

4.1 Multiplying & Common Factors

A. Multiplying Numbers using Box Method

1.  $(7)(28)$       2.  $(5)(-42)$       3.  $(-4)(-38)$

|    |     |
|----|-----|
| 20 | 8   |
| 7  | 140 |
| 7  | 56  |

$= 140 + 56$   
 $= 196$

|     |      |
|-----|------|
| -40 | -2   |
| 5   | -200 |
| 5   | -10  |

$= -200 + (-10)$   
 $= -210$

|     |     |
|-----|-----|
| -30 | -8  |
| -4  | 120 |
| -4  | 32  |

$= 120 + 32$   
 $= 152$

4.  $(21)(35)$       5.  $(-17)(51)$       6.  $(-42)(-25)$

|    |     |
|----|-----|
| 30 | 5   |
| 20 | 600 |
| 20 | 100 |
| 1  | 30  |
| 1  | 5   |

$= 600 + 100 + 30 + 5$   
 $= 735$

|     |      |
|-----|------|
| 50  | 1    |
| -10 | -500 |
| -10 | -10  |
| -7  | -350 |
| -7  | -7   |

$= -500 + (-350) + (-10) + (-7)$   
 $= -867$

|     |     |
|-----|-----|
| -20 | -5  |
| -40 | 800 |
| -40 | 200 |
| -2  | 40  |
| -2  | 10  |

$= 800 + 200 + 40 + 10$   
 $= 1050$

B. Factoring Numbers Using Box Method

\*fill in the missing values to determine the factors of each number\*\*

1. 252  $\begin{matrix} 252 \\ 6 \end{matrix}$   
 $= (6)(42)$

$\begin{matrix} 40 & 2 \\ ? & ? \end{matrix} = 42$

|   |     |
|---|-----|
| 6 | 240 |
| 6 | 12  |

2. 576  
 $= (8)(72)$

$\begin{matrix} 70 & 2 \\ ? & ? \end{matrix} = 72$

|   |     |
|---|-----|
| 8 | 560 |
| 8 | 16  |

3. 168  
 $= (3)(56)$

$\begin{matrix} 50 & 6 \\ ? & ? \end{matrix}$

|   |     |
|---|-----|
| 3 | 150 |
| 3 | 18  |

4. 322  
 $= (14)(23)$

$\begin{matrix} 20 & 3 \\ ? & ? \end{matrix}$  110?

|    |                 |
|----|-----------------|
| 10 | 200             |
| 10 | ? <sub>30</sub> |
| 4  | ? <sub>80</sub> |
| 4  | 12              |

5. 903  
 $= (43)(21)$

$\begin{matrix} 20 & 1 \\ ? & ? \end{matrix}$

|    |                  |
|----|------------------|
| 40 | ? <sub>800</sub> |
| 40 | 40               |
| 3  | 60               |
| 3  | ? <sub>3</sub>   |

6. 522  
 $= (18)(29)$

$\begin{matrix} 20 & 9 \\ ? & ? \end{matrix}$

|    |                  |
|----|------------------|
| 10 | ? <sub>200</sub> |
| 10 | ? <sub>90</sub>  |
| 8  | ? <sub>160</sub> |
| 8  | 72               |

$90 + 72 = 162$   
 $522 - 162 = 360$

C. Multiplying Algebraic Expressions using Box Method

1.  $3(x+2)$

$$3 \begin{array}{|c|c|} \hline x & 2 \\ \hline 3x & 6 \\ \hline \end{array} \\ = 3x + 6$$

2.  $-2(3x-1)$

$$-2 \begin{array}{|c|c|} \hline 3x & -1 \\ \hline -6x & 2 \\ \hline \end{array} \\ = -6x + 2$$

3.  $4x(3x-5)$

$$4x \begin{array}{|c|c|} \hline 3x & -5 \\ \hline 12x^2 & -20x \\ \hline \end{array} \\ = 12x^2 - 20x$$

4.  $5x(3x^2 - 2x - 1)$   
 $= 15x^3 - 10x^2 - 5x$

$$5x \begin{array}{|c|c|c|} \hline 3x^2 & -2x & -1 \\ \hline 15x^3 & -10x^2 & -5x \\ \hline \end{array}$$

5.  $-3(4x^5 - 3x^2y + 4)$   
 $= -12x^5 + 9x^2y - 12$

$$-3 \begin{array}{|c|c|c|} \hline 4x^5 & -3x^2y & 4 \\ \hline -12x^5 & 9x^2y & -12 \\ \hline \end{array}$$

6.  $-2x^3y(5x - 2y + 3)$   
 $= -10x^4y + 4x^3y^2 - 6x^3y$

$$-2x^3y \begin{array}{|c|c|c|} \hline 5x & -2y & 3 \\ \hline 10x^4y & 4x^3y^2 & -6x^3y \\ \hline \end{array}$$

7.  $3x^2y^4z(2x - 3y + 1)$   
 $= 6x^3y^4z - 9x^2y^5z + 3x^2y^4z$

$$3x^2y^4z \begin{array}{|c|c|c|} \hline 2x & -3y & 1 \\ \hline 6x^3y^4z & -9x^2y^5z & 3x^2y^4z \\ \hline \end{array}$$

D. Factoring Algebraic Expressions using Box Method

GCF = greatest common factor

\*\*When we factor algebraic expressions we are dividing out the GCF\*\*

**Recall:** Determine the GCF of each set of expressions.

|          |              |   |   |
|----------|--------------|---|---|
| 4, 8, 12 | 9x, 27x, 18x | 2x <sup>3</sup> , 10x <sup>2</sup> , 12x <sup>5</sup> | 5x <sup>5</sup> y <sup>2</sup> , -25x <sup>3</sup> y <sup>2</sup> , 15x <sup>4</sup> y <sup>2</sup> |
| 4        | 9x           | 2x <sup>2</sup>                                       | 5x <sup>3</sup> y <sup>2</sup>  |

Factor each expression by removing the GCF.

|  |                     |    |   |     |     |  |                 |                     |
|--|---------------------|----|---|-----|-----|--|-----------------|---------------------|
| <p>1. <math>5x + 10</math><br/><math>= 5(x + 2)</math></p> <p style="text-align: center; margin-left: 20px;">x      2</p> <p>5 <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="padding: 5px;">5x</td><td style="padding: 5px;">10</td></tr></table></p> | 5x                  | 10 | <p>2. <math>-4x - 12</math><br/><math>= -4(x + 3)</math></p> <p style="text-align: center; margin-left: 20px;">x      3</p> <p>-4 <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="padding: 5px;">-4x</td><td style="padding: 5px;">-12</td></tr></table></p> | -4x | -12 | <p>3. <math>5x^3 - 15x^2y</math><br/><math>= 5x^3(1 - 3x^2y)</math></p> <p style="text-align: center; margin-left: 20px;">1      -3x<sup>2</sup>y</p> <p>5x<sup>3</sup> <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="padding: 5px;">5x<sup>3</sup></td><td style="padding: 5px;">-15x<sup>2</sup>y</td></tr></table></p> | 5x <sup>3</sup> | -15x <sup>2</sup> y |
| 5x   | 10                  |    |   |     |     |  |                 |                     |
| -4x  | -12                 |    |   |     |     |  |                 |                     |
| 5x <sup>3</sup>  | -15x <sup>2</sup> y |    |   |     |     |  |                 |                     |

4.  $3x^3 + 2x^2 - x$   
 $= x(3x^2 + 2x - 1)$

3x<sup>2</sup>    2x    -1

x 

|                 |                 |    |
|-----------------|-----------------|----|
| 3x <sup>3</sup> | 2x <sup>2</sup> | -x |
|-----------------|-----------------|----|

5.  $12x^2 - 10x + 4$   
 $= 2(6x^2 - 5x + 2)$

6x<sup>2</sup>    -5x    2

2 

|                  |      |   |
|------------------|------|---|
| 12x <sup>2</sup> | -10x | 4 |
|------------------|------|---|

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

x<sup>2</sup>    -4x    -3

2x 

|                 |                  |     |
|-----------------|------------------|-----|
| 2x <sup>3</sup> | -8x <sup>2</sup> | -6x |
|-----------------|------------------|-----|

7.  $2z^2 - 3z - 2xz$   
 $= z(2z - 3 - 2x)$

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

8.  $4x^3 - 12x^2 + 8x$   
 $= 4x(x^2 - 3x + 2)$

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

9.  $3x^3y^2 - x^2y^2 + 4xy^3$   
 $= xy^2(3x^2 - x + 4y)$

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

Practice

Set 1: ~~p.209 #5,6~~ p.234 #1,2,3,7ab

Set 2: ~~p.209 #5,6~~ p.234 #4,7cd,10,13a,15a