# Understood 1

What happens when you multiply or divide something by $1$, or raise something to the first power? It stays the same. This is the premise of the "understood $1$." When you have a variable such as $x$, you should get to a point where you almost immediately remember that "just plain $x$" can be written as $1x$, because $x = 1 \cdot x = 1x$, and similarly that $x$ can be written as $x/1$ or $x^1$.

Cases of the Understood $1$:

$$x = 1 \cdot x$$

$$x = 1x$$

$$x = \frac{x}{1}$$

$$x = x^1$$

If we combine the kinds of techniques that we used to get these expression, we can also say

$$x = \frac{1x^1}{1}$$

Why is this useful? There are times when $x$ appears in a fraction, or $x$ is added to some term in which $x$ appears, or $x$ is multiplied by some factor in which $x$ appears. When something like this happens, it'll be helpful to remember the understood $1$ (and maybe even write out a $1$ instead of leaving it as an understood $1$).

**Example**

Simplify the expression.

$$(x+2x)\cdot x^3$$

Start by simplifying the expression in parentheses, using the fact that $x = 1x$.

$$(1x+2x)\cdot x^3$$

$$(3x)\cdot x^3$$

Multiply and remember that $3x = 3x^1$.

$$3x^1\cdot x^3$$

$$3x^4$$

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This time let's go in the opposite direction, by looking at an example where one or more "unnecessary" $1$'s appear in an expression that we can simplify by replacing the unnecessary $1$'s with understood $1$'s.

**Example**

Simplify the expression.

$$\frac{1}{1(1x^1)}+1\left(\frac{x}{1}+1\right)$$

In this example an unnecessary $1$ has been written out multiple times. Let's simplify by replacing each unnecessary $1$ with an understood $1$.

$$\frac{1}{1x^1}+1\left(\frac{x}{1}+1\right)$$

$$\frac{1}{x^1}+1\left(\frac{x}{1}+1\right)$$

$$\frac{1}{x}+1\left(\frac{x}{1}+1\right)$$

$$\frac{1}{x}+\frac{x}{1}+1$$

$$\frac{1}{x}+x+1$$

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In our next example, we'll see how to deal with the understood $1$ when we want to add two fractions where the denominator of one fraction is just plain $x$ and the denominator of the other fraction is $x$ raised to some power other than $1$.

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**Example**

Add the fractions.

$$\frac{2}{x}+\frac{5}{x^3}$$

In the denominator of the first fraction, use the fact that $x = x^1$.

$$\frac{2}{x^1} + \frac{5}{x^3}$$

If we multiply the top and bottom of the first fraction by $x^2$, we'll find that we can use $x^3$ as the common denominator.

$$\frac{2}{x^1}\left(\frac{x^2}{x^2}\right) + \frac{5}{x^3}$$

$$\frac{2(x^2)}{x^1(x^2)} + \frac{5}{x^3}$$

$$\frac{2x^2}{x^3} + \frac{5}{x^3}$$

$$\frac{2x^2 + 5}{x^3}$$