MPM1D: Principles of Mathematics

Distributive Property

Part 2: Fractions and Decimals

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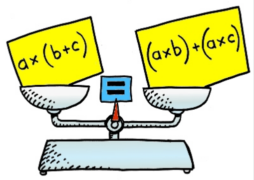

Distributive Property

Recap

Simplify $-6x^3(2x - 5x^4)$.

Watch the sign changes when multiplying by a negative.

$$\begin{aligned} -6x^3(2x - 5x^4) &= -6x^3(2x) - 6x^3(-5x^4) \\ &= -12x^5 + 30x^7 \end{aligned}$$

Distributive Property

In all of the previous examples, we have dealt with integral values only.

The distributive property can also be used with fractions, decimals, or any other real number.

As before, any fractional or decimal value is distributed across all terms of a polynomial.

Be sure to watch out for sign changes when dealing with negative values.

Distributive Property

Example

Expand $\frac{1}{2}(8x^2 - 12x + 20)$ using the distributive property.

Distribute the $\frac{1}{2}$ across all three terms of the trinomial.

$$\begin{aligned} \tfrac{1}{2}(8x^2 - 12x + 20) &= \tfrac{1}{2}(8x^2) - \tfrac{1}{2}(12x) + \tfrac{1}{2}(20) \\ &= 4x^2 - 6x + 10 \end{aligned}$$

Distributive Property

Example

Expand $0.4x(5x + 15x^2)$ using the distributive property.

Treat the decimal value the same as any other.

$$\begin{aligned} 0.4x(5x + 15x^2) &= 0.4x(5x) + 0.4x(15x^2) \\ &= 2x^2 + 6x^3 \end{aligned}$$

Distributive Property

Example

Expand $-\frac{3}{2}(14x^3 - 8x)$.

When multiplying a value by a fraction, remember that the numerator represents a multiplication, while the denominator represents a division.

While these can be done in any order, dividing first has the benefit of making a value smaller and (potentially) easier to work with.

$$\begin{aligned} -\tfrac{3}{2}(14x^3 - 8x) &= -\tfrac{3}{2}(14x^3) + \tfrac{3}{2}(8x) \\ &= -3(7x^3) + 3(4x) \\ &= -21x^3 + 12x \end{aligned}$$

Distributive Property

Example

Expand $\frac{3}{4}x(9x^2 + 6x - 10)$.

Sometimes terms remain as fractions. If so, be sure to reduce them to lowest terms.

$$\begin{aligned}\tfrac{3}{4}x(9x^2 + 6x - 10) &= \tfrac{3}{4}x(9x^2) + \tfrac{3}{4}x(6x) - \tfrac{3}{4}x(10)\\ &= \tfrac{27}{4}x^3 + \tfrac{9}{2}x^2 - \tfrac{15}{2}x\end{aligned}$$

Distributive Property

Example

Expand and simplify $\frac{2}{5}\left(\frac{1}{2}x^2 - \frac{3}{4}x\right)$.

When multiplying two fractions, remember to multiply the numerators and the denominators. Simplify if possible.

$$\begin{aligned}\tfrac{2}{5}\left(\tfrac{1}{2}x^2 - \tfrac{3}{4}x\right) &= \tfrac{2}{5}\left(\tfrac{1}{2}x^2\right) - \tfrac{2}{5}\left(\tfrac{3}{4}x\right)\\ &= \tfrac{1}{5}x^2 - \tfrac{3}{10}x\end{aligned}$$

Distributive Property

Example

Expand and simplify $\frac{1}{2}(3x + 5) - \frac{2}{3}(4x - 9)$.

First, use the distributive property to expand.

$$\begin{aligned}\tfrac{1}{2}(3x + 5) - \tfrac{2}{3}(4x - 9) &= \tfrac{1}{2}(3x) + \tfrac{1}{2}(5) - \tfrac{2}{3}(4x) + \tfrac{2}{3}(9)\\ &= \tfrac{3}{2}x + \tfrac{5}{2} - \tfrac{8}{3}x + 6\end{aligned}$$

Next, find common denominators for all like terms and simplify.

$$\begin{aligned}\tfrac{3}{2}x + \tfrac{5}{2} - \tfrac{8}{3}x + 6 &= \tfrac{9}{6}x + \tfrac{5}{2} - \tfrac{16}{6}x + \tfrac{12}{2}\\ &= \tfrac{9}{6}x - \tfrac{16}{6}x + \tfrac{5}{2} + \tfrac{12}{2}\\ &= -\tfrac{7}{6}x + \tfrac{17}{2}\end{aligned}$$

Questions?