

# Math-3A

Lesson 2-3  
Factoring Quadratics with Lead  
Coefficient Not = 1,  
Complex Conjugates

Factor the quadratic expressions.

$$3x^3 + 15x^2 - 42x$$

$$5x^3 - 25x^2 - 20x$$

What if there is no common factor AND the lead coefficient is NOT equal to 1?  $(a)x^2 + bx + c$

(These come from multiplying binomials that also do not have lead coefficients of 1.)  $(2x + 1)(x + 3)$

Use the "box method" to multiply the binomials

$$2x^2 + 7x + 3$$

	x	3
2x	2x <sup>2</sup>	6x
1	x	3

Notice a nice pattern when you multiply this out ("simplify")

$$(2x + 1)(x + 3)$$

"right plus right" does not add up to 7, but notice something.

$$2x^2 + 7x + 3$$

Left times left is left

Right times right is right

$$(2x + 1)(x + 3)$$

$$6x$$

$$x$$

$$6x + x = 7x$$

$$2x^2 + 7x + 3$$

$$1 + 6 = 7$$

$$6 = 1 * 6$$

$2 * 3 = 6$   
Are there any other factors of 6 that add up to 7?

$$2 * 15 = 30$$

$$2x^2 + 13x + 15$$

$$10 + 3 = 13$$

$30 = 10 * 3$   
Are there any other factors of 30 that add up to 13?

This tells us to break 13x into 10x + 3x

$$2x^2 + 13x + 15$$

$$2x^2 + 10x + 3x + 15$$

These are all of the terms in "the box"

	x	5
2x	2x <sup>2</sup>	10x
3	3x	15

What is the bottom-left term in the box?

$$x * (3) = 3x$$

What is the top-right term in the box?

$$2x * (5) = 10x$$

Final check:  $3 * 5 = 15$

Factored form:

$$2x^2 + 13x + 15$$

$$\rightarrow (2x + 3)(x + 5)$$

$4 * 10 = 40$  These are all of the terms in "the box"

	$4x$	$5$
$x$	$4x^2$	$5x$
$2$	$8x$	$10$

$4x^2 + 13x + 10$   
 $8 + 5 = 13$  Other factors of 40 that add up to 13?  
 $40 = 8 * 5$  Since  $4x^2$  can be factored 2 ways, look for the common factors of the 1<sup>st</sup> row.  
 This tells us to break  $13x$  into  $8x + 5x$  'x' is the common factor of  $4x^2$  and  $5x$   
 $4x^2 + 13x + 10$  Look for the common factors of the 1<sup>st</sup> column  
 $4x^2 + 8x + 5x + 10$  '4x' is the common factor of  $4x^2$  and  $8x$   
 Factored form:  $4x^2 + 13x + 10$   
 $\rightarrow (x + 2)(4x + 5)$

$4x^*(\underline{2}) = 8x$   
 $x*(\underline{5}) = 5x$   
 Final check:  $2*5 = 10$ ?

$3 * 8 = 24$  These are all of the terms in "the box"

	$x$	$4$
$3x$	$3x^2$	$12x$
$2$	$2x$	$8$

$3x^2 + 14x + 8$   
 $2 + 12 = 14$  Other factors of 24 that add up to 14?  
 $24 = 2 * 12$  What is the bottom-left term in the box?  
 $x*(\underline{2}) = 2x$   
 This tells us to break  $14x$  into  $2x + 12x$  What is the top-right term in the box?  
 $3x^2 + 14x + 8$   $3x*(\underline{4}) = 12x$   
 $3x^2 + 2x + 12x + 8$  Final check:  $2*4 = 8$ ?  
 Factored form:  
 $3x^2 + 14x + 8$   
 $\rightarrow (3x + 2)(x + 4)$

Factor

<p><math>5 * 4 = \underline{\quad}</math></p> <p><math>5x^2 + 12x + 4</math></p> <table border="1" style="width: 100%; height: 40px;"> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table> <p><math>\underline{\quad} * \underline{\quad} = \underline{\quad}</math></p> <p><math>\underline{\quad} + \underline{\quad} = 12</math></p>										<p><math>11 * (-9) = \underline{\quad}</math></p> <p><math>11x^2 + 2x - 9</math></p> <table border="1" style="width: 100%; height: 40px;"> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table> <p><math>\underline{\quad} * \underline{\quad} = \underline{\quad}</math></p> <p><math>\underline{\quad} + \underline{\quad} = 2</math></p>									

Factor

<p><math>9 * 10 = \underline{\quad}</math></p> <p><math>9x^2 - 13x - 10</math></p> <table border="1" style="width: 100%; height: 40px;"> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table> <p><math>\underline{\quad} * \underline{\quad} = \underline{\quad}</math></p> <p><math>\underline{\quad} + \underline{\quad} = -13</math></p>										<p><math>12 * 5 = \underline{\quad}</math></p> <p><math>12x^2 - 16x + 5</math></p> <table border="1" style="width: 100%; height: 40px;"> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table> <p><math>\underline{\quad} * \underline{\quad} = \underline{\quad}</math></p> <p><math>\underline{\quad} + \underline{\quad} = -16</math></p>									

Factor

_	*	_	=	_
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$$6x^2 - 5x - 6$$


_	*	_	=	_
---	---	---	---	---

_	+	_	=	_
---	---	---	---	---

_	*	_	=	_
---	---	---	---	---

$$8x^2 - 2x - 3$$


_	*	_	=	_
---	---	---	---	---

_	+	_	=	_
---	---	---	---	---

Factor

_	*	_	=	_
---	---	---	---	---

$$7x^2 - 12x - 4$$


_	*	_	=	_
---	---	---	---	---

_	+	_	=	_
---	---	---	---	---

_	*	_	=	_
---	---	---	---	---

$$6x^2 - 29x + 9$$


_	*	_	=	_
---	---	---	---	---

_	+	_	=	_
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