Today, we will be looking at two aspects of quadratics:
1. How to write a standard form quadratic ($ax^2 + bx + c$) in factored form.
   Remember: To factor a 3-term quadratic, you must first split the middle term by answering the questions
   What is $A \cdot C$?   What is B?   What set of two numbers will multiply to $A \cdot C$, and add to B?
2. How the intercepts of a quadratic are related to both standard and vertex forms.

EXAMPLE: Write in factored form.
$$a(x) = x^2 + 5x - 14$$

Solve the Puzzle:
$A \cdot C = (1)(-14) = -14$
$\& \ B = 5$

$\underline{7} \cdot \underline{-2} = -14$
$\qquad \& \ \underline{7} + \underline{-2} = 5$

Split Bx using 7 & -2:
$+7x - 2x$

$a(x) = x^2\underline{+7x} \ \underline{-2x} - 14$

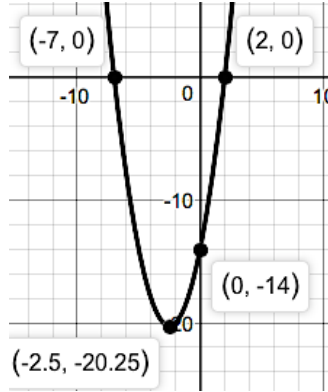*Group & Factor:*
$a(x) = \underbrace{x^2 + 7x}\ \underbrace{-2x - 14}$

$a(x) = 1x(x + 7) - 2(x + 7)$
$a(x) = (x + 7)(1x - 2)$
$\boxed{a(x) = (x + 7)(x - 2)}$

(graph with points (-7, 0), (2, 0), (0, -14), (-2.5, -20.25))

Factors: $\boxed{(x + 7)(x - 2)}$

X-intercept(s):
$\boxed{(-7, 0) \ \& \ (2, 0)}$

Y-intercept: $\boxed{(0, -14)}$

Vertex: $\boxed{(-2.5, -20.25)}$

EXAMPLE: Write in factored form.
$$b(x) = 5x^2 - 23x + 12$$

Solve the Puzzle:
$A \cdot C = (5)(12) = 60$
$\& \ B = -23$

$\underline{-20} \cdot \underline{-3} = 60$
$\qquad \& \ \underline{-20} + \underline{-3} = -23$
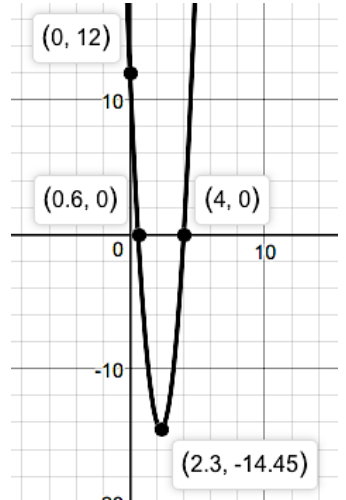
Split Bx using -20 & -3:
$-20x - 3x$

$b(x) = 5x^2\underline{-20x} \ \underline{-3x} + 12$

Group & Factor:
$b(x) = \underbrace{5x^2 - 20x}\ \underbrace{-3x + 12}$

$b(x) = 5x(x - 4) - 3(x - 4)$
$b(x) = \boxed{(x - 4)(5x - 3)}$

(graph with points (0, 12), (0.6, 0), (4, 0), (2.3, -14.45))

Factors: $\boxed{(x - 4)(5x - 3)}$

X-intercept(s):
$\boxed{(0.6, 0) \ \& \ (4, 0)}$

Y-intercept: $\boxed{(0, 12)}$

Vertex: $\boxed{(2.3, -14.45)}$

EXAMPLE: Write in factored form.
$$c(x) = 4x^2 - 4x - 8$$

Puzzle:
$A \cdot C = (4)(-8) = -32$
$\& \ B = -4$

$\underline{-8} \cdot \underline{4} = -32$
$\qquad \& \ \underline{-8} + \underline{4} = -4$

Split Bx using -8 & 4:
$-8x + 4x$

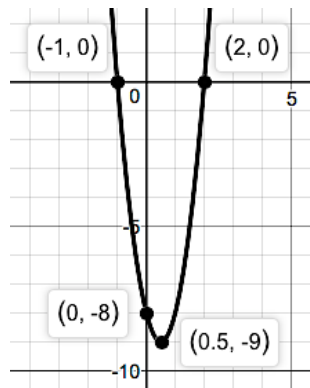$b(x) = 4x^2\underline{-8x} \ \underline{+4x} - 8$

Group & Factor:
$b(x) = \underbrace{4x^2 - 8x}\ \underbrace{+4x - 8}$

$b(x) = 4x(x - 2) + 4(x - 2)$
$b(x) = (x - 2)(4x + 4)$

(4x+4) can be factored…
take out the 4: 4(x+1)
$b(x) = \boxed{4(x - 2)(x + 1)}$

(graph with points (-1, 0), (2, 0), (0, -8), (0.5, -9))
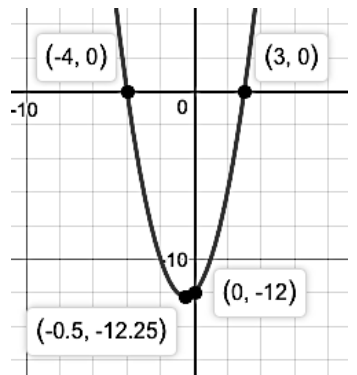
Factors: $\boxed{4(x - 2)(x + 1)}$

X-intercept(s):
$\boxed{(-1, 0) \ \& \ (2, 0)}$

Y-intercept: $\boxed{(0, -8)}$

Vertex: $\boxed{(0.5, -9)}$

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1. Write in factored form.
$$f(x) = x^2 + x - 12$$

What do you notice about the factors and the x-int's?

What do you notice about standard form and the y-int?

(graph with points (-4, 0), (3, 0), (0, -12), (-0.5, -12.25))

Factors:

X-intercept(s):

Y-intercept(s):

Vertex:

2. Write in factored form.
   $$g(x) = 2x^2 - 9x - 5$$

(-0.5, 0)　(5, 0)

10

(0, -5)

-10

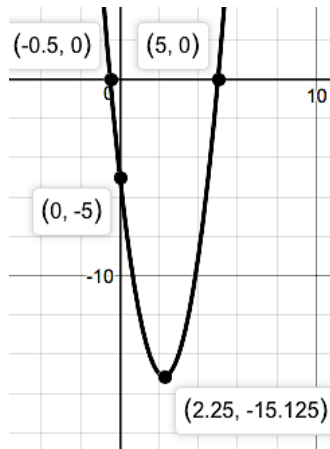(2.25, -15.125)
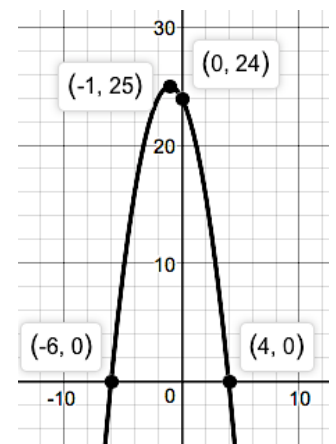
Factors:

X-intercept(s):

Y-intercept(s):

What do you notice about the factors and the x-int's?

Vertex:

What do you notice about standard form and the y-int?

3. Write in factored form.
   $$h(x) = -x^2 - 2x + 24$$

30

(-1, 25)　(0, 24)

20

10

(-6, 0)　(4, 0)

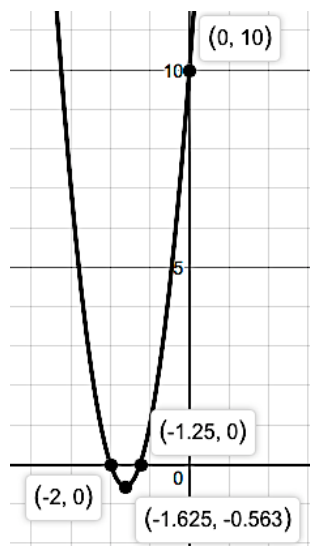-10　0　10

Factors:

X-intercept(s):

Y-intercept(s):

What do you notice about the factors and the x-int's?

Vertex:

What do you notice about standard form and the y-int?

4. Write in factored form.
   $$k(x) = 4x^2 + 13x + 10$$

(0, 10)

10

5

(-1.25, 0)

0

(-2, 0)

(-1.625, -0.563)

Factors:
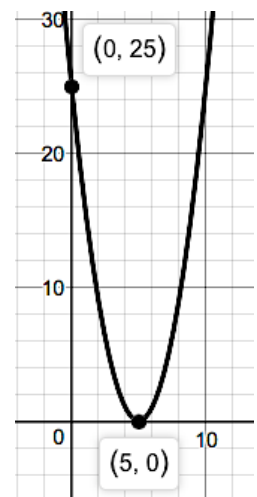
X-intercept(s):

Y-intercept(s):

What do you notice about the factors and the x-int's?

Vertex:

What do you notice about standard form and the y-int?

5. Write in factored form.
   $$m(x) = x^2 - 10x + 25$$

30

(0, 25)

20

10

0　10
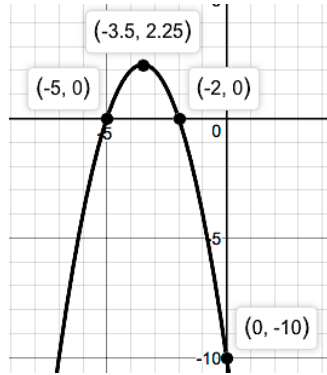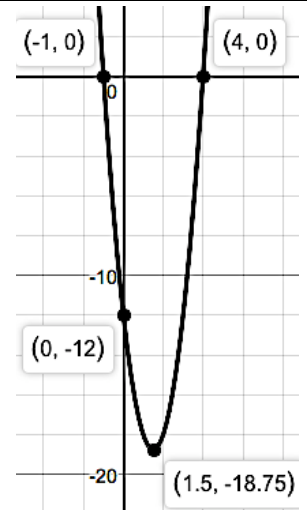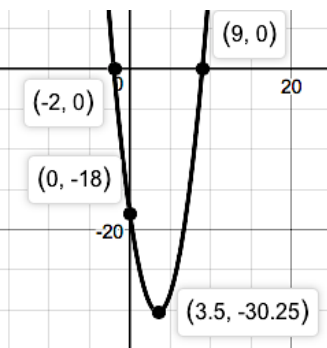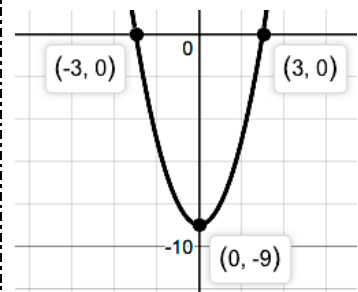
(5, 0)

Factors:

X-intercept(s):

Y-intercept(s):

Vertex:

What do you notice about the factors and the x-int's?

What do you notice about standard form and the y-int?

6. Write in factored form.
$n(x) = -x^2 - 7x - 10$

(-3.5, 2.25)
(-5, 0)   (-2, 0)
0
5
(0, -10)
-10

Factors:

X-intercept(s):

What do you notice about the factors and the x-int's?   Y-intercept(s):

Vertex:

What do you notice about standard form and the y-int?

7. Write in factored form.
$p(x) = 3x^2 - 9x - 12$

(-1, 0)   (4, 0)
0
-10
(0, -12)
-20   (1.5, -18.75)

Factors:

What do you notice about the factors and the x-int's?   X-intercept(s):

Y-intercept(s):

What do you notice about standard form and the y-int?   Vertex:

8. Write in factored form.
$q(x) = x^2 - 7x - 18$

(9, 0)
20
(-2, 0)
(0, -18)
-20
(3.5, -30.25)

Factors:

X-intercept(s):

Y-intercept(s):

What do you notice about the factors and the x-int's?   Vertex:

What do you notice about standard form and the y-int?

9. Write in factored form.
$r(x) = x^2 - 9$
*Use Difference of Squares, OR
Think of it as:*
$r(x) = x^2 + 0x - 9$

0
(-3, 0)   (3, 0)
-10   (0, -9)

Factors:

X-intercept(s):

Y-intercept(s):

Vertex:

What do you notice about the factors and the x-int's?

What do you notice about standard form and the y-int?

10.

X-intercept(s):

Y-intercept(s):

Vertex:

(4, 0)
0
(-1, 0)   5
(0, -4)
-5
(1.5, -6.25)
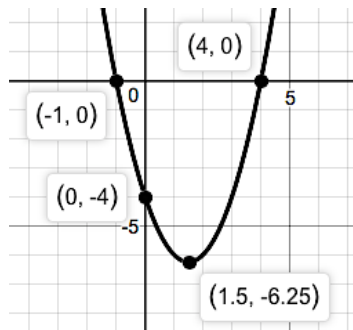
Using the patterns you noticed above,
what would you guess that the factors are?