

The Distributive Law

The Distributive Law states:

$$a(b+c) = ab + ac \quad \text{[multiply 'a' by 'b', then 'a' by 'c' and add]}$$

$$a(b-c) = ab - ac$$

Let's look at some examples.

$$\textcircled{1} \quad 3(2x+5y) + 7(4x-2y)$$

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• expand
• collect like-terms

$$\textcircled{2} \quad -5(3m+6n) - 8(9m-2n)$$

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* Don't forget when multiplying the sign in front of the number. *

$$\textcircled{3} \quad 6h - (3h-4) - 12h$$

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the number is 1

Try these on your own.

Part A.

(a) $3x + 2(5x-7)$

(b) $9 - 3(2x-4)$

(c) $8x - 6(3-2x)$

(d) $-5 + 5(x+4)$

(e) $4(6n+9) - 10n$

(f) $14 - 3(4n-1)$

(g) $-8n - 8(-4-2n)$

(h) $7k - 2(3k+1) - 9$

(i) $-6 + 5(8-k) - 8k$

The Distributive Law

Part A Collect the like terms

- $3x+2+2x+5$
- $4x+5-3x-2$
- $2x+3-5x+1$
- $x-4x-3+5$
- $3x-5-2x+3$
- $-4+2x-3-4x$
- $3x-2-x+3-5-2x$
- $4-3x-1+x-3+2x$

Part B Distributing a "-" sign

$-(3x-5) = -3x - (-5) = -3x + 5$ Notice the - sign is applied to each term inside the brackets.

To simplify

$$\begin{aligned} & (3x-7) - (2x+8) \\ & = 3x-7-2x-8 \\ & = x-15 \end{aligned}$$

Simplify the following:

- $(2x+3) - (x+5)$
- $(4x-4) - (-2x-3)$
- $-(2x+1) + (3x+4)$
- $-(3x-2) - (-2x-1)$
- $(-4x+3) - (2x-3)$
- $(2x+3) - (3x-2) - (x+4)$
- $5x - (4x+2) - (3-2x)$

Part C Expanding using the Distributive Law.

The distributive law says

$$a(b+c) = a \times b + a \times c = ab + ac$$

$$a(b-c) = a \times b - a \times c = ab - ac$$

So $7(x+y) = 7x+7y$ and $2(3x+4y) = 6x+8y$

Expand each expression below:

- | | |
|---------------------|---------------------------|
| 1. $5(k+1) =$ | 2. $2(3-2w) =$ |
| 3. $4(2m+1) =$ | 4. $-1(4+5y) =$ |
| 5. $-3(2-p) =$ | 6. $3(1-3b) =$ |
| 7. $-2(4r-5) =$ | 8. $-4(2s+2) =$ |
| 9. $6(2.5y-9.3) =$ | 10. $1.4(2x+7.5) =$ |
| 11. $9(6.8x-3.1) =$ | 12. $\frac{1}{2}(6+8z) =$ |
| 13. $3(x+2y-7) =$ | |
| 14. $-2(a-5b+2) =$ | |
| 15. $4(9p+q-9r) =$ | |
| 16. $5(x+6y-4) =$ | |

Part D To simplify with more than one set of brackets.

| | |
|-----------------------|------------------------|
| $3(2x+5y) + 7(4x-2y)$ | $-5(3m+6n) - 8(9m-2n)$ |
| $= 6x+15y+28x-14y$ | $= -15m-18n-72m+16n$ |
| $= 34x+y$ | $= -87m-2n$ |
| expand first | expand first |
| collect like terms | collect like terms |

| | | |
|---------------------|--------------------|--------------|
| $6h - (3h-4) - 12h$ | $= 6h-3h+4-12h$ | expand first |
| $= -9h+4$ | collect like terms | |

Complete the following in your notebook:

- $3x+2(5x-7)$
- $9-3(2x-4)$
- $8x-6(3-2x)$
- $-5+5(x+4)$
- $4(6x+9)-10x$
- $14-3(4n-1)$
- $-8n-8(-4-2n)$
- $7n-2(3n+1)-9$
- $-6+5(8-n)-8n$
- $7(2p-1)+5(3-4p)$
- $-5(-2p+7)-3(5-9p)$

1. State the numerical coefficient (nc) and literal coefficient (lc) of each term.

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|--------------------|------|------|-----------------------|------|------|
| a) $15y$ | nc = | lc = | g) $-10n^3m^2k$ | nc = | lc = |
| b) $-6x$ | nc = | lc = | h) $\frac{1x}{4}$ | nc = | lc = |
| c) $5x^2$ | nc = | lc = | i) $\frac{k}{6}$ | nc = | lc = |
| d) $\frac{3}{5}yz$ | nc = | lc = | j) $\frac{-x}{8}$ | nc = | lc = |
| e) m | nc = | lc = | k) $\frac{4y}{5}$ | nc = | lc = |
| f) $-n^2$ | nc = | lc = | l) $\frac{-3m^2n}{4}$ | nc = | lc = |

2. Simplify each expression.

- | | | | |
|-----------------------|-------------------------|---------------------------|-----------------|
| a) $10x + 4x$ | b) $10x + 4x$ | c) $12y - 8y$ | d) $12y - 8y$ |
| e) $\frac{-8y}{+12y}$ | f) $-8y + 12y$ | g) $\frac{7m}{+(-4m)}$ | h) $7m + (-4m)$ |
| i) $\frac{-5m}{-4m}$ | j) $-6m - 3m$ | k) $15x - 20x$ | l) $-25x + 20x$ |
| m) $-4m + 7m$ | n) $-8n + 5n - 2n + 7n$ | o) $3k - 10k - 10k + 17k$ | |

3. Simplify each expression.

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|--------------------------|-------------------------------|
| a) $5x + 3y - 2x - 2y$ | k) $10x + (-3x) =$ |
| b) $10m - 5k - 3m + 6k$ | l) $15x - (-5x)$ |
| c) $8x - 4y + 2x - 5y$ | m) $-4m + (-3m) =$ |
| d) $-5x + 6y + 3x - 4y$ | n) $-2m - (-3m)$ |
| e) $-3x - 3y + 5x + 6y$ | o) $4x - (-2x) + 3y + (-2y)$ |
| f) $-4a + 10m - 3a - 7m$ | p) $5x - (-5x) + 4y - (-4y)$ |
| g) $4x - 7x + 6y - 5y$ | q) $10m + (-3m) - 2x + (-2x)$ |
| h) $10k - 9k - 8m + 9m$ | r) $-4x - (-3x) - 5y - (-4y)$ |
| i) $-9k + 10k + 9m - 8m$ | |
| j) $-4x - 3y - 2x - 5y$ | |