Name: ______________________________________ Date: ___________________________ Hour: ____Alg 1____

Unit 7C Day 26: Intercept form of a quadratic

Focus Question: How do I graph a quadratic in intercept form?

A. Review

We know two forms of quadratics so far…

1. The function $f(x) = 3(x-4)^2 + 7$ is in ________________ form because we can immediately tell the ___________________ which is at ______________________. All quadratics have a real vertex, so all quadratics can be written in this form.

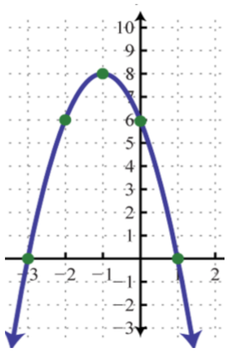
2. The function $f(x) = \frac{2}{3}x^2 - 3 + 6$ is in ____________________ form because _____________________________. We can immediately tell the ________________ which is at __________. All quadratics have real y-intercepts so all quadratics can be written in this form.

3. What is/are the other important points of a quadratic?

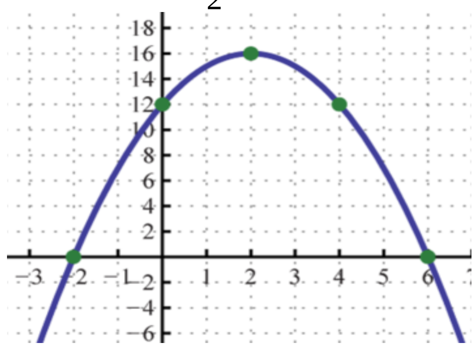
B. New Form

1. Each of the following quadratics in vertex form has been graphed.

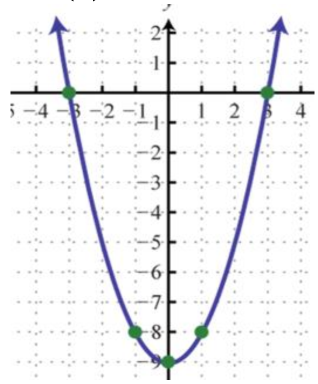
$f(x) = -2(x+1)^2 + 8$



$g(x) = -\frac{1}{2}(x-2)^2 + 16$



$h(x) = x^2 - 9$



Give the axis of symmetry and x intercepts for each function.

Axis of symmetry: ______________ Axis of symmetry: _____________ Axis of symmetry: ________________

X Intercepts: ______________ and ______________ X Intercepts: _______________ and ______________ X Intercepts: ________________ and ________________

2. Each of the following equations is a different way to write the quadratic. Match it to the graph.

a. $j(x) = -\frac{1}{2}(x+2)(x-6)$ matches ________ because…

b. $k(x) = -2(x+3)(x-1)$ matches _________ because…

c. $m(x) = (x+3)(x-3)$ matches __________ because…

3. How are the axis of symmetry and the x intercepts related? (In other words, if you knew the x-intercepts, how could you find the axis of symmetry?)

4. What form would you call *j(x), k(x),* and *m(x)*? Explain.

C. Intercept form of a quadratic is $f(x) = a(x - p)(x - q)$.

1. The x intercepts are found at ___________ and _______________ (Just like in vertex form, if it is in the parenthesis with x you should ________________________.)

2. The axis of symmetry is found at _______________________

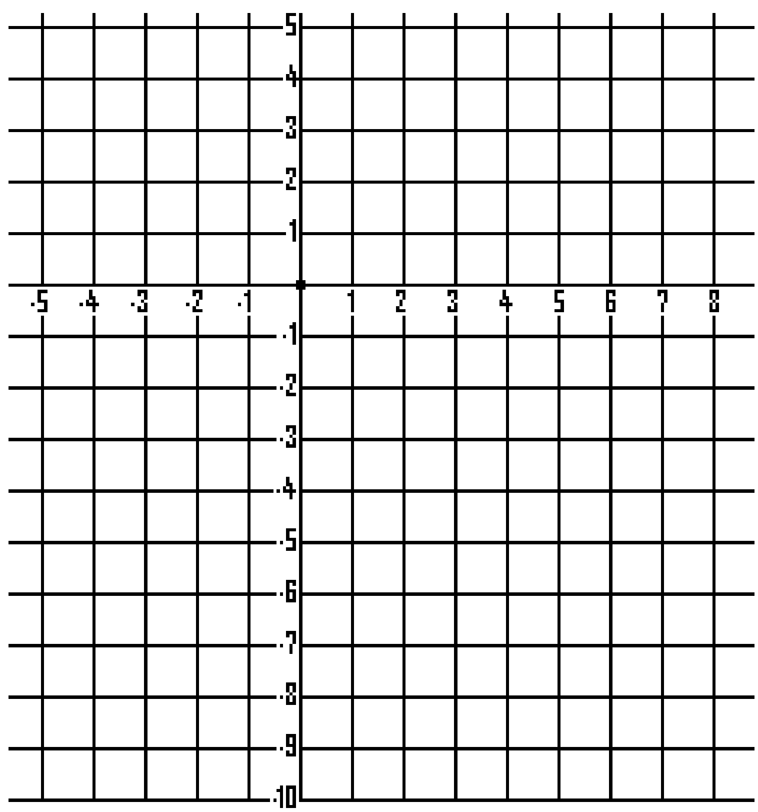
3. To find the *y* value of the vertex, substitute the *x* value of the ________________ into the function.

4. If a < 0, the parabola __________________________.

   If $|a| > 1$ the parabola ____________________. If $0 < |a| < 1$, the parabola __________________.

D. Use the function *f(x)=(x+1)(x – 5)* to answer each question.

1. Prove it is a quadratic.



2. Where are the x- intercepts?

3. Where is the axis of symmetry?

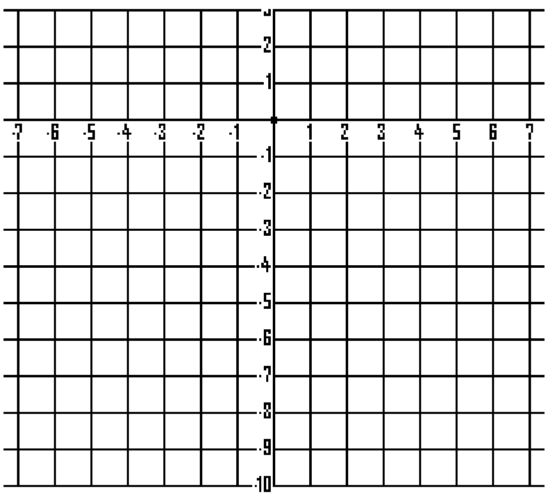
4. Where is the vertex?

5. Where is the y-intercept?

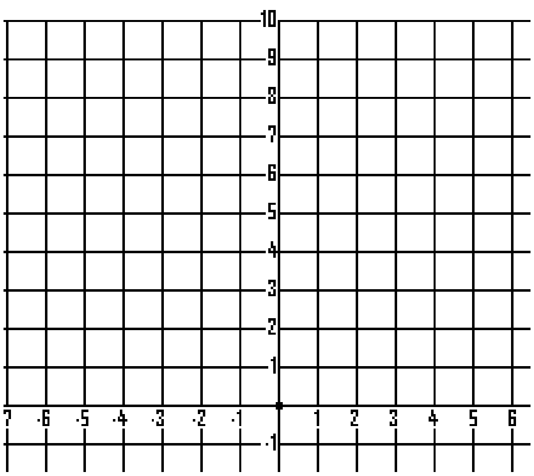
6. Graph the function.

E. Graph each function given in intercept form.

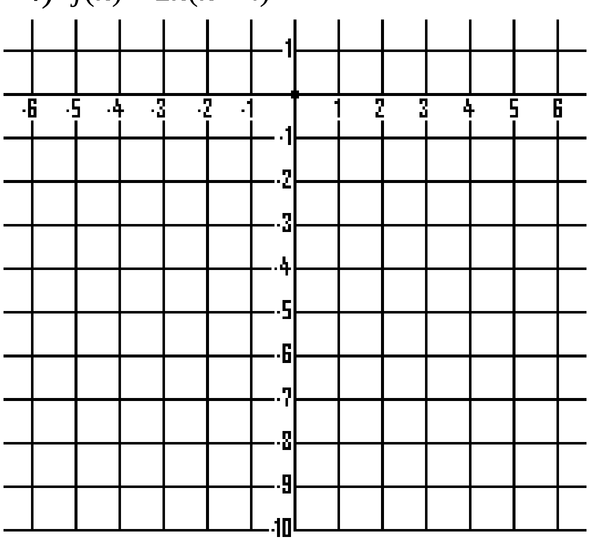
1) $f(x) = (x + 2)(x - 4)$



3) $h(x) = -\frac{1}{3}(x+6)(x-4)$



4) $j(x) = 2x(x-4)$



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Unit 7C Day 27: Solving quadratics in intercept form

Focus Question: How do I solve a quadratic in intercept form?

A. Solving from intercept form

1. What are the synonyms for "solve a quadratic?"

2. Find the product of each expression below.

a) $5 \cdot 2 \cdot 0$ b) $0 \cdot 592 \cdot 3.64$ c) $\frac{4}{11} \cdot 0 \cdot 7\pi$ d) $p \cdot q \cdot m \cdot 0$

3. Those should have been easy because **if any of the factors is zero**, the product is __________.

4. Intercept form of a quadratic is $f(x) = a(x-p)(x-q)$. What operation is occurring between *a*, *(x-p)*, and *(x-q)*?_______________________ So, *a*, *(x-p)*, and *(x-q)* are all _______________ of the quadratic. The other name for intercept form is factored form. Why do both names make sense?

5. The first step in solving a quadratic is substitute _______ for ________ because
____.

6. So now, we know that we are multiplying to make zero, so ONE of the three ___________ must equal __________. Obviously $a \neq 0$ because ____________________________________ so one of the other two factors must equal zero. We don't know which one, so we solve for both and its okay to have two different answers because ____.

B. Practice: Solve each of the quadratics below.

1) $f(x) = 4(x-2)(x+7)$ 2) $g(x) = \frac{1}{4}x(x-3)$

Don't be fooled into thinking that all you have to do is put the opposite of what's behind the x…you need to show work and do thinking because not all intercepts are integers! $f(x) = a(x-p)(x-q)$ can be deceiving.

3) $h(x) = (2x - 7)(3x + 8)$

4) $j(x) = 2(x - 6)(4x - 1)$

5) $h(t) = \frac{1}{4}(t - 2)(8t + 17)$

6) $P(a) = -5(4a + 7)(6a + 5)$

Name: ___________________________________ Date: _________________________ Hour: ____Alg 1____

Unit 7C Day 28: Applications of quadratics in intercept form

Focus Question: How do I use a quadratic in intercept form?

A. The path of a kicked football can be modeled by the function $f(x) = -0.026x(x-46)$ where x is the horizontal distance in yards and *f(x)* is the corresponding height in yards.

1) How far was the ball kicked?

2) What is the maximum height of the ball in yards? In feet?

3) If this was a 40 yard field goal attempt and the height of the cross bar is 10 feet, would the kicker have made or missed the field goal (assume his aim was good and between the goal posts)?

B. Although a football field appears to be flat, its surface is actually shaped like a parabola so that rain runs off to both side lines. The cross section of a field with synthetic turf can be modeled by the function $h(x) = -0.000234x(x-160)$ where *x*, which represents the distance from the sideline, and *h*, which represents height, are both measured in feet.

1) How much higher is the center of a football field than the sidelines?

2) How wide is a football field?

C. Babe Ruth is a famous New York Yankee's slugger. One of his hits can be modeled by the function $h(d) = -0.00002(2d + 73)(4d - 1981)$ where h is the height of the ball and d is the horizontal distance it's been hit in feet.

1. How high was the ball off the ground when he hit it?

2. In 1923 the outfield wall up the right field line was 295 feet from home plate and had a height of 10 feet. Would this hit have been a homerun?

3. The straight away center field fence was 520 feet from home plate. How far from the fence would the ball have hit the ground?

4. What was the highest the ball went in the air?

D. A bottlenose dolphin jumps out of the water. The path the dolphin travels can be modeled

by $h(d) = -0.2d(d - 10)$, here h represents height of the dolphin in feet and d represents horizontal distance in feet.

a) What is the maximum height the dolphin reaches?

b) How far did the dolphin jump?

Name: ______________________________ Date: ______________________ Hour: ____Alg 1____

Unit 7C Day 29: The "Why" of Factoring and Factoring Binomials

Focus Question: What is factoring and why is it useful? Can I factor a binomial?

A. One case for factoring:

1. To solve a quadratic in vertex form we had to ____________________________

2. To solve a quadratic in standard form we could…

- do the ____________________ formula

OR

- Use the process of ______________ the _____________ then solve

3. To solve a quadratic in intercept form we had to _______________________

4. Which of the ways above was easiest to you?

5. Most people prefer solving from intercept form and believe it is easiest. What was the other name for intercept form?

6. What does it mean to be a factor?

Factoring is the process of turning a standard form polynomial into the polynomials that were multiplied to create it. For a quadratic we will be finding the monomials or binomials that were multiplied to make our trinomial. **Most people believe factoring is the easiest way to solve a quadratic. BUT…**

7. Do ALL quadratics have real rational x intercepts?

8. So will the process we are going to learn work for EVERY quadratic?

9. What helps us determine if a quadratic has real rational x – intercepts?

10. If a quadratic won't factor, what will you have to remember to solve it?

B. The Second Case for Factoring

The reason you learned to write numbers as factors was so you could reduce fractions. . $\frac{10}{12} \to \frac{\cancel{2}\cdot 5}{\cancel{2}\cdot 6} \to \frac{5}{6}$

Remember that fractions are division problems.

So when you are in algebra II and required to divide polynomials, you will be using the process of finding the factors. $\frac{x^2+3x-4}{x-1} \to \frac{\cancel{(x-1)}(x+4)}{\cancel{(x-1)}} \to x+4.$

C. Factoring Binomials (two terms…starting easy with the opposite of distributing.)

1. Distribute showing all work 3(x + 7)

In factoring, you are “undoing” the distribution of a factor that has occurred.

Distributing	What’s happening	Factoring	What’s happening
$3(x+7)$ $3(x)+3(7)$ $3x+21$	The two factors being multiplied are 3 and the expression x + 7. We know that we distribute (or **multiply**) the 3 to each term in the second factor	$3x+21$ $3(x)+3(7)$ $3(x+7)$	The common factor of 3x and 21 is 3 When 3x is **divided** by 3, x is left When 21 is **divided** by 3, 7 is left So when the factor 3 is pulled to the front, the x + 7 remains as the other factor.

2. Factor each degree 1 expression below (you did this in 6th grade!)

a. $6x + 9$ b. $20y - 5$ c. $2m + \frac{2}{3}$ d. $-4x - 40$ e. $-3x + 20$

3. A quadratic with a y intercept of (0,0) will look like $f(x) = ax^2 + bx$. This will always factor because ______ is a factor of both terms.

4. In an intercept form quadratic, $f(x)=a(x-p)(x-q)$, which value tells you how it opens? ___________

So even though we say “greatest” common factor, if *a* (or the leading coefficient) is negative, we want to factor out the negative.

5. Turn each function below into intercept form

a. $f(x) = x^2 - 8x$ b. $g(x) = -6x^2 + 15x$ c. $h(x) = 4x^2 - 20x$ d. $j(x) = \frac{1}{2}x^2 + 10x$

6. Rather than use the quadratic formula, solve each quadratic by factoring

a. $f(x) = 2x^2 - 10x$ b. $g(x) = -x^2 + 12x$ c. $h(x) = \frac{1}{2}x^2 + 6x$

Name: ____ Date: ____________________________ Hour: ____Alg 1____

Unit 7C Day 30: Factoring when a = 1

Focus Question: How do I factor $ax^2 + bx + c$ when $a = 1$?

A. Review: Multiply each set of binomials:

1. $(x + 5)(x - 3)$ 2. $(x - 4)(x - 2)$ 3. $(x + m)(x + k)$

4. When you were simplifying, what did you notice about the first (or a) term?

5. What did you notice about the constant (or c) term?

6. What did you notice about the middle (or b) term?

B. So when we try to turn standard form into factored (or intercept) form, we will be turning the trinomial into the two binomials that were multiplied to make the trinomial.

*****<u>When a = 1</u>, which term (a, b, or c) do we <u>really</u> need to factor?** ********a*** **will not always be 1**

Will *c* only have 1 pair of factors? ________ So it's a little bit of trial and error because we need two factors that multiply to make *c* AND ALSO combine to make ________.

Just a reminder…will every trinomial factor?

Turn each of the functions into intercept form by factor each of the following trinomials (fill in the blanks and then use the box)

1) $f(x) = x^2 - 7x + 10$ 2) $g(x) = x^2 + 2x - 35$ 3) $h(x) = x^2 + 7x - 8$

x^2 + _____ + _____ + 10 x^2 + _____ + _____ - 35 x^2 + _____ + _____ - 8

f(x) = ____________________ *g(x)* = ______________________ *h(x)* = __________________

4) $k(x) = x^2 - 13x - 48$

5) $m(x) = x^2 + 10x + 36$

6) $n(x) = x^2 + 13x + 40$

x^2 + ____ + ____ - 48

x^2 + ____ + ____ + 36

x^2 + ____ + ____ + 40

$k(x)$ = ____________________

$m(x)$ = __________________

$n(x)$ = ________________

7. What it looks like without the box….Remember that we could also multiply binomials with the distributive property rather than with the box. Go back and use grouping to see how to perform factoring without a box.

C: Solve each function using factoring rather than the quadratic formula

1) $f(x) = x^2 + 5x - 24$

2) $f(x) = x^2 + 6x - 40$

3) $f(x) = x^2 + 8x + 12$

4. Do an algebra II problem: Simplify $\frac{x^2-x-12}{x^2+2x-24}$

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Unit 7C Day 31: Factoring when a ≠ 1 but is the GCF

Focus Question: How do I factor $ax^2 + bx + c$ when $a \neq 1$?

A. Review: Factor each of the following

1) $3x^2 + 27x$

2) $x^2 - 13x - 30$

3) $4x^2 + 24x - 160$

4) How is problem three different from the quadratics we have factored before?

5) When factoring, what should you ALWAYS look for first?

Remember, your greatest common factor becomes the *a* value, so sometimes it's negative and sometimes it's a fraction.

B: Re-write each standard form quadratic in intercept form.

1) $f(x) = 5x^2 + 10x - 15$

2) $g(x) = 2x^2 + 6x - 108$

3) $h(x) = 4x^2 + 20x + 24$

4) $f(x) = 3x^2 - 147$

5) $h(x) = \frac{1}{2}x^2 + 12x + 72$

6) $k(x) = -2x^4 + 6x^3 + 8x^2$

7) $h(t) = 2t^2 + 28t + 96$

8) $h(s) = \frac{1}{4}s^2 - 1$

C. Applications of factoring

1. A bottlenose dolphin jumps out of the water. The path the dolphin travels can be modeled by $h(d) = -2d^2 - 24d$, here h represents height of the dolphin in feet and d represents horizontal distance in feet.
   a. How far did the dolphin jump?

   b. What is the maximum height the dolphin reaches?

2. A diet coke and mentos rocket was launched off the top of a building by the president of the rocketry club in a lead up to a challenge. The height in feet, *h*, of the rocket can be modeled by the function $h(t) = -16t^2 + 80t + 96$ where t is the time in seconds since launch.

a. How long was the rocket in the air?

b. How high did the rocket go?

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Unit 7C Day 32: Factoring when a ≠ 1 AND IS NOT THE GCF

Focus Question: How do I factor $ax^2 + bx + c$ *when* $a \neq 1$*?*

A. Expand each of the following

1. $(3x + 2)(x - 7)$
2. $(2x + 5)(3x + 1)$
3. $(4x - 3)(5x - 6)$

In the problems above, you should notice….

- The *a* is not the _______
- There is still no combining needed to get the ________ or __________ term
- The combining to get the *b* term is no longer just the factors of ________. It also now **ALSO INVOLVES** the factors of ________.
- The original factored form does not look like a traditional intercept form $f(x) = a(x - p)(x - q)$. Instead, the x values will have coefficients of a number other than 1.

B. Steps to factor when a ≠1 and not the GCF: **EX.** $\mathbf{4x^2 - 5x - 6}$

1) Because a is not a greatest common factor but is involved in the *b* term, we need to force it into the factorizing by multiplying it by c.

2) Factor the new $a \cdot c$ term and find the factors that help you make b.

3) Proceed as normal by either writing the new equation and either factor by grouping or write the four terms in the box and factor each pair.

C: Factor and solve each of the following

1) $2x^2 - 9x + 4 = 0$

2) $9x^2 + 30x + 16 = 0$

3) $4x^2 + 12x + 9 = 0$

4) $12n^2 + 4n - 5 = 0$

5) $8f^2 - 6f - 27 = 0$

6) $3x^2 - 7x - 6 = 0$

7) $10m^2 + 8m - 24 = 0$

8) $10x^2 - 17x + 3 = 0$

9) $-2x^2 + 5x + 7 = 0$

10) $2x^4 - 5x^3 - 3x^2 = 0$

Remember: Not all quadratics factor. Also, factoring is intended to be a shortcut to the quadratic formula, so if it's not going well, you can ALWAYS solve using the quadratic formula.

Name: ____________________________________ Date: _________________________ Hour: ____Alg 1____

Unit 7C Day 33: Factoring a Difference of Squares (Special Case of Factoring)

Focus Question: How do I quickly factor a special case?

A. Use the following expressions

$x^2 - 6$ $\quad$ $x^2 - 25$ $\quad$ $4x^2 - 36$ $\quad$ $x^2 + 16$

1. What do all 4 expressions have in common?

2. Only two of the expressions can be factored, which two? _________________ and _______________

3. Factor those two expressions.

1. What do those two original expressions have in common?
   - ____
   - ____
   - ____

2. What do the two factored expressions have in common?

B. Difference of squares

The two expressions $x^2 - 25$ and $4x^2 - 36$ are examples of a special case called "The difference of squares." Meaning it could always be re-written as $a^2 - b^2$ and its factors will always be $(a+b)(a-b)$. Factor each of the following. (Remember, the first thing you should always look for is the __________.

1. $x^2 - 144$ $\quad$ 2. $k^2 - 225$ $\quad$ 3. $9x^2 - 1$

4. $4n^2 - 49$

5. $3n^2 - 75$

6. $24x^3 - 54x$

7. $a^2 - 25b^2$

8. $4x^2 + 49y^2$

9. $\frac{1}{4}s^2 - 1$

C. The difference between factoring and solving

Just because an expression can't be factored doesn't mean it can't be solved! Remember, you have other methods like ______________________________ or ______________________________.

1. Factor $a^2 + 16$

2. Solve $a^2 + 16 = 0$

3. Factor $b^2 - 12$

4. Solve $b^2 - 12 = 0$

5. Factor $d^2 + 2d - 1$

6. Solve $d^2 + 2d - 1 = 0$

Name: ________________________________ Date: _______________________ Hour: ____Alg 1____

Unit 7C Day 34: Review Intercept Form of Quadratics and Factoring

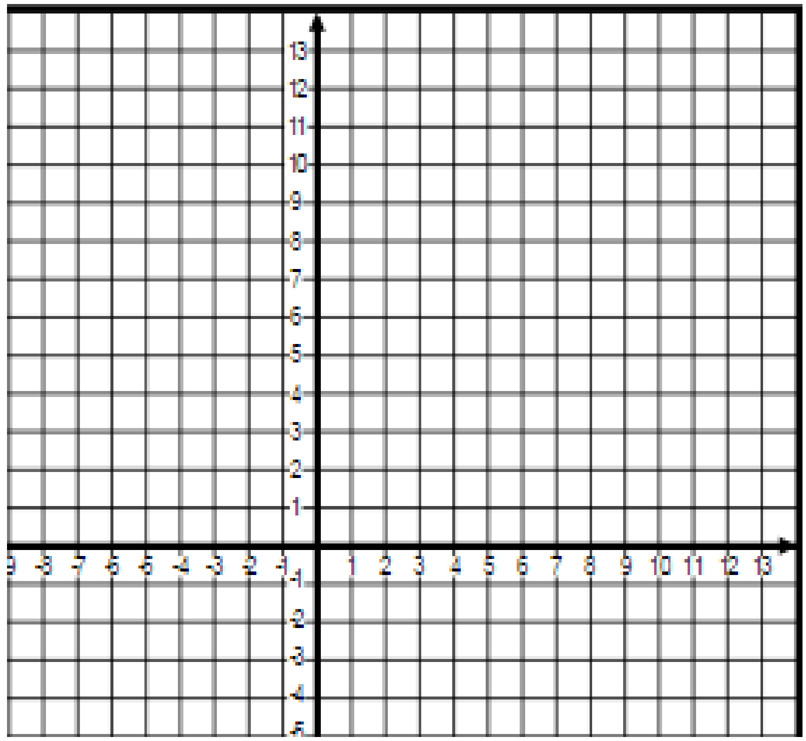
Focus Question: Do I remember intercept form and how to create it?

A. Intercept form

Use the following quadratic

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

1. Solve the function.



2. Find the axis of symmetry.

3. Find its vertex

4. Is the vertex a max or min?

5. Find the y-intercept.

6. Give its domain

7. Give its range

8. Jackie threw a ball straight up in the air. The height of the ball in meters, *h*, at any time in seconds, *t*, can be modeled by the function $h(t) = -(5t + 1)(t - 3)$

a. When did the ball hit the ground? Show all work.

b. What was the highest the ball went? Show all work.

c. Find h(0). What does this point represent?

Factor each of the following:

$n^2 + 4n - 12$

$b^2 + 16b + 64$

$k^2 - 13k + 40$

$2k^2 + 22k + 60$

$5v^2 - 30v + 40$

$5n^2 + 19n + 12$

$6n^2 + 5n - 6$

$4x^2 + 20x$

$25x^2 - 49$

Solve each of the following. (hint: remember not all quadratics factor!)

$f(x) = x^2 - 5x - 84$

$g(x) = 5x^2 - 20x$

$h(x) = 6x^2 - 72x - 96$

1. Cal Ripken hit a pop up above home plate. The height of the ball, *h*, in feet is related to time, *t*, in seconds described by the function $h(t) = -16t^2 + 64t + 2$. How long does an infielder have to get under the ball before it hits the ground?

2. A square field has 3 meters added to its width and 2 meters added to its length. The new field has an area of 90m^2. Find the length of a side of the original field.

Algebra II: Simplify the following $\frac{6x^2+12x+6}{x^2-1}$