NC Concepts: #19 (& Math 9 Review)

Factoring Day 1

FP10.5A: Students will demonstrate understanding of multiplication of monomials, binomials and trinomials, concretely, pictorially and symbolically.

Online Video Lessons:

https://goo.gl/4g26Qc https://goo.gl/dT3h0G https://goo.gl/3eogzs

In this section, we will review what a Polynomial is and learn to Factor a polynomial using Algebra Tiles and Factor Trees.

Polynomials

➡ a sum of monomials

➡ $x + 5$, $2a^2 - 6ab + 18b^2$

A Polynomial is an algebraic expression that is made up of terms that are added or subtracted together. Each term can have all or some of the following:

- A letter or more than one letter. A letter in math is called a Variable.
- The Variable(s) may have an exponent (a small number above and to the right of the variable. If you don't actually see an exponent with the variable, there is always an exponent of "1" that is assumed to be there.
- A number. A number in front of a variable is called a Coefficient. A number by itself is called a Constant.
- The Degree of a polynomial is given by the largest exponent of the variable. A polynomial that contains the highest power being an x^2 will have a Degree of 2. If it has an x as the highest power it has a Degree of 1. If it contains no variables the Degree is considered to be 0.

The terms in a polynomial are separated by the plus or minus signs. A polynomial with one term is called a Monomial. A polynomial with two terms is called a Binomial. A polynomial with three terms is called a trinomial.

Polynomial Examples: $4x + 6$ $-6x^2 + 8x - 1$ $3x$ -5 $5x^2 - 1$

Polynomial Non-Examples: $\sqrt{x+6}$ $\frac{5}{x+6}$ $\frac{6}{x^2} - 8$

The terms of a polynomial can be represented by using Algebra Tiles.

x^2 x 1 $-x^2$ $-x$ -1

These are what each tile represents

Note: The x can be ANY letter!

Example #1: Represent the following polynomials using algebra tiles.

a) $5x^2 - 3x + 2$ b) $-2x^2 + 7$

Example #2: Simplify the following expression by combining like terms.

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

Example #3: What does 4(3x) look like using algebra tiles?

Example #4:

Use any strategy or materials you wish to determine each product.

a) $2(3x)$ b) $3(2x + 1)$ c) $2(2x^2 + x + 4)$

d) $-2(3x)$ e) $-3(2x + 1)$ f) $-2(2x^2 + x + 4)$

Example #5: What does (2x)(4x) look like using algebra tiles?

Example #6:

Determine each product.

Use a strategy of your choice.

a) $2a(5a)$ b) $4b(3b - 2)$ c) $-3c(-5c + 1)$

Another way to think about it....

Recall:
Exponent Law - What do you do when you are multiplying same bases?
ie. $a^3 \times a^4$

You ADD exponents!

So, $5x(3x)$ is the same as $5x^1(3x^1)$ so you multiply 5 and 3 (the coefficients) and add the exponents on the variables to get $15x^2$

Try:

a) $5m(-2m - 3)$ b) $-5x^2y(2x + 3y)$ c) $3m^2n^3p^2(-5m^2n + 2mp^3 - 4n^2p^6)$

Example #8: Multiply the following using algebra tiles:

a) $(c + 4)(c + 2)$ b) $(c + 4)(c + 4)$

Example #9: Multiply the following without using algebra tiles:

a) $(a + 3)(a - 6)$ b) $(3c + 4)(c + 5)$

Example #10: Expand and simplify

a) (8 - b)(3 - b) b) (3d + 4)(4d + 2) d) (-2g + 8)(7 - 3g)

CALCULATORS NOT ALLOWED!!! Label this assignment properly!

Factoring Day 1 *FA (Foundational Assign)
Practice #3 1odd, 2a, 3, 4
Page 187 #16, 17

Factoring Day 1 ULA (Upper Level Assign)
NOTE: Do Practice 1 & 2 If needed

NC Factor Day 1 Assign. for Concept #19

Practice #1 Multiplying Polynomials

1. Simplify

a) 5(x + 3) b) 2(m + 5) c) -3(n + 1) d) 6(x – 5) e) 3(m – 2)
f) -2(c – 3) g) 5(x + y + 3) h) 2(m + n + 5) i) -3(c + d + 2) j) 4(e – f – 3)
k) 2(m – n + 2) l) -5(x + y – 4) m) 3(3x + 4) n) 2(4m – 6) o) -5(2x – 3)
p) 5(2x – 3y + 2) q) 6(3x + 2y – 5) r) -2(4m – n + 3)

Practice #2 Multiplying Polynomials

1. Simplify

a) 2x(x + 5) b) 3m(m – 2) c) 4y(y + 2) d) 3x(2x + 4) e) 5c(2c – 3)
f) 3x(5x – 2) g) -2n(4n – 5) h) -3m(2m + 5) i) -5x(3x – 2) j) -3x(-2x + 5)
k) 4x(-2x – 3) l) -6n(4n + 6) m) 3b(4b + 5c – 2) n) 2h(3h – 5j + 7)
o) 7x(-2x + 5y – 7) p) 5xy(3x + 2y – 7) q) -2mn(3m – 5n + 7) r) 3gh(-5h + 2g – 5)
s) $3x^2y^3(2x + 5y)$ t) $4m^2n^7(3m^2 + 5n^2)$ u) $-3h^2j^7(3hj^2 + 2h – 4j^6)$ v) $-2a^3b^6c^2(4ab + 4b^2c^5 – 2a^7c^2)$

Practice #3 Multiplying Polynomials

1. Multiply

a) (x – 2)(x + 3) b) (x – 5)(x – 2) c) (x + 4)(x + 7) d)(3x – 4)(2x – 1)
e) (2x – 5)(x – 3) f) (x + 1)(x – 2) g) (x – 3)(x – 4) h) (x + 4)(x – 3)
i) (2v + 3)(v + 2) j) (3r + 1)(r + 4) k) (2g + 3)(3g + 2) l) (3t + 4)(3t + 4)
m) (2g – 5)(3g – 3) n) (12 + h)(7 – h) o) (11 – j)(2 – j) p) (3 + m)(5 – m)
q) (-4 – 2h)(-2 – 4h) r) (-m + 5)(4m – 1) s)(5- r)(6 + r) t) (-y + 1)(-3y – 1)

2. Model the following (use algebra tiles or area model)

a) (x + 2)(x + 3) b) (2x + 5)(3x + 1)

3. Find and correct the errors in each expansion

a) $(r – 13)(r + 4) = R^2 + 4r – 13r + 52$
$= R^2 + 9r + 52$

b) $(s – 15)(s – 5) = S^2 – 15s + 15s + 75$
$= S^2 + 75$

c) $(p + 3)(p + 7) = p^2 + 7p + 3p + 21$
$P^2 + 10p + 21$
$11p^2 + 21$

4. Explain the relationship between the multiplication of two binomial expressions and the area of a rectangular region.

Factoring Day 2

NC Concepts: #20

FP 10.5A: Students will demonstrate understanding of multiplication of monomials, binomials and trinomials, concretely, pictorially and symbolically.

Online Video Lessons: **https://goo.gl/1UWFQd** **&** **https://goo.gl/ngAu56**

The *distributive property* can be used to perform any polynomial multiplication. Each term of one polynomial must be multiplied by each term of the other polynomial.

Example #1: Using the Distributive Property to Multiply Two Polynomials

Expand and simplify

a) $(2h + 5)(h^2 + 3h - 4)$

b) $(-3f^2 + 3f - 2)(4f^2 - f - 6)$

Example #2: Multiplying Polynomials in More Than One Variable

Expand and Simplify

a) $(2r + 5t)^2$

b) $(3x - 2y)(4x - 3y + 5)$

Example #3: Expand and Simplify

a) $(x + 5)^3$

b) $(2x – 3)^3$

Example #3: Simplify

a) $(5a - 8) - (2a + 3)$

b) $(3a^2 - 2a + 6) - (-2a^2 + 7a - 9)$

Example #4: Simplifying Sums and Differences of Polynomial Products

Expand and Simplify

a) $(2c - 3)(c + 5) + (c - 3)(-3c + 1)$

b) $(3x - 1)(2x - 4) - (3x + 2)^2$

c) $2b(2b - c)(b + c)$

CALCULATORS NOT ALLOWED!!! Label this assignment properly!

Factoring Day 2 *FA (Foundational Assign)
Practice #4 (on next page) 1even, 2, 3
Practice #5 (on next page) 1odd, 2, 3
Page 187 #16, 17

Factoring Day 2 ULA (Upper Level Assign)
Page 187 # 18c, 20, 21ad

NC Factor Day 2 Assign. for Concept #20

Practice #4 Multiplying Polynomials

1. Simplify

a)	$(c + 1)(c^2 + 3c + 2)$	b)	$(2y + 11)(j^2 + 3j + 1)$
c)	$(2x – 3)(3x^2 + 7x + 2)$	d)	$(5 – 4r)(6 + 3r – 2r^2)$
e)	$(4m – p)^2$	f)	$(3g – 4h)(2g + 3h)$
g)	$(y – 2z)(y + z – 2)$	h)	$(x – 3)(6x^2 – 4x – 12)$
i)	$(2y^2 + 3y – 1)(y^2 + 4y + 5)$	j)	$(4s^2 + s)(3s^2 – 2s + 6)$

2. The product of 45 and 34 can be thought of as (40 + 5)(30 + 4). You can represent 40 + 5 as 4t + 5 where t represents 10.
   a) What expression could represent 30 + 4?
   b) Use binomial multiplication of the algebraic expression. Substitute to find the product of 45 and 34.

3. Rachel's solution to the multiplication of a binomial and a trinomial is shown below.

$$(4x – 1)(2x^2 + 11x – 7) = 8x^3 + 44x – 24x – 2x^2 – 11x + 6$$
$$= 6x^2 – 9x + 6$$

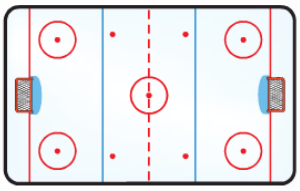
   a) Check Rachel's solution for x = 2
   b) Does Rachel have a correct solution? If not, identify her error and provide the correct product in simplified form.

Practice #5 Multiplying Polynomials

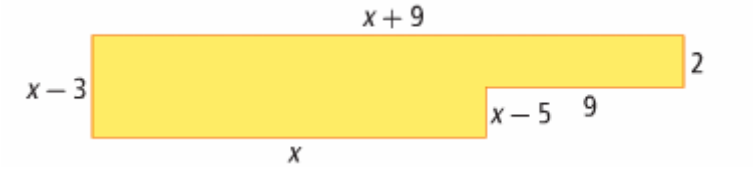
1. Expand and Simplify

a)	$(3x + 5)(2x + 2) + (3x + 7)(x + 6)$	b)	$(2x + 3)(5x + 4) + (x – 4)(3x – 7)$
b)	$(4y – 5)(3y + 2) – (3y + 2)(4y – 5)$	d)	$(3x – 2)^2 – (2x + 6)(3x – 1)$
e)	$2a(2a – 1)(3a + 2)$	f)	$-3r(r – 1)(2r + 1)$
g)	$5x^2(2x – 1)(4x – 3)$	h)	$-xy(2x + 5)(4x – 5)$
j)	$(x + 6)^3$	k)	$(3x – 1)^3$

2. The length of the ice surface of a hockey rink is represented by 5x + 25. The width is represented by 2x + 10. What expression represents the area of the ice surface?



3. Write an expression to represent the area of the figure. Simplify.



Factoring Day 3: The Window Method

NC Concepts: #21

FP 10.5B **Students will demonstrate understanding of factoring concretely, pictorially and symbolically**

ACTIVITY:

Complete the handout activity using algebra tiles.

1. a) Go and get a bag of algebra tiles
   b) Gather in a group the correct tiles that together will represent the expression $x^2 + 2x + 1$
   c) Rearrange the tiles you have found into a **rectangle** (draw below)

   d) What is the expression for the length and width of your rectangle?
   Length=_____ Width=_____

   e) What is the expression for the area of the rectangle?
   Area:

2. Repeat the above process for $x^2 + 5x + 4$

3. Repeat the above process for $2x^2 + 7x + 6$

Online Video Lessons: https://goo.gl/qYLBUu

$(2x + 3)(x + 1)$ ⟸ FACTORS

$2x^2 + 5x + 3$ ⟸ EXPANDED FORM

Factoring and expanding are inverse process

How did we use factors earlier this year?

Factoring and multiplying are inverse processes. We can use this to factor a trinomial.

When a trinomial contains only positive terms, we may use algebra tiles to factor it.

We say that the factors of $v^2 + 12v + 20$ are $v + 2$ and $v + 10$

The Box Method for factoring

This method will work for all types of factoring in this course EXCEPT those that require GCF. Although it will work for all types, it may not be the most efficient method.

NOTE: There are two different ways of factoring that are called the box method. We will try and refer to the method I am teaching you as "The Window Method" to help avoid confusion.

Example #1:

a) $x^2 - 2x - 8$

b) $z^2 - 12z + 35$

c) $-24 - 5d + d^2$

d) $m^2 - 7m - 60$

CALCULATORS NOT ALLOWED!!! Label this assignment properly!

Factoring Day 3 *FA (Foundational Assign)
Practice #6 1, 2, 3

Factoring Day 3 ULA (Upper Level Assign)
Textbook P167 #19abcd, 20ace

NC Factor Day 3 Assign. for Concept #21

Practice #6 Factoring Polynomials

1. Factor the following. You may use algebra tiles to assist you if necessary.

a)	$v^2 + 2v + 1$	b)	$v^2 + 4v + 4$	c)	$x^2 + 6x + 9$
d)	$x^2 + 8x + 16$	e)	$m^2 + 13m + 40$	f)	$y^2 + 12y + 27$

2. Factor the following.

a)	$x^2 + 19x – 20$	b)	$x^2 + 15x – 54$	c)	$x^2 + 12x – 28$
d)	$n^2 – 5n – 24$	e)	$a^2 – a – 20$	f)	$y^2 – 2y – 48$
g)	$a^2 + a – 20$	h)	$y^2 + 2y – 48$	i)	$m^2 – 15m + 50$
j)	$a^2 – 12a + 36$	k)	$12 + 13k + k^2$	l)	$-16 – 6g + g^2$
m)	$60 + 17y + y^2$	n)	$-72 – z + z^2$	o)	$m^2 – 7m – 60$
p)	$w^2 – 14w + 45$	q)	$b^2 + 9b – 36$	r)	$h^2 – 10h – 24$

3. Can you find a pattern that would lead to a more efficient/quicker way to factor these?
4. Factor and then verify

a)	$q^2 + 6q + 8$	b)	$n^2 – 4n – 45$	c)	$k^2 – 9k – 90$

TEXTBOOK: P167 19abcd, 20ace

Did anyone find a more efficient/quicker way to factor the previous trinomials? Can you use this explanation to show how the following questions can be quickly factored?

$x^2+8x+12$	$x^2+7x+10$	$x^2+8x+15$
= (x + 6)(x + 2)	= (x + 5)(x + 2)	(x + 5)(x + 3)
q^2+6q+8	$m^2+7m+12$	$r^2+13m+12$
= (q + 4)(q + 2)	= (m + 3)(m + 4)	= (r + 12)(r + 1)

Factoring Day 4: The Window Method Part 2

NC Concepts: #22

FP 10.5B **Students will demonstrate understanding of factoring concretely, pictorially and symbolically**

Online Video Lessons: **https://goo.gl/XzatNv** **&** **https://goo.gl/tPvfx4**

More of the Box Method!

Example #1: Factor:

a) $4h^2 + 20h + 9$

b) $6k^2 - 11k - 35$

c) $4g^2 + 11g + 6$

d) $6m^2 - 7m - 10$

Example #2:

a) Evaluate $3x^2 - 14x + 15$ when $x = 2$

b) Factor $3x^2 - 14x + 15$

Example #3: Factor

a) $x^2 - 25$

b) $4x^2 - 49$

c) $25x^2 - 16$

d) $9m^2 - 100n^2$

Can you find an easier way to factor the above "DIFFERENCE OF SQUARES" questions? What criteria must be present in order for this method to work?

Example #4: Use your new method to factor the following. If you can't factor them – explain why.

a) $36x^2 - 25y^2$

b) $x^2 + 81$

c) $x^2 - 0.25$

d) $\frac{4}{9}x^2 - 25$

e) $1.21x^2 - 0.36$

f) $\frac{x^2}{16} - \frac{y^2}{49}$

g) $-100 + r^2$

h) $81a^4 - 16b^4$

i) $49a^2b^2 - 1$

j) How about this one? $x^2 - 7$

CALCULATORS NOT ALLOWED!!! Label this assignment properly!

Factoring Day 4 *FA (Foundational Assign)
Practice #7 1
Practice #8 1
Practice #9 1

Factoring Day 4 ULA (Upper Level Assign)
Practice #7 2, 3
Practice #8 2, 3, 4
Practice #9 2, 3
TEXTBOOK: Page 178 20ace, 23
Page 195 14, 15, 18, 20a

NC Factor Day 4 Assign. for Concept #22

Practice #7 Factoring Polynomials

1. Factor the following

a)	$3m^2 + 4m + 1$	b)	$2n^2 + 13n + 6$	c)	$2y^2 + 5y + 2$
b)	$2a^2 + 11a + 12$	e)	$2m^2 – 11m + 12$	f)	$5a^2 – 7a – 6$
g)	$5s^2 + 19s – 4$	h)	$14c^2 – 19c – 3$	i)	$8a^2 + 18a – 5$
j)	$8r^2 – 14r + 3$	k)	$6d^2 + d – 5$	l)	$15e^2 – 7e – 2$
m)	$14y^2 – 13y + 3$	n)	$10p^2 – 17p – 6$	o)	$10r^2 – 33r – 7$

2. Find and correct the errors in each factorization
   a) $6u^2 + 17u – 14 = (2u – 7)(3u + 2)$
   b) $3k^2 – k – 30 = (3k – 3)(k + 10)$
   c) $4v^2 – 21v + 20 = (4v – 4)(v + 5)$

3. a) Evaluate $12x^2 – 17x – 5$ when $x = 3$
   b) Factor $12x^2 – 17x – 5$
   c) If we evaluate the factored form of $12x^2 – 17x – 5$ when $x = 3$, what do you think the answer will be? Explain why and prove your answer.

Practice #8 Factoring Polynomials

1. Factor

a)	$81m^2 – 49$	b)	$25m^2 – 36$	c)	$t^2 – 25$
d)	$x^2 – 49$	e)	$q^2 – 1$	f)	$c^2 – 36$
g)	$b^2 – 121$	h)	$9d^2 – 16f^2$	i)	$144a^2 – 9b^2$
j)	$81k^2 – 49m^2$	k)	$v^2 – 36t^2$	l)	$4j^2 – 225h^2$
m)	$100y^2 – 81z^2$	n)	$121m^2 – n^2$	o)	$25m^2 – 64n^2$

2. Do you see any patterns that would lead you to a more efficient/quicker method for factoring these types?

3. Factor and verify
   a) $16v^2 – 49$ b) $x^2 – 9$

4. Explain how difference of squares can be factored using trinomial factoring strategies.

Practice #9 Factoring Polynomials

1. Factor the following. You can use the box method or a more efficient method if you recognize the polynomial.

a)	$4k^2 - 7k + 3$	b)	$4b^2 - 5b - 6$	c)	$4b^2 - 81$
d)	$9g^2 - 16h^2$	e)	$f^2 + 17f + 16$	f)	$c^2 - 13c + 22$
g)	$g^2 + 6gh + 9h^2$	h)	$16j^2 - 24jk + 9k^2$	i)	$6x^2 - 13x - 5$
j)	$m^2 - 14m + 49$	k)	$n^2 + 10m + 25$	l)	$6a^2 - 31a + 5$
m)	$x^2 + 4x + 1$	n)	$4k^2 - 7k + 3$	o)	$f^2 + 17f + 16$
p)	$6x^2 - 17xy + 5y^2$	q)	$h^2 - 25j^2$	r)	$16r^2 + 8rt + t^2$

2. Factor and verify

a) $m^2 - 14m + 49$ b) $4p^2 + 12p + 9$

3. Critique the statement "any trinomial can be factored into two binomial factors"

Factoring Day 5: Greatest Common Factor

NC Concept: #23

FP 10.5B **Students will demonstrate understanding of factoring concretely, pictorially and symbolically**

Online Video Lessons: https://goo.gl/5B0akL

GREATEST COMMON FACTOR:

- the largest factor shared by two or more terms
- for example, the GCF of 12 and 28 is 4

Review Example #1: Identify the greatest common factor of each pair.

a) 25 and 40

b) 16, 24 and 36

c) 8^4 and 8^7

d) x^5 and x^8

e) $12x^4$ and $8x^3$

f) $72m^3$ and $48m^5$

Example #2:

Factor out the GCF from a polynomial by dividing each term by the GCF. Then, the polynomial can be written in a simpler form to solve more complex problems.

Factor

a) $16x^2y + 24x^2y^3$

b) $7a^2b - 28ab + 14ab^2$

c) $8x + 24$

d) $15a^2b - 18ab$

e) $-16x^2y^2 + 24x^3y^3$

f) $12cd^2 - 8cd - 20c^3d$

CALCULATORS NOT ALLOWED!!! Label this assignment properly!

Factoring Day 5 *FA (Foundational Assign)
Practice #10 1-4

Factoring Day 5 ULA (Upper Level Assign)
TEXTBOOK: Page 156 17, 18, 20, 21

NC Factor Day 5 Assign. for Concept #23

Practice #10 Factoring Polynomials

1. Factor the following:

a)	$15n - 6$	b)	$5y + 10$	c)	$9k + 6$
d)	$6 + 12x^2$	e)	$4m^2 + 14m$	f)	$3h + 7h^2$
g)	$9m^2 - 12m^3$	h)	$48x^2 - 24$	i)	$-a^2 - a^3$
j)	$3x^2 + 6x^4$	k)	$8y^3 - 12y$	l)	$-7d - 14d^4$
m)	$3x^2 + 12x - 6$	n)	$4 - 6y - 8y^2$	o)	$-7m - 7m^2 - 14$
p)	$10n - 6 - 12n^2$	q)	$6v^4 + 7v - 8v^3$	r)	$24x + 30x^3 - 12x^4$
s)	$25xy + 15x^2 - 30x^2y^2$	t)	$9a^4b^2 - 6a^3b^5 + 12a^2b^6$		
u)	$10a^3b^2 + 12a^5b^3 - 5a^2b^2$	v)	$7r^3s^2 + 14r^2s^2 - 21rs^2$		

2. Here are a student's solutions for factoring polynomials. Identify the errors in each solution. Write a correct solution.
   a) Factor: $3m^2 + 9m^3 – 3m$
      Solution: $3m(m + 3m^2)$
   b) Factor: $-16 + 8n – 4n^3$
      Solution: $-4(4 + 2n + n^2)$
3. Factor the following:
   a) 32 + 20 b) 48 + 36 c) 18 + 45
4. Can every binomial be factored? Explain.

Factoring Day 6: Putting it All Together

NC Concept: #23

FP 10.5B **Students will demonstrate understanding of factoring concretely, pictorially and symbolically**

Online Video Lessons: **https://goo.gl/9I9V1g** **https://goo.gl/k5KaFk**

Example #1:

Factor $20r^2 + 70r + 60$

Example #2:

Factor $-5h^2 - 20h + 60$

Example #3:

Factor $x^2 + 5x + 1$

Example #4:

Factor $4m^2 - 16n^2$

Example #5:

Factor $x^4 - 81y^4$

The box/window method is only one strategy that works for factoring trinomials and difference of squares. There are other strategies: decomposition, logical reasoning, algebra tiles.

CALCULATORS NOT ALLOWED!!! Label this assignment properly!

Factoring Day 6 *FA (Foundational Assign)
Practice #11 1,2
Practice #12 1,2
Textbook: P 195 #13
P 167 #21

Factoring Day 6 ULA (Upper Level Assign)
Practice #12 3, 4
Textbook: P 195 #19

NC Factor Day 6 Assign. for Concept #23

Practice #11 Factoring Polynomials

1. Factor completely

a) $15a^2 - 65a + 20$
b) $18h^2 + 15h - 18$
c) $12m^2 - 52m - 40$
d) $24g^2 - 2g - 70$
e) $4x^2 + 4x - 48$
f) $-5n^2 + 40n - 35$
g) $-3m^2 - 18m - 24$
h) $10x^2 + 80x + 120$
i) $7x^2 - 35x + 42$
j) $18m^2 - 2n^2$
k) $16x^4 - m^8$
l) $x^8 - y^8$
m) $16m^8 - 81$
n) $2m^4 - 8n^8$

2. Explain why it is important to look for common factors first when factoring a trinomial.

Math 10 Practice #12 – Factoring Polynomials

1. Factor fully . Use the strategy that you prefer.

a)	$9k + 6$	b)	$3x^2 - 6x^4$	c)	$-3c^2 - 13c^4 - 12c^3$
d)	$x^2 + 12x - 28$	e)	$y^2 - 2y - 48$	f)	$8a^2 + 18a - 5$
g)	$15a^2 - 65a + 20$	h)	$s^2 + 11s + 30$	i)	$2x^2 + 14x + 6$
j)	$3x^2 + 15x - 42$	k)	$15a^3 - 3a^2b - 6ab^2$	l)	$w^2 + 10w - 24$
m)	$3c^2d - 10cd - 2d$	n)	$f^2 + 17f + 16$	o)	$4t^2 + 9t - 28$
p)	$h^2 - 25j^2$	q)	$6x^2 - 17xy + 5y^2$	r)	$28a^2 - 7a^3$
s)	$25t^2 + 20tu + 4u^2$	t)	$3x^2 - 3x - 60$	u)	$18m^2 - 2n^2$

2. Factor and verify

a)	$c^2 - 13c + 22$	b)	$4t^2 + 9t - 28$	c)	$h^2 - 25j^2$

3. Explain, using examples, how the processes of factoring and multiplication are related.
4. Which strategies can you use to factor a trinomial? Give an example of when you might use each strategy to factor a trinomial.

Practice Answers

Practice #1

1a) $5x + 15$	b) $2m + 10$	c) $-3n - 3$	d) $6x - 30$	e) $3m - 6$
f) $-2c + 6$	g) $5x + 5y + 15$	h) $2m + 2n + 10$	i) $-3c - 3d - 6$	j) $4e - 4f - 12$
k) $2m - 2n + 4$	l) $-5x - 5y + 20$	m) $9x + 12$	n) $8m - 12$	o) $-10 + 15$
p) $10x - 15y + 10$	q) $18x + 12y - 30$	r) $-8m + 2n - 6$		

Practice #2

1a) $2x^2 + 10x$	b) $3m^2 - 6m$	c) $4y^2 + 8y$	d) $6x^2 + 12x$	e) $10c^2 - 15c$
f) $15x^2 - 6x$	g) $-8n^2 + 10n$	h) $-6m^2 - 15m$	i) $-15x^2 + 10x$	j) $6x^2 - 15x$
k) $-8x^2 - 12x$	l) $-24n^2 - 36n$	m) $12b^2 + 15bc - 6b$	n) $6h^2 - 10hj + 14h$	o) $-14x^2 + 35xy - 49x$
p) $15x^2y + 10xy^2 - 35xy$	q) $-6m^2n + 10mn^2 - 14mn$	r) $-15gh^2 + 6g^2h - 15gh$		
s) $6x^3y^3 + 15x^2y^4$	t) $12m^4n^7 + 20m^2n^9$	u) $-9h^3j^9 - 6h^3j^7 + 12h^2j^{13}$		
v) $-8a^4b^7c^2 - 8a^3b^8c^2 + 4a^{10}b^6c^4$				

Practice #3

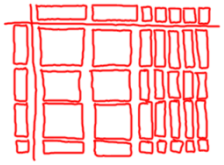
1a) $x^2 + x - 6$	b) $x^2 - 7x + 10$	c) $x^2 + 11x + 28$	d) $6x^2 - 11x + 4$	e) $2x^2 - 11x + 15$
f) $x^2 - x - 2$	g) $x^2 - 7x + 12$	h) $x^2 + x - 12$	i) $2v^2 + 7v + 6$	j) $3r^2 + 13r + 4$
k) $6g^2 + 13g + 6$	l) $9t^2 + 24t + 16$	m) $6g^2 - 21g + 15$	n) $84 - 5h - h^2$	o) $22 - 13j + j^2$
p) $15 + 2m - m^2$	q) $8 + 20h + 8h^2$	r) $-4m^2 + 21m - 5$	s) $30 - r - r^2$	t) $3y^2 - 2y - 1$

2a $(x + 2)(x + 3) = x^2 + 5x + 6$

Or

	x	2
x	x^2	2x
3	3x	6

b) $(2x + 5)(3x + 1) = 6x^2 + 17x + 5$



or

	2x	5
3x	$6x^2$	15x
1	2x	5

3a) first step, 52 should be -52; second step, $4r - 13r$ is not 9r, it is -9r; final answer should be $r^2 - 9r - 52$

b) first step should be $s^2 - 15s - 5s + 75$;
final step should be $s^2 - 20s + 75$

c) answer is the second step; third step is eliminated

4. various answers

Practice #4

1a) $c^3 + 4c^2 + 5c + 2$ b) $2j^2y + 6jy + 2y + 11j^2 + 33j + 11$ c) $6x^3 + 5x^2 – 17x – 6$
d) $8r^3 – 22r^2 – 9r + 30$ e) $16m^2 – 8mp + p^2$ f) $6g^2 + gh – 12h^2$
g) $y^2 – yz – 2y – 2z^2 + 4z$ h) $6x^3 – 22x^2 +36$ i) $2y^4 + 11y^3 + 21y^2 + 11y – 5$
j) $12s^4 – 5s^3 + 22s^2 + 6s$

2a) $3t + 4$ b) 1530

3a) $161 \neq 12$ b) $4x(11x) = 44x^2$ not $44x$;
$4x(-7) = -28x$ not $-24x$;
$(-1)(-7) = 7$ not 6
Correct: $8x^3 + 42x^2 – 39x + 7$

Practice #5

1a) $9x^2 + 41x + 52$ b) $13x^2 + 4x + 40$ c) 0 d) $3x^2 – 28x + 10$
e) $12a^3 + 2a^2 – 4a$ f) $-6r^3 + 3r^2 + 3r$ g) $40x^4 – 50x^3 + 15x^2$ h) $-8x^3y – 10x^2y + 25xy$
2) $10x^2 + 100x + 250$ 3) $x(x – 3) + 2(9)$; $x^2 – 3x + 18$

Practice #6

1a) $(v + 1)^2$ b) $(v + 2)^2$ c) $(v + 3)^2$ d) $(x + 4)^2$ e)$(m + 8)(m + 5)$ f) $(y + 9)(y + 3)$
2a) $(x + 20)(x – 1)$ b) $(x + 18)(x – 3)$ c) $(x + 14)(x – 2)$ d) $(n – 8)(n + 3)$
e) $(a – 5)(a + 4)$ f) $(y – 8)(y + 6)$ g) $(a + 5)(a – 4)$ h) $(y + 8)(y – 6)$
i)$(m – 10)(m – 5)$ j) $(a – 6)^2$ k) $(12 + k)(1 + k)$ or $(k + 12)(k + 1)$ l) $(-8 + g)(2 + g)$ or $(g – 8)(g + 2)$
m) $(12 + y)(5 + y)$ or $(y + 12)(y + 5)$ n) $(-9 + z)(8 + z)$ or $(z – 9)(z + 8)$ o) $(m – 12)(m + 5)$
p) $(w – 9)(w – 5)$ q) $(b + 12)(b – 3)$ r) $(h – 12)(h + 2)$

3. Discussion

4a) $(q + 4)(q + 2)$ b) $(n – 9)(n + 5)$
Verify: $q^2 + 2q + 4q + 8$ Verify: $n^2 + 5n – 9n - 45$
$Q^2 + 6q + 8$ $n^2 – 4n – 45$

c) $(k – 15)(k + 6)$
Verify: $k^2 + 6k – 15k – 90$
$K^2 – 9k – 90$

Practice #7

1a) $(3m + 1)(m + 1)$ b) $(2n + 1)(n + 6)$ c) $(2y + 1)(y + 2)$ d) $(2a + 3)(a + 4)$
e) $(2m – 3)(m – 4)$ f) $(5a + 3)(a – 2)$ g) $(5s – 1)(s + 4)$ h) $(7c + 1)(2c – 3)$
i) $(4a – 1)(2a + 5)$ j) $(4r – 1)(2r – 3)$ k) $(6d – 5)(d + 1)$ l) $(5e + 1)(3e – 2)$
m) $(7y – 3)(2y – 1)$ n) $(10p + 3)(p – 2)$ o) $(5r + 1)(2r – 7)$

2a) signs are mixed, should be $(2u + 7)(3u – 2)$
b) numbers are mixed, should be $(3k – 10)(k + 3)$
c) numbers and signs are mixed, should be $(4v – 5)(v – 4)$

3a) 52 b) $(3x – 5)(4x + 1)$ c) Discussion

Practice #8

1a) $(9m – 7)(9m + 7)$ b) $(5m – 6)(5m + 6)$ c) $(t – 5)(t + 5)$ d) $(x – 7)(x + 7)$
e) $(q – 1)(q + 1)$ f) $(c – 6)(c + 6)$ g) $(b – 11)(b + 11)$ h) $(3d – 4f)(3d + 4f)$
i) $(12a – 3b)(12a + 3b)$ j) $(9k – 7m)(9k + 7m)$ k) $(v – 6t)(v + 6t)$ l) $(2j – 15h)(2j + 15h)$
m) $(10y – 9z)(10y + 9z)$ n) $(11m – n)(11m + n)$ o) $(5m – 8n)(5m + 8n)$

2) Discussion

3a) $(4v – 7)(4v + 7)$ b) $(x – 3)(x + 3)$
Verify: $16v^2 + 28v – 28v – 49$ Verify: $x^2 + 3x – 3x – 9$
$16v^2 – 49$ $x^2 – 9$

4. Discussion

Practice #9

1a) $(4k – 3)(k – 1)$ b) $(4b + 3)(b – 2)$ c) $(2b – 9)(2b + 9)$
d) $(3g – 4h)(3g + 4h)$ e) $(f + 16)(f + 1)$ f) $(c – 11)(c – 2)$
g) $(g + 3h)^2$ h) $(4j – 3k)^2$ i) $(3x + 1)(2x – 5)$
j) $(m – 7)^2$ k) $(n + 5)^2$ l) $(6a – 1)(a – 5)$
m) prime n) $(4k – 3)(k – 1)$ o) $(f + 16)(f + 1)$
p) $(3x – y)(2x – 5y)$ q) $(h – 5j)(h + 5j)$ r) $(4r + t)^2$
2a) $(m – 7)^2$ b) $(2p + 3)^2$
Verify: $(m – 7)(m – 7)$ Verify: $(2p + 3)(2p + 3)$
$M^2 – 7m – 7m + 49$ $4p^2 + 6p + 6p + 9$
$M^2 – 14m + 49$ $4p^2 + 12p + 9$
3) Discussion

Practice #10

1a) $3(5n – 2)$ b) $5(y + 2)$ c) $3(3k + 2)$ d) $6(1 + 2x^2)$
e) $2m(2m + 7)$ f) $h(3 + 7h)$ g) $3m^2(3 – 4m)$ h) $24(2x^2 – 1)$
i) $-a^2(1 + a)$ j) $3x^2(1 + 2x^2)$ k) $4y(2y^2 – 3)$ l) $-7d(1 + 2d^3)$
m) $3(x^2 + 4x – 2)$ n) $2(2 – 3y – 4y^2)$ o) $-7(m + m^2 + 2)$ p) $2(5n – 3 – 6n^2)$
q) $v(6v^3 + 7 – 8v^2)$ r) $6x(4 + 5x^2 – 2x^3)$ s) $5xy(5 + 3x – 6xy)$
t) $3a^2b^2(3a^2 – 2ab^3 + 4b^4)$ u) $a^2b^2(10a + 12a^3b – 5)$
v) $7rs^2(r^2 + 2r – 3)$
2a) They forgot the 1 as the third term in the bracket; should be $3m(m + 3m^2 – 1)$
b) They forgot to change the sign on the second term: should be $-4(4 – 2n + n^2)$
3a) $4(8 + 5)$ b) $12(4 + 3)$ c) $9(2 + 5)$
4) Discussion

Practice #11

1a) $5(a – 4)(3a – 1)$ b) $3(2h + 3)(3h – 2)$ c) $4(3m + 2)(m – 5)$
d) $2(3g + 5)(4g – 7)$ e) $4(x + 4)(x – 3)$ f) $-5(n – 7)(n – 1)$
g) $-3(m + 4)(m + 2)h)$ $10(x + 6)(x + 2)$ i) $7(x – 3)(x – 2)$
j) $2(3m – n)(3m + n)$ k) $(2x – m^2)(2x + m^2)(4x^2 + m^4)$
l) $(x – y)(x + y)(x^2 + y^2)(x^4 + y^4)$ m) $(2m^2 – 3)(2m^2 + 3)(4m^4 + 9)$
n) $2(m^2 – 2n^4)(m^2 + 2n^4)$
2) Discussion

Practice #12

1a) $3(3K + 2)$ b) $3x^2(1 – 2x^2)$ c) $-c^2(3 + 13c^2 + 12c)$
d) $(x + 14)(x – 2)$ e) $(y – 8)(y + 6)$ f) $(4a – 1)(2a + 5)$
g) $5(3a – 1)(a – 4)$ h) $(s + 5)(s + 6)$ i) $2(x^2 + 7x + 3)$
j) $3(x + 7)(x – 2)$ k) $3a(5a^2 – ab – 2b^2)$ l) $(w + 12)(w – 2)$
m) $d(3c^2 – 10c – 2)$ n) $(f + 16)(f + 1)$ o) $(4t – 7)(t + 4)$
p) $(h – 5j)(h + 5j)$ q) $(3x – y)(2x – 5y)$ r) $7a^2(4 – a)$
s) $(5t + 2u)^2$ t) $3(x – 5)(x + 4)$ u) $2(3m – n)(3m + n)$
2a) $(c – 11)(c – 2)$ b) $(4t – 7)(t + 4)$ c) $(h – 5j)(h + 5j)$
V: $c^2 – 2c – 11c + 22$ V: $4t^2 + 16t – 7t – 28$ V: $h^2 + 5hj – 5hj – 25j^2$
$C^2 – 13c + 22$ $4t^2 + 9t – 28$ $h^2 – 25j^2$
3. Discussion 4. Discussion