

## 2-7-3 Factoring

Assume  $12x+6$  is the result of distribution. What did it look like before the distribution was done? There was something outside a set of parenthesis and two terms inside the parenthesis.

$$\boxed{\phantom{6}} \left( \boxed{\phantom{2x}} + \boxed{\phantom{1}} \right)$$

$$\boxed{6} \left( \boxed{2x} + \boxed{1} \right)$$

Separating an expression so that the smallest possible pieces called factors multiply together to get the original expression is called **factoring**.

Look at each term and find the largest factor that is in all terms.

Example:  $72x^2 + 60x + 36$  Find the largest number that divides evenly into 72, 60 and 36.

This number goes in front of the parenthesis.

$$\frac{72x^2}{12}, \frac{60x}{12}, \frac{36}{12}$$

Divide each term by the common factor.

$$\boxed{12} \left( \boxed{\phantom{6x^2}} + \boxed{\phantom{5x}} + \boxed{\phantom{3}} \right)$$

Fill in the positions in the parenthesis. Distribute to check the factoring.

$$\boxed{12} \left( \boxed{6x^2} + \boxed{5x} + \boxed{3} \right)$$

$24x^2y^2 + 16x^2y - 56xy^2$  The largest factor in all terms is  $8xy$ . When the division is done there shouldn't be any negative exponents. Notice the negative in the third term.

Divide each term by the common factor.

$$\frac{24x^2y^2}{8xy}, \frac{16x^2y}{8xy}, \frac{-56xy^2}{8xy}$$

$$\boxed{8xy} \left( \boxed{\phantom{3xy}} + \boxed{\phantom{2x}} - \boxed{\phantom{7y}} \right)$$

$$\boxed{8xy} \left( \boxed{3xy} + \boxed{2x} - \boxed{7y} \right)$$

The division can be done in your head, but some students need to write it down.

Practice: Factor the following.

- |   |                                |                                    |                                  |                                |
|---|--------------------------------|------------------------------------|----------------------------------|--------------------------------|
| a) $15y-25=5(3y-5)$   | 14z+56=                        | 39u-13=                            | 81p-18=                          | 7t+21=                         |
| b) $8+8t=$  | 14-21w=                        | 9v-81=                             | 2x-10=                           | 3w+9=                          |
| c) $^{-2}/_3y^{-10}/_3=^{-2}/_3(y+5)$<br>Note the negative. | $\frac{4y}{5} + \frac{8}{5} =$ | $\frac{10}{12} - \frac{15r}{12} =$ | $\frac{4}{25}y + \frac{6}{25} =$ | $\frac{5r}{3} + \frac{2}{3} =$ |
| d) $6x^2-9x+12= 3(2x^2-3x+4)$                               | $14e^2+21e+56=$                | $2x^2-4x-8=$                       | $8a^2+4a+4=$                     | $10b^2+5b-25$                  |
| e) $3+3w+3w^2=$   | $-5-5t-5t^2=$                  | $-8+16e-24e^2=$                    | $12-24y^2+36y=$                  | $15r+15r^2-25$                 |
| f) $ax+2a=a(x+2)$   | $bx-7x=$                       | $3s-3ts=$                          | $4ef+3f=$                        | $2w-wx=$                       |
| g) $4x^2-12x=4x(x-3)$                                       | $14y^2+21y=$                   | $81z+18z^2=$                       | $10q^2-20q=$                     | $8a-8a^2=$                     |
| h) $2ax^2+4ax-8a=$  | $12xy^2+16xy+24x=$             | $a^2x^2+a^2x+a^2=$                 | $2a^2x-4a=$                      | $e^3-5e^2x=$                   |
| i) $3x^3y^2+9x^2y^2-12x^2y^3=3x^2y^2(x+3-4y)$               | $25a^4b^2+45a^2b^3-15a^2b^5=$  |                                    |                                  |                                |

j)  $a^7b^5 - 5a^8b^7 - a^5b^4 =$

k)  $25a^4b^2 + 75a^2b^3 - 100a^2b^2$

l)  $\frac{3}{4}x^2 - \frac{x}{4} + \frac{1}{4}$  Hint: Factor out a  $\frac{1}{4}$ .

$2e^4f^3 + 4e^2f^2 - ef^3 =$

$21x^3y^6 + 14x^2y^5 - 28x^4y^4$

$\frac{15a^2}{8} - \frac{21a}{8}$