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CHAPTER 7

Quadratic Expressions

Get Set

Answer these questions to check your understanding of the Get Ready concepts on pages 278–279 of the *Foundations of Mathematics 10* textbook.

Polynomials

1. Circle the numerical coefficient in each term and identify each expression as a monomial, binomial, or trinomial.

a) $3x$ **b)** $4x^2 + 3x - 1$ **c)** $8x^3$ **d)** $x^2 + 7x$

Algebraic Expressions

2. Multiply or divide as indicated.

a) $3(4y)$ **b)** $(-2t)(-3t)$ **c)** $-6x \div 3$ **d)** $\frac{15x^2}{3x}$

3. Simplify.

a) $5x + 4 - 7x - 1$ **b)** $x^2 + 2x + 4 + x$ **c)** $x^2 + 8x^2 - 7 - 5x + 13x$

4. Expand.

a) $2(x - 5)$ **b)** $5x(2x + 6)$ **c)** $-3(4x^2 + 4x - 2)$ **d)** $2x^2(3x + 5)$

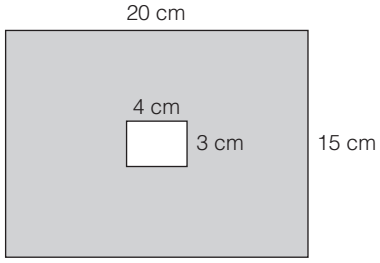
Number Operations

5. Square each term.

a) -6 **b)** $4x$ **c)** $10y$ **d)** $-5x$

Measurement

6. Find the area of the shaded region in the diagram.



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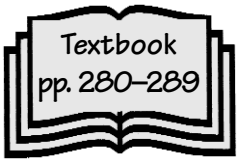
7.1 Multiply Two Binomials



Warm-Up

1. Number Operations	2. Factors
Evaluate. **a)** $3(2 + 6)$ **b)** $(12 - 6)(10 - 5) + 4$	Find the greatest whole number that divides evenly into each pair. **a)** 8 and 16 **b)** 21 and 49
3. The Distributive Property	**4. Math Literacy**
Expand. **a)** $4x(3x + 2)$ **b)** $5x(2x + 6)$	**a)** What does the prefix *bi* mean? **b)** Give an example of a word with this prefix.
5. Estimation	**6. Simplify Algebraic Expressions**
A piece of string 8.2 m long is lengthened by a factor of 4.1. What is the approximate length of the new string?	Simplify. **a)** $14x + 12 - 5x + 8$ **b)** $-(a + 5) + 4a + 7$

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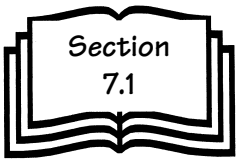
Practise



1. **a)** Write an example of a binomial expression that contains a variable and a constant.

b) Explain your answer for **a)**.

2. Use algebra tiles to illustrate each product of the binomials.

a) $(x + 2)(x + 5)$

b) $(2a + 1)(a + 4)$

3. Use a multiplication pattern to determine the products of the binomials. The order for multiplying terms in binomials is indicated for the first example and is represented by the acronym FOIL.

a) $(x + 6)(x + 3)$

$= x(x) + x(\_\_) + 6(\_\_) + \_\_(\_\_)$

$= x^2 + \_\_x + \_\_$

b) $(2x - 3)(x - 10)$

c) $(a - 9)(7a + 6)$

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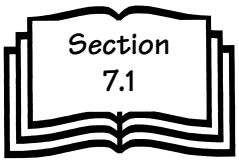


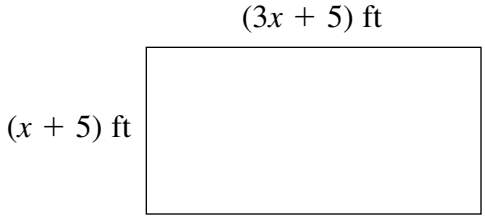
4. **a)** Use algebra tiles to find the product of $(x + 3)(x + 3)$.

b) What is another way of writing the binomial in **a)**?

c) What shape did you construct in **a)**?

d) What term is used to describe the resulting expression in **a)**?

5. Rajeet would like to paint a wall in his bedroom and needs to figure out how much paint he has to buy.
The height and length of the wall can be represented as



a) Find a quadratic expression that represents the area of the wall.

Area = length × width

Therefore,

Area = (_____) × (_____)

= ___x^2 + ___x + ___x + ___

=

b) Find the area of the wall if $x = 3$.

6. Use the distributive property of multiplication to determine the product of the following binomials.
$(3x + 2)(x + 2)$

= ___x^2 + ___x + ___x + ___

=

7. Use a CAS to determine the product of the following binomials.
$(4x + 3)(x + 2)$

So, $(4x + 3)(x + 2)$ = _____

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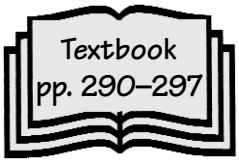
7.2 Common Factoring



Warm-Up

1. Number Operations

Evaluate.

a) $\frac{(3 \times 4)}{2} + \frac{(3 \times 9)}{3}$

b) $-(-2 \times 9) \div 3$

2. Factors

Provide three factors of

a) 30

b) 72

3. The Distributive Property

Expand.

a) $2a(6 - 2a + b)$

b) $-7(x - 4y + 6)$

4. Math Literacy

What is the opposite process to factoring? Explain why.

5. Estimate

A case of printer paper containing 5 packages of 500 sheets costs $24.89.

a) Roughly how much does each package of paper cost?

b) Roughly how much does each sheet of paper cost?

6. Simplify Algebraic Expressions

Simplify.

a) $-4x + 4 - 12x - 6$

b) $x^2 + 2x + 4 + x + 4x^2$

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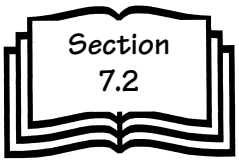
Practise



1. Find the greatest common factor (GCF) of
a) 64 and 72 **b)** $2a^2$ and $12a$ **c)** $4x^2$ and $6x$

2. For each polynomial, indicate if it is in the *factored* form or *expanded* form and identify the greatest common factor.
a) $3x - 12$ **b)** $5(13y - x^2)$ **c)** $3x^2 - 12x + 9$

GCF = GCF = GCF =

3. Completely factor each polynomial and check by expanding
a) $3p - 15$ **b)** $21x^2 - 9x + 18$ **c)** $6y^2 + 18y + 30$

$= 3(\_\_\_ - \_\_\_)$ = =

Check: **Check:** **Check:**

4. Write a trinomial expression with a GCF of $3n$. Factor the expression.

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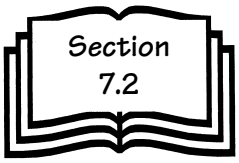

5. The expression $A = 5x^2 + 15x$ represents the area of a playground in a park, with area in square metres (m^2).

a) Factor the expression completely.

$A = \_\_(\_\_ + \_\_)$

b) Based on your answer for part **a)**, provide expressions for the dimensions and draw a sketch of the playground.

c) What is the area of the playground if $x = 9$ m?

d) The city has decided to completely fence in the playground and needs to determine its perimeter. Using the dimensions from part **b)**, write the formulas for the perimeter and area of the playground.

Perimeter $= 2\_\_\_\_\_ + 2\_\_\_\_\_$

Area $= \_\_\_\_\_ \_\_\_\_\_$

e) Using the area you calculated in **c)**, determine how many metres of fencing will be needed to completely fence in the playground.

6. Use a CAS to find the GCF for the following trinomials.

a) $6a^2 + 12a + 18$

GCF = _____

b) $18a^2 + 27a + 81$

GCF = _____

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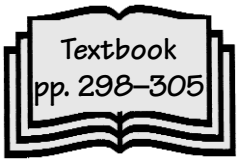
7.3 Factor a Difference of Squares



Warm-Up

1. Number Operations

Evaluate.

a) $(6)^2 - (-2)^2$

b) $(-3)^2 - (1)^2$

2. Factors

a) Circle the common factors of 16 and 36

2, 3, 4, 6, 8, 9, 16, 18

b) Which number from **a)** is the greatest common factor?

3. Algebra

Expand.

a) $4(t^2 - 4)$

b) Is your answer for **a)** a difference of squares?

4. Math Literacy

Circle the example of a difference of squares.

a) $5^2 - 3$

b) $100 - 50$

c) $49 - x^2$

d) $x^2 - x$

5. Estimate

Estimate the value of 11.1^2.

6. Algebraic Expressions

a) Simplify $3x^2 + (6)^2 - 2x^2$

b) Evaluate part **a)** when $x = 3$

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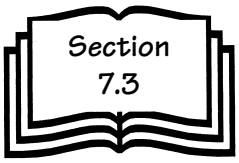
Practise



1. Write each as a power of its positive square root.
a) 64 **b)** 144 **c)** $9x^2$

2. Identify the expressions that are differences of squares. Explain your answers.
a) $x^2 - 49$ **b)** $4x^2 - 4y^2$ **c)** $9x^2 - 5y$

_____

_____

3. Factor each expression and check by expanding.
a) $x^2 - 9$

STEP 1: Both terms are square terms and the operation between them is subtraction, so you are factoring a difference of squares. Each term can be written as a power of its positive square root.

$= x^2 - 3^2$

STEP 2: Write the binomials that represent the factors.

$= (x + \_\_)(\_\_ - \_\_)$

Check:

b) $100 - x^2$

Check:

c) $a^2 - 81$

Check:

4. a) Using a ruler, draw a square with sides measuring 6 cm.

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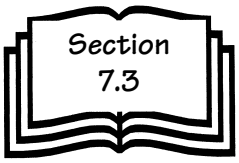

b) Determine the area of the square.

A = _____ × _____

=

c) Is it possible to represent the calculation in part **a)** as a squared number? Explain.

d) Inside of the large square, draw another square with sides measuring 2 cm and calculate its area.

e) Determine the remaining area of the large square if you were to cut out the small square.

f) How is the calculation in part **e)** related to determining a difference of squares?

5. The area of a $5 bill can be modelled by the expression $A = x^2 - 16$, with area in square centimetres.

a) Find the expressions for length and width.
You can find them by factoring the equation for area. Therefore,

A = ( )( )

b) Determine what x is, to the nearest centimetre, by measuring a $5 bill.

c) What is the area of the $5 bill?

d) Check your answer to part **c)** by substituting the value of x into $A = x^2 - 16$.

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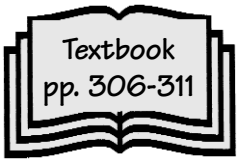
7.4 Factor Trinomials of the Form $x^2 + bx + c$



Warm-Up

1. Number Operations

Evaluate.

a) $24 - (4 \times 2 + 2 \times 9)$

b) $22 \times 3 - (-2)(1)$

2. Factors

Find the greatest common factor for the expressions in each pair.

a) $3x^2$ and 9

b) $4x$ and $6xy$

3. Algebra

Expand.

a) $7(x^2 - 2x + 6)$

b) $4b(b - 7)$

4. Math Literacy

Give two examples of careers that require knowing how to calculate areas.

5. Estimate

The distance between Toronto and North Bay is about 345 km. If you travel at an average speed of 80 km/h, about how long will it take you to get there?

a) 3 h

b) 4 h

c) 5 h

d) 6 h

6. Algebraic Expressions

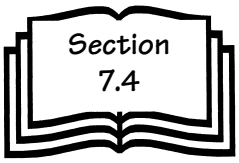
Simplify.

a) $-2b + 6 + 7b^2 + 7 - b^2$

b) Evaluate part **a)** when $b = 2$

Date: _____

Practise



1. Complete the table by determining the appropriate pair of integers whose product and sum are as listed.

Pair of Integers	Product	Sum
	8	6
	36	13
	−20	−1
	24	−10

2. **a)** Use algebra tiles to construct a rectangle with area $x^2 + 6x + 8$.
b) Based on your model, what expressions represent the length and width for this rectangle?

c) How do the length and width of your rectangle relate to the factors for the trinomial expression?

3. Factor each trinomial and check by expanding.
a) $x^2 + 4x + 3$

STEP 1: Find a pair of integers that have a product of 3 and a sum of 4.
The product is positive, so both integers are either negative or positive.

Since their sum is 4 the integers must be ____ and _____.

STEP 2: Determine the binomial factors.

$(x +$ ___$)($___ $+$ ____$)$

Check:

b) $x^2 + 11x + 28$

Check:

c) $x^2 + 9x + 20$

Check:

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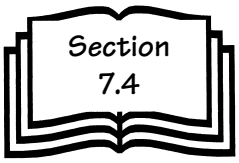

4. Nancy is factoring $x^2 - 6x + 8$ and decides that she will use 4 and 2 as her values so that the expression becomes $(x + 4)(x + 2)$. Explain where a mistake was made.

5. A rectangle has an area $x^2 + 8x + 7$.

a) What are the expressions that could represent the dimensions of the rectangle?

A = ( )( )

b) What is the name of the process you performed to get the expressions in part **a)**?

c) What is the area of this rectangle when $x = 9$ cm?

6. An interior designer wants to develop a floor plan of a room with the area $x^2 + 6x + 9$.

a) Factor to find the dimensions of the room. Explain your answer.

b) What is the area of the room if $x = 1$ m?

c) Draw and label a diagram of the room.

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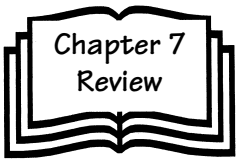
Chapter 7 Review



7.1 Multiply Two Binomials, textbook pages 280–289

1. Expand and simplify.

a) $(2x - 1)(3x + 4)$

b) $(x + 7)(2x - 2)$

c) $(x - 3)(3x + 1)$

d) $(x - 1)^2$

7.2 Common Factoring, textbook pages 290–297

2. Expand.

a) $(x - 3)(x + 3)$

b) $(x + 3)^2$

c) What do you notice about your answers? Explain.

3. Determine if the following expressions are factored completely. If they are not, write the correctly factored form.

a) $3x^2 + 12x$
$= x(3x + 12)$

b) $18x^3 + 6x^2$
$= 2x(9x^2 + 3x)$

4. Find the greatest common factor, if necessary, then factor each expression completely.

a) $2x^2 + 20$

b) $4x^2y + 8xy$

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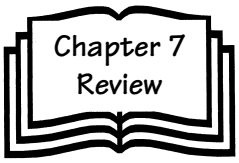
c) $x^2 - 144$ **d)** $x^2 - 5x - 14$



7.3 Factor a Difference of Squares, textbook pages 298–305

5. Write each number as a power of its positive square root.

a) 25 = _____ **b)** 49 = _____ **c)** 81 = _____

6. Circle the difference of squares.

a) $x^2 - 64$ **b)** $4x^2 - 100$ **c)** $x - 25$ **d)** $x^2 + 49$

7. Factor each difference of squares.

a) $x^2 - 9$ **b)** $x^2 - 16$

Check: **Check:**

7.4 Factor Trinomials of the Form $x^2 + bx + c$, textbook pages 306–311

8. A carpenter is installing a countertop with an area $x^2 + 7x + 6$.

a) Write expressions for the length and width of the countertop.

b) What is the shape of the countertop?

c) Calculate the area of the countertop if $x = 1$ ft.