 + B^2 = 22^2$$

$$25 + B^2 = 484$$

Evaluate $5^2 = 25$ and $22^2 = 484$

$$25 - 25 + B^2 = 484 - 25$$

Subtract 25 from both sides.

$$B^2 = 459$$

Simplify: $484 - 25$

$$\sqrt{B^2} = \sqrt{459}$$

Take the square root of both sides.

$$B = 21.42$$

Evaluate: $\sqrt{459} = 21.42$

The measurement of Leg B is 21.4.

A. 21.4

B. 22.6

C. 27

D. None of the Above

Part 2: Directions: For problems 21-27, write the correct answer on your answer sheet.

21. If you were to graph the following function, identify the point at which the vertex would be located. Identify whether this point would be a minimum point or a maximum point.

$$F(x) = -2x^2 - 8x - 10$$

We know that the parabola will open down with a **maximum point** because the lead coefficient is negative $(-2x^2 - 8x - 10)$

We can find the location of the vertex by using the vertex formula: $a = -2$ $b = -8$ $c = -10$

$$x = \frac{-b}{2a} \quad x = \frac{-(-8)}{2(-2)} \quad x = \frac{8}{-4} \quad x = -2 \quad \text{The x-coordinate of the vertex is } -2.$$

We know the x coordinate is -2 by using the formula, but we must also find the y-coordinate. We can substitute -2 for x into the function and solve for f(x) which is our y coordinate.

$$F(x) = -2x^2 - 8x - 10 \quad x = -2$$

$$F(x) = -2(-2)^2 - 8(-2) - 10$$

$$F(x) = -8 + 16 - 10$$

$$F(x) = -2$$

The y-coordinate is -2. **Therefore, the point of the vertex is (-2,-2) and it is a maximum point.**

22. Factor the following trinomial: $8x^2 - 10x - 3$

In order to factor this trinomial, we will need to use the guess and check method.

$$(4x - 3)(2x + 1) = 8x^2 + 4x - 6x - 3 \quad \text{or} \quad 8x^2 - 2x - 3 \quad \text{This doesn't work}$$

$$(4x + 1)(2x - 3) = 8x^2 - 12x + 2x - 3 \quad \text{or} \quad 8x^2 - 10x - 3 \quad \text{This works!!}$$

The factors are: $(4x+1)(2x-3)$

23. Graph the following system of equations on the grid. Identify the solution to the system.

$$y = 3x + 6$$

$$2x + y = -9$$

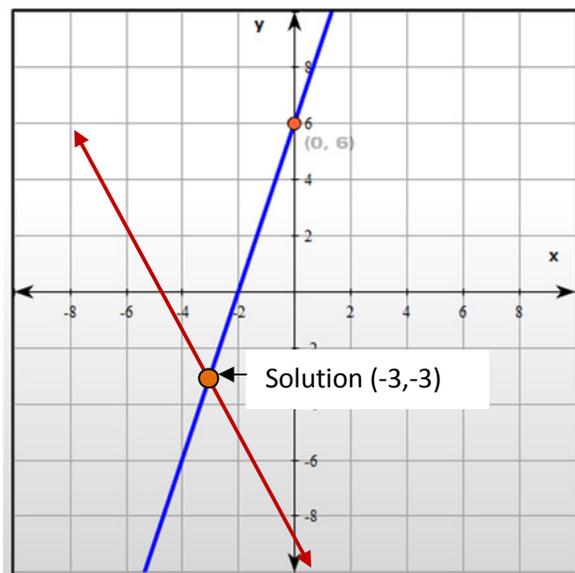
It would be easiest to have both equations written in slope intercept form in order to graph. The first equation is written in slope intercept form:

$$Y = 3x + 6 \quad (\text{slope} = 3 \quad \text{y-intercept} = 6)$$

Rewrite the second equation in slope intercept form:

$$2x - 2x + y = -2x - 9 \quad \text{Subtract } -2x$$

$$y = -2x - 9 \quad \text{Slope} = -2 \quad \text{y-intercept} = -9$$



24. Use quadratic formula to solve the equation: $x^2 + 4x = 9$

Since this equation is not set equal to 0, we must first subtract 9 from both sides.

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

Subtract 9 from both sides.

$$x^2 + 4x - 9 = 0$$

Now we know that:

$$A = 1$$

$$B = 4$$

$$C = -9$$

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

The quadratic formula

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-9)}}{2(1)}$$

Substitute A, B, and C into the quadratic formula

$$x = \frac{-4 \pm \sqrt{16 + 36}}{2}$$

Begin simplifying (inside of the radical sign)

$$x = \frac{-4 \pm \sqrt{52}}{2}$$

Continue simplifying inside of the radical sign.

$$x = \frac{-4 \pm \sqrt{52}}{2} \quad \text{or in decimal form: } x = 1.6 \text{ and } x = -5.6$$

25. Graph the following equation and identify the x-intercepts, and vertex of the parabola.

$$Y = x^2 - 4$$

In order to graph, I must first find the x-intercepts and the vertex of the parabola. Since there is no middle term, and A and C are both perfect squares, I know that this is the difference of two squares.

If I set $y = 0$ and factor using the difference of two squares rule, then I can find the x-intercepts.

$$0 = x^2 - 4$$

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

The factors of $x^2 - 4$

$$x + 2 = 0 \quad x - 2 = 0$$

Set each factor equal to 0

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

The x-intercepts are -2 & 2

Now we will use the vertex formula to find the vertex:

$$X = -b/2a$$

The vertex formula

$$X = 0/2(1)$$

$$b = 0, a = 1$$

The x-coordinate is 0.

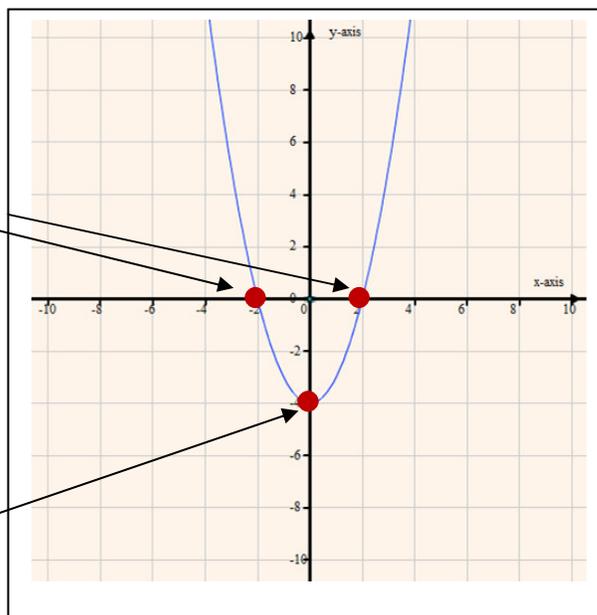
Now substitute 0 for x.

$$Y = 0^2 - 4$$

$$Y = -4$$

The y-coordinate is -4

The vertex is (0, -4)



26. Simplify $(7 - x)^2$. Express your answer in standard form.

In order to write this answer in standard form, we must expand the expression.

$$(7-x)(7-x)$$

Now we can use FOIL to multiply

$$\color{red}{7}(7) + \color{red}{7}(-x) + \color{red}{(-x)}(7) + \color{red}{(-x)}(-x)$$

First distribute 7 and then distribute $-x$.

$$\begin{array}{ccccccc} \downarrow & \downarrow & \downarrow & \downarrow & & & \\ 49 & -7x & -7x & +x^2 & & & \end{array}$$

$$49 - 14x + x^2$$

Simplify: $-7x - 7x = -14x$

$$\color{red}{x^2 - 14x + 49}$$

Rewrite in standard form: $Ax^2 + Bx + C$

27. What is the value of the discriminant for the following equation? What does it tell you about the solutions?

$$3x^2 - 7x + 4 = 0$$

The formula for finding the discriminant is: $b^2 - 4ac$ where $a = 3$ $b = -7$ $c = 4$

$$b^2 - 4ac$$

$$(-7)^2 - 4(3)(4)$$

Substitute for a b and c.

$$49 - 48$$

Simplify: $(-7)^2 = 49$ & $(-4)(3)(4) = 48$

$$1$$

Simplify: $49 - 48 = 1$

The discriminant = 1. 1 is a positive number and it's a perfect square. **Therefore, there are two rational solutions** and the equation can be factored.

Part 3: Directions: For problems 28 – 32, write your answer on the answer sheet. Be sure to answer all of the bullets for each problem!

28. Liam is choosing a new cell phone plan. Wireless Plus offers \$65 a month plus \$0.10 per gigabyte over the monthly limit. New Age Phones has a monthly fee of \$35 per month, plus \$0.20 per gigabyte over the monthly limit.
- Write a system of equations that describes this situation.
 - For how many gigabytes over the monthly limit, will the two plans charge the same amount?
 - If you were to average 200 gigabytes over the monthly limit, which company would be the better value?

- A system of equations is two or more equations. Therefore, we must write an equation for Wireless Plus and an equation for New Age Phones. Let x = # of gigabytes Let y = total cost

Wireless Plus: $y = .10x + 65$.10 is the slope (key word “per” gigabyte) & 65 is the constant or y-intercept.

New Age Phones: $y = .20x + 35$.20 is the slope (key word “per” gigabyte) & 35 is the constant or y-intercept.

- In order to figure out when the two plans will charge the same amount, we must solve the system of equations. Since both equations are written in slope intercept form, I will use the substitution method for solving.

$$.20x + 35 = .10x + 65$$

$$.20x - .10x + 35 = .10x - .10x + 65$$

$$.10x + 35 = 65$$

$$.10x + 35 - 35 = 65 - 35$$

$$.10x = 30$$

$$.10x / .10 = 30 / .10$$

$$x = 300$$

Substitute $.20x + 35$ for y in the first equation.

Subtract $.10x$ from each side.

$$\text{Simplify: } .20x - .10x = .10x$$

Subtract 35 from both sides.

$$\text{Simplify: } 65 - 35 = 29$$

Divide by $.10$ on both sides.

The two companies will charge the same amount for 300 gigabytes over the monthly limit.

- In order to figure out which company would cost more for 200 gigabytes over the monthly limit, we can substitute 200 for x into each equation and simplify:

$$\text{Wireless Plus: } .10(200) + 65 = \$85$$

$$\text{New Aged: } .20(200) + 35 = \$75$$

Therefore, New Age Phones would charge less for 200 gigabytes over the monthly limit. New Age charges \$75 and Wireless Plus charges \$85.

Summary: System of Equations

$$\text{Wireless Plus: } y = .10x + 65$$

$$\text{New Age: } y = .20x + 35$$

For 300 gigabytes over the monthly limit, the two companies will charge the same amount.

New Age Phones would charge less for 200 gigabytes over the monthly limit.

New Age charges \$75 and Wireless Plus charges \$85.

29. An ice cream store made a profit of \$35700 in 1990 and a profit of \$85360 in 2008. Write an equation that can be used to predict the profit, y , in terms of the year, x . Let $x=0$ represent the year 1990.

- Predict the profit for the year 2011.

Since the direction says let $x = 0$ represent the year 1990 that means that 1990 = year 0 and 2008 is 18 years later, so 2008 = year 18. We must write two ordered pairs with x being the number of the year and y being profit. Therefore, our ordered pairs are: $(0, 35700)$ & $(18, 85360)$

In order to make a prediction, we must first find the slope and write an equation.

$$\text{Slope formula} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{85360 - 35700}{18 - 0} = \frac{49660}{18} = 2758.89 \quad (\text{this is the slope or rate of change})$$

The y -intercept is the 35700 because the y -intercept is the point where $x = 0$. $(0, 35700)$

Therefore, our equation that represents this situation is:

$$Y = 2758.89x + 35700 \quad \text{where } x = \text{the year} \quad y = \text{profit}$$

In order to predict the profit for 2011, we will substitute 21 for x since 2011 is 21 years after 1990.

$$Y = 2758.89(21) + 35700$$

$$Y = 93,636.69$$

In 2011, the ice cream store should make a profit of \$93, 636.69

- What does the y -intercept represent in the context of this problem?

The y -intercept is the amount of profit in the very beginning (year 0) which in this case is 1990. This ice cream store was probably established in 1990 and this was their profit the first year.

30. A candy store finds that it can make a profit of P dollars each month by selling x boxes of candy. Using the formula: $P(x) = -.0013x^2 + 5.5x - 800$, how many boxes of candy must the store sell in order to maximize their profits? What is the maximum profit?

In order to find the maximum number of boxes of candy and the maximum profit, we must find the maximum point which is the vertex for this function.

$$\text{Vertex Formula: } x = -b/2a \quad \text{where } a = -.0013 \quad b = 5.5$$

$$X = -5.5/2(-.0013)$$

$$\mathbf{X = 2115.4} \quad \text{This is the number of boxes of candy the store must sell.}$$

In order to find the maximum profit, which is $P(x)$, we must substitute 2115 for x into the function and evaluate:

$$P(x) = -.0013(2115)^2 + 5.5(2115) - 800$$

$$\mathbf{P(x) = 5017.31} \quad \text{The candy store could maximize their profit of } \mathbf{\$5017.31} \mathbf{ by selling 2115 boxes of candy.}$$

31. A rectangle has a length of $3x + 9$ and a width of $5x - 4$. The perimeter of the rectangle is 106 units. Find the width of the rectangle.

The perimeter formula for a rectangle is: $P = 2L + 2W$ we know: $L = 3x + 9$, $W = 5x - 4$ $P = 106$

Let's substitute into the formula:	$106 = 2(3x + 9) + 2(5x - 4)$	Substitute
	$106 = 6x + 18 + 10x - 8$	Distribute
	$106 = 6x + 10x + 18 - 8$	Rewrite like terms together
	$106 = 16x + 10$	Combine like terms
	$106 - 10 = 16x + 10 - 10$	Subtract 10 from both sides
	$96 = 16x$	Simplify: $106 - 10 = 96$
	$96/16 = 16x/16$	Divide by 16 on both sides.
	$6 = x$	$x = 6$

We know the value of x is 6, but the problem asks to find the width of the rectangle. We know the width is: $5x - 4$, so we must substitute 6 for x in order to find the width:

$$\text{Width} = 5x - 4$$

$$\text{Width} = 5(6) - 4$$

$$\text{Width} = 26 \text{ units.}$$

The width of the rectangle is 26 units.

32. The boy's soccer team is holding a fundraiser. They are selling cheese pizzas for \$12 and supreme pizzas for \$15. They would like to raise at least \$1000. The boys estimate that at most they will be able to sell 120 pizzas.

- Write a system of inequalities to represent this situation.

Since this is a system of inequalities, we must write two inequalities to represent this situation.

The first inequality will represent the price of the pizzas and how much they would like to raise.

Let $x = \#$ of cheese pizzas

Let $y =$ the number of supreme pizzas.

Price of cheese ($\#$ of cheese) + Price of Supreme ($\#$ of supreme) is at least \$1000

$$12x + 15y \geq 1000$$

the symbol for at least is greater than or equal to

The second inequality can represent the number of pizzas that they estimate that they will sell.

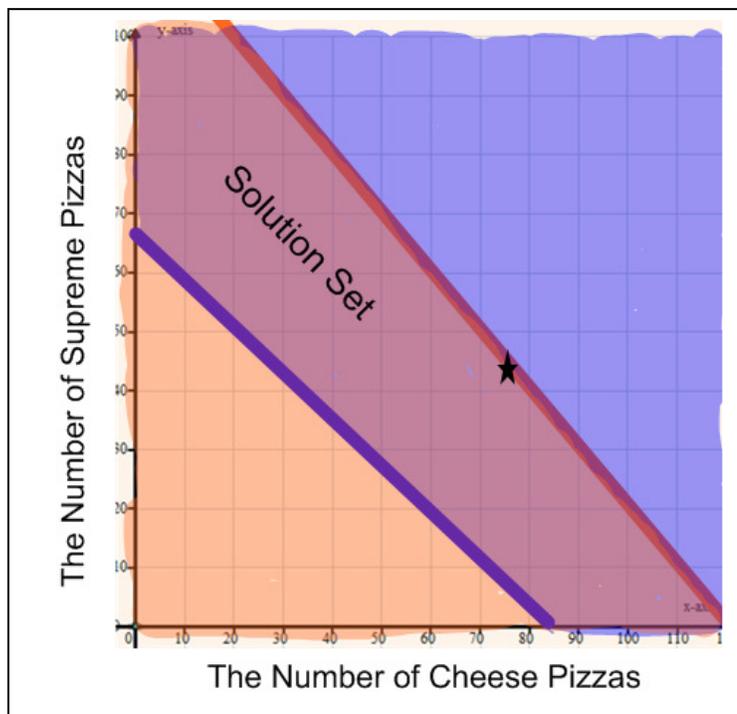
$\#$ of Cheese + $\#$ of Supreme is at most 120

$$x + y \leq 120$$

the symbol for at most is less than or equal to.

The system of inequalities for this graph is: $12x + 15y \geq 1000$ & $x + y \leq 120$

- Graph each inequality on the grid.



First graph $12x + 15y = 1000$ by finding the x- and y intercepts. (This is my purple line)

Let $x = 0$ to find the y-intercept.

$$12(0) + 15y = 1000$$

$$15y = 1000$$

$$15y/15 = 1000/15$$

Y = 66.7 this is the y-intercept.

Let $y = 0$ to find the x-intercept.

$$12x + 15(0) = 1000$$

$$12x = 1000$$

$$12x/12 = 1000/12$$

X = 83.3 this is the x-intercept.

Graph the x and y intercept. Now look at the inequality. $12x + 15y \geq 1000$. Since it's greater than or equal to, we must use a solid line. If we substitute (0,0) for x and y we get: $12(0) + 15(0) \geq 1000$. Since 0 is not greater than 1000, we shade the side that does not contain (0,0) (light purple)

Next graph $x + y = 120$. To find the y-intercept, let $x = 0$.

$$0 + y = 120 \text{ or } y = 120$$

To find the x-intercept, let $y = 0$

$$x + 0 = 120 \text{ or } x = 120$$

The x and y intercept are both 120. Graph these points.

The line is solid since the symbol is less than or equal to. Now to figure out the shading...

To shade, substitute (0,0) for x and y. $0 + 0 \leq 120$

Since 0 is less than or equal to 120, we will shade the left side which contains (0,0). (The light pink)

The middle section is where the two inequalities overlap and this is the solution set for the system of inequalities.

- 75 cheese pizzas have been sold. Use your graph to determine a reasonable number of supreme pizzas that must be sold in order for the girls to reach their goal of at least \$1000. Justify your answer.

If 75 pizzas have been sold, then the about 45 supreme pizzas must be sold in order to reach their goal of at least \$1000. (See the star on the graph)

Let's check by substituting:

$$12x + 15y \geq 1000$$

$$12x(75) + 15(45) \geq 1000$$

$$1575 \geq 1000 \text{ 😊}$$

$$x + y \leq 120$$

$$75 + 45 \leq 120$$

$$120 \leq 120 \text{ 😊}$$

Both statements are true, so 45 is correct. Answers may vary. Any answer between 7 and 45 would work, but a larger number closer to 45 would be most reasonable.