

**5-Minute Check**

Over Lesson 8–4

**4** Find  $(2c^2 + 6d)(2c^2 - 6d)$ .

**abc** New Vocabulary

- factoring
- factoring by grouping
- Zero Product Property

distributing: to multiply together

Ex.  $3 \cdot 5 = 15$

factoring: to break down

Ex. 
$$\begin{array}{r} 30 \\ \hline 1 \cdot 1 \\ 6 \cdot 5 \\ \hline 2 \cdot 3 \cdot 5 \end{array}$$

**EXAMPLE 1****Use the Distributive Property****A. Use the Distributive Property to factor  $15x + 25x^2$ .**

First, find the GCF of  $15x + 25x^2$ .

$$15x = 3 \cdot 5 \cdot x$$

$$25x^2 = 5 \cdot 5 \cdot x \cdot x$$

$$\text{GCF} = 5 \cdot x \text{ or } 5x$$

Factor each monomial.

Circle the common prime factors.

$$15x + 25x^2 = 5x(3) + 5x(5 \cdot x)$$

Rewrite each term using the GCF.

$$= 5x(3 + 5x)$$

Distributive Property

check:

$$5x(3 + 5x)$$
$$5x + 25x^2$$

**Answer:** The completely factored form of  $15x + 25x^2$  is  $5x(3 + 5x)$ .

**B. Use the Distributive Property to factor**  
 $12xy + 24xy^2 - 30x^2y^4$ .

$$12xy = 2 \cdot 2 \cdot 3 \cdot x \cdot y$$

$$24xy^2 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot x \cdot y \cdot y$$

$$-30x^2y^4 = -1 \cdot 2 \cdot 3 \cdot 5 \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y$$

Factor each term.

GCF =  $6xy$

Circle common factors.

$$\frac{12xy + 24xy^2 - 30x^2y^4}{6xy \quad 6xy \quad 6xy}$$

GCF =  $2 \cdot 3 \cdot x \cdot y$  or  $6xy$

$$6xy(2 + 4y - 5xy^3)$$

$$12xy + 24xy^2 - 30x^2y^4 = 6xy(2) + 6xy(4y) + 6xy(-5xy^3)$$

Rewrite each term using the GCF.

$$= 6xy(2 + 4y - 5xy^3)$$

Distributive Property



**Example 1**

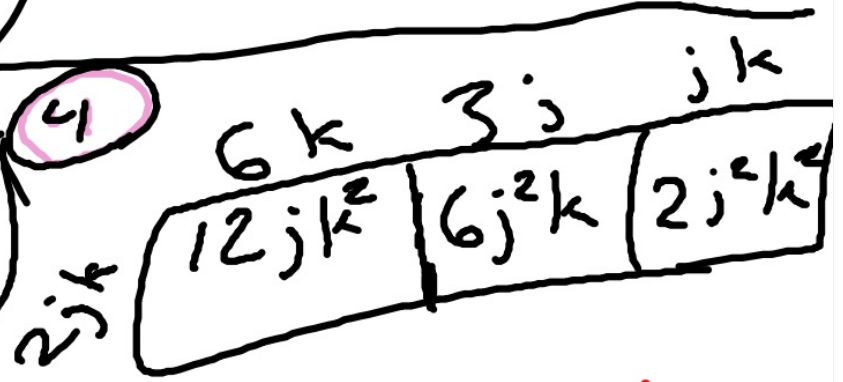
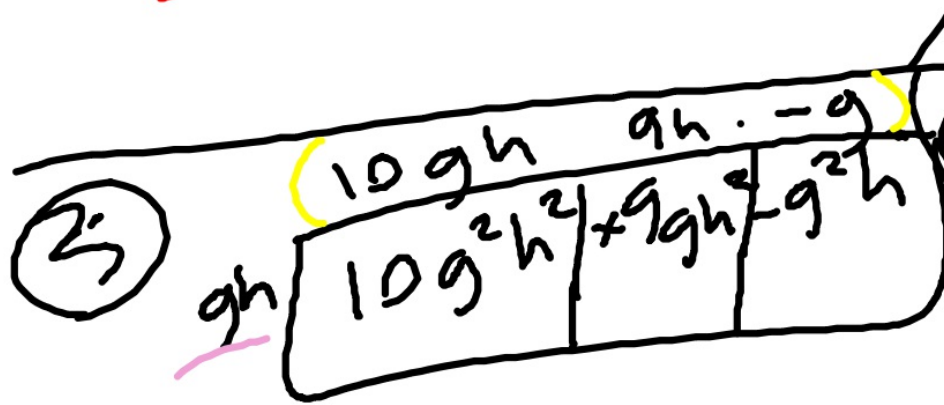
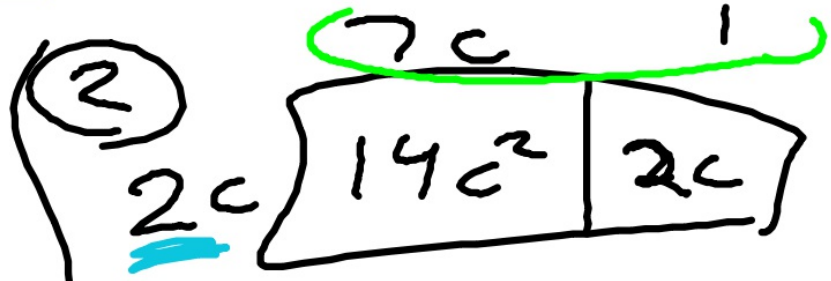
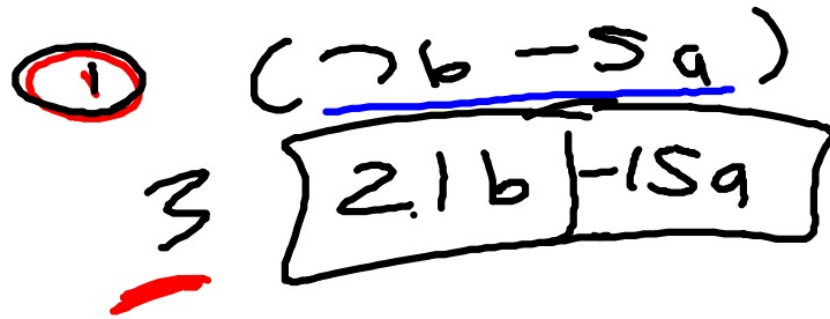
Use the Distributive Property to factor each polynomial.

1.  $21b - 15a$   $3(7b - 5a)$

2.  $14c^2 + 2c$   $2c(7c + 1)$

3.  $10g^2h^2 + 9gh^2 - g^2h$   $gh(10gh + 9h - g)$

4.  $12jk^2 + 6j^2k + 2j^2k^2$   $2jk(6k + 3j + jk)$



**EXAMPLE 2****Factor by Grouping**

**Factor  $2xy + 7x - 2y - 7$ .**

$$2xy + 7x - 2y - 7$$

$$= (2xy - 2y) + (7x - 7)$$

Group terms with common factors.

$$= 2y(x - 1) + 7(x - 1)$$

Factor the GCF from each group.

$$= (2y + 7)(x - 1)$$

Distributive Property

**Answer:**  $(2y + 7)(x - 1)$  or  $(x - 1)(2y + 7)$

**Example 3** Factor by Grouping with Additive Inverses

PT

almost... !!

Factor  $2mk - 12m + 42 - 7k$ .

$$2mk - 12m + 42 - 7k$$

$$= (2mk - 12m) + (42 - 7k)$$

$$= 2m(k - 6) + 7(6 - k)$$

$$= 2m(k - 6) + 7[(-1)(k - 6)]$$

$$= 2m(k - 6) - 7(k - 6)$$

$$= (2m - 7)(k - 6)$$

Group terms with common factors

Factor the GCF from each group.

$$6 - k = -1(k - 6)$$

Associative Property

Distributive Property

⑦  $(3bc - 2b) - (10 - 15c)$   
 $= b(3c - 2) - 5(2 - 3c)$   
 $= b(3c - 2) + 5(3c - 2)$   
 GCF:  $(b + 5)(3c - 2)$

**Examples 2-3** Factor each polynomial.

⑤  $np + 2n + 8p + 16$   $(n + 8)(p + 2)$

7.  $3bc - 2b - 10 + 15c$

GCF:  $n$

$(np + 2n) + (8p + 16)$   
 $n(p + 2) + 8(p + 2)$

6.  $xy - 7x + 7y - 49$   $(x + 7)(y - 7)$

8.  $9fg - 45f - 7g + 35$   $(9f - 7)(g - 5)$

⑥  $(x + -7x) + (7y - 49)$   
 $x(y - 7) + 7(y - 7)$   
 $(x + 7)(y - 7)$

7.  $3bc - 2b - 10 + 15c$



### Example 4 Solve Equations

Solve each equation. Check your solutions.

a.  $(2d + 6)(3d - 15) = 0$

$(2d + 6)(3d - 15) = 0$

Original equation

$2d + 6 = 0$  or  $3d - 15 = 0$

Zero Product Property

$2d = -6$

$3d = 15$

Solve each equation.

$d = -3$

$d = 5$

Divide.

The roots are  $-3$  and  $5$ .

skip #13!

IF  $ab = 0$

then  $a = 0$

or  $b = 0$

$4m + 2 = 0$   
 $\frac{-2}{4} = \frac{-2}{4}$   
 $\frac{1}{2}m = -\frac{1}{2}$

**Example 4** Solve each equation. Check your solutions.

9.  $3k(k + 10) = 0$   $0, -10$

10.  $(4m + 2)(3m - 9) = 0$   $-\frac{1}{2}, 3$

11.  $20p^2 - 15p = 0$   $0, \frac{3}{4}$

12.  $r^2 = 14r$   $0, 14$

①  $3k = 0$  or  
 $\frac{3k}{3} = \frac{0}{3}$   
 $k = 0$

$k + 10 = 0$   
 $\frac{-10}{1} = \frac{-10}{1}$   
 $k = -10$

$m = -\frac{1}{2}$

$$11. \frac{20p^2}{5p} - \frac{15p}{5p} = 0$$

$$\text{GCF: } 5p$$

$$5p(4p - 3) = 0$$

$$a \quad b = 0$$

$$5p = 0$$

$$p = 0$$

$$\left. \begin{array}{r} 4p - 3 = 0 \\ p + 3 \quad + 3 \\ \hline 4p = 3 \\ 4 \quad \quad 4 \end{array} \right\}$$

$$p = \frac{3}{4}$$

**Example 1** Use the Distributive Property to factor each polynomial.

15.  $16t - 40y$   $8(2t - 5y)$

17.  $2k^2 + 4k$   $2k(k + 2)$

19.  $4a^2b^2 + 2a^2b - 10ab^2$   
 $2ab(2ab + a - 5b)$

19.  $4a^2b^2 + 2a^2b - 10ab^2$   
 $\frac{4a^2b^2}{2ab} + \frac{2a^2b}{2ab} - \frac{10ab^2}{2ab}$   
 GCF:  $2ab$

**Examples 2-3** Factor each polynomial.

21.  $fg - 5g + 4f - 20$   $(g + 4)(f - 5)$

23.  $hj - 2h + 5j - 10$   $(h + 5)(j - 2)$

25.  $45pq - 27q - 50p + 30$

27.  $3dt - 21d + 35 - 5t$   $(3d - 5)(t - 7)$

29.  $21th - 3t - 35h + 5$   $(3t - 5)(7h - 1)$

31.  $5br - 25b + 2r - 10$   $(r - 5)(5b + 2)$

33.  $5gf^2 + g^2f + 15gf$   $gf(5f + g + 15)$

35.  $27cd^2 - 18c^2d^2 + 3cd$

37.  $48tu - 90t + 32u - 60$

$2ab(2ab + a - 5b)$

25.  $45pq - 27q - 50p + 30$

$(45pq - 27q) - (50p - 30)$

$9q(5p - 3) - 10(5p - 3)$

$(9q - 10)(5p - 3)$

**Example 4** Solve each equation. Check your solution:

39.  $3b(9b - 27) = 0$   $0, 3$

41.  $(8z + 4)(5z + 10) = 0$   $-\frac{1}{2}, -2$

43.  $b^2 = -3b$   $0, -3$

31.  $5br - 25b + 2r - 10$   $(r-5)(5b+2)$

$$(5br - 25b) + (2r - 10)$$

$$5b(\underline{r-5}) + 2(\underline{r-5})$$

$$(5b+2)(r-5)$$

43.  $b^2 = -3b$   $0, -3$

$$b^2 = -3b$$

$$b^2 + 3b = 0$$

$$b(b+3) = 0$$

$$b = 0 \quad b+3 = 0$$

$$b = -3$$

33.  $5gf^2 + g^2f + 15gf$   $gf(5f+g+15)$

GCF:  $gf$   
 $gf(5f+g+15)$