

WeBWork Syntax

WeBWork uses calculator-like syntax, this is, you need to input your answer using a specific order. The complete rules for the precedence of operations are:

- Multiplications and divisions are performed left to right: $2/3*4 = (2/3)*4 = 8/3$.
- Additions and subtractions are performed left to right: $1-2+3 = (1-2)+3 = 2$.
- Exponents are taken right to left: $2^3^4 = 2^{(3^4)} = 2^{81} = \text{a big number}$.

Use the "Preview Button" to see exactly how your entry looks. E.g. to tell the difference between $1+2/3*4$ and $[1+2]/[3*4]$ click the "Preview Button".

Example:

- Perform all calculations inside brackets or parentheses. If you have more than one set of brackets, do the inner brackets first. Example: $180/((12-2)*3^2)-2 = 180/((10)*3^2)-2$
- Simplify exponents or radicals. Example: $180/(10*3^2)-2 = 180/(10*9)-2$
- Multiply or divide. Example $180/(10*9)-2 = 180/90-2 = 2-2$
- Add or subtract subtract. Example $2-2 = 0$

Operators. Here are some of the basic mathematical operators that you can use in WeBWork:

Operator	Description	Example	Syntax
+	Unary plus indicates addition, or indicates that a value x is positive	$x + y$ $+z$	x+y +z
-	Unary minus, indicates subtraction, or indicates that a value x is negative	$x - y$ $-z$	x-y -z
*	Multiplication	$x * y$ xy	x * y xy

Continued...

Operator	Description	Example	Syntax
/	Division	x/y	<code>x/y</code>
^	Exponentiation, such as powers square root n-root	x^y 10^3 $\sqrt{5}$ $\sqrt[5]{5}$ $\sqrt[6]{123}$	<code>x^y</code> <code>10^3</code> <code>5^(1/2)</code> <code>sqrt(5)</code> <code>123^(1/6)</code>
**	Exponentiation, same as ^ above	x^y	<code>x**y</code>
!	Factorial	$4! = 4 * 3 * 2 * 1$	<code>4!</code>
,	List separator (set, points, etc.)	$1, 2, 3, 4, \dots$	<code>1,2,3,4,...</code>

Grouping symbols. Parentheses (), brackets [] and braces { } are used in two ways: to group algebraic expressions or to define intervals in the real numbers.

- Grouping algebraic expressions.** You can use any of the above grouping symbols to group algebraic expressions but **they must match**, otherwise you will have the error of “Mismatched parentheses”. Here is an example:
 $3*(4+5)$ and $2*[2*(4+5)+6]$ are valid.
 $3*(4+5}$ and $2*[2*(4+5}+6]$ will give the error: “Mismatched parentheses: '(' and '}'”.
- Defining intervals in the real numbers.** You need to use (,) to denote open intervals, and [,] to denote closed intervals. Be **careful** as this notation might exceptionally change in some problems, **if** it ever changes it will be stated in the specific problem for which this happens. Next we have an example of intervals:
 $(-1, 3)$, open interval such that $-1 < x < 3$.
 $[5, 10]$, open interval such that $5 \leq x \leq 10$.

Constants.

Constant	Value	Example
pi	This gives 3.14159265358979	<code>cos(pi) = -1</code>
e	This gives 2.71828182845905	<code>ln(2*e) = 1+ln(2)</code>

Functions. There are mathematical functions built-in in WeBWork. In general, functions can be used with or without parentheses. For example `cosx` is equivalent to `cos(x)`. However, using parentheses makes grouping more explicit and it is highly recommended.

Not all functions are available in all problems.

Function	Description	Example	Syntax
<code>sqrt()</code>	Square root; $\sqrt{\quad}$	$\sqrt{36}$	<code>sqrt(36)</code>
<code>abs()</code>	Absolute value; $ \quad $,	$ -33 $	<code>abs(-33)</code>
<code>int()</code>	Integer or floor function; $\lfloor \quad \rfloor$,	$\lfloor 1.234 \rfloor$	<code>floor(1.234)</code>
<code>exp()</code>	Exponential function; e^x	e^{100}	<code>exp(100)</code>
<code>log()</code>	Logarithmic function; $\log(x)$ base e or base 10 depending on each problem	$\log 100$	<code>log(100)</code>
<code>ln()</code>	Natural logarithm; $\ln(x)$	$\ln(2e)$	<code>ln(2*e)</code>
<code>log10()</code> <code>logten()</code>	Logarithm in base 10; $\log_{10}(x)$	$\log_{10}(30)$	<code>log10(30)</code> <code>logten(30)</code>
<code>logb()</code>	Logarithm in base b; $\log_b(x)$ WeBWork does not have a function for $\log_b(x)$, instead you need to use the change of base formula.	$\log_b(15)$ $\log_b(x) = \frac{\log(x)}{\log(b)}$	<code>log(15)/log(b)</code>
<code>sin()</code> <code>cos()</code> <code>tan()</code> <code>sec()</code> <code>csc()</code> <code>cot()</code>	Trigonometric functions Sine function; $\sin(x)$ Cosine function; $\cos(x)$ Tangent function; $\tan(x)$ Secant function; $\sec(x)$ Cosecant function; $\csc(x)$ Cotangent function; $\cot(x)$	$\sin(3\pi)$ $\cos(3\pi)$ $\tan(3\pi)$ $\sec(\pi/4)$ $\csc(\pi/4)$ $\cot(\pi/4)$	<code>sin(3*pi)</code> <code>cos(3*pi)</code> <code>tan(3*pi)</code> <code>sec(pi/4)</code> <code>csc(pi/4)</code> <code>cot(pi/4)</code>

Other functions. List of other trigonometric and hyperbolic functions:

- **Inverse trigonometric functions:** `asin()`, `arcsin()`, `acos()`, `arccos()`, `atan()`, `arctan()`, `asec()`, `arcsec()`, `acsc()`, `arccsc()`, `acot()`, `arccot()` .

- **Simple hyperbolic functions:** `sin()`, `cosh()`, `tanh()`, `sech()`, `csch()`, `coth()` .
- **Inverse hyperbolic functions:** `asinh()`, `arsinh()`, `acosh()`, `arcosh()`, `atanh()`, `artanh()`, `asech()`, `arcsech()`, `acsch()`, `arccsch()`, `acoth()`, `arcoth()` .

Units. Some problems require an answer that consists of a numerical value followed by an abbreviation for the appropriate units of the physical quantity. A space must separate the numerical value from the units, as in for example 1.234 m.

Below is a list of basic units and how they need to be abbreviated in WeBWork answers. In some problems, you may need to combine units (e.g, velocity might be in ft/s for feet per second). Whenever you need to answer with units this will be stated in the problem.

Unit	Abbr.	Unit	Abbr.	Unit	Abbr.
Seconds	s	Minutes	min	Hours	hr
Days	day	Years	year	Milliseconds	ms
Feet	ft	Inches	in	Miles	mi
Meters	m	Centimeters	cm	Milimeters	mm
Kilometers	km	Angstroms	Å	Light years	light-year
Grams	g	Kilograms	kg	Slugs	slug
Liters	L	Centimeters ³	cc	Mililiters	ml
Newtons	N	Dynes	dyne	Pounds	lb
Tons	ton	Joules	J	Kilo Joule	kJ
ergs	erg	foot pounds	lbf	calories	cal
Kilo calories	kcal	electron volts	eV	Kilo Watt hours	kWh

Important hints:

- Be careful entering expressions just as you would be careful entering expressions in a calculator.
- Use the "Preview Button" to see exactly how your entry looks. E.g. to tell the difference between $1+2/3*4$ and $[1+2]/[3*4]$ click the "Preview Button".

- Don't enter $2/4+5$ (which is 5.5) when you really want $2/(4+5)$ (which is $2/9$).
- Don't enter $2/3*4$ (which is $8/3$) when you really want $2/(3*4)$ (which is $2/12$).
- Entering big quotients with square brackets, e.g. $[1+2+3+4]/[5+6+7+8]$, is a good practice.
- Be careful when entering functions. It's always good practice to use parentheses when entering functions. Write $\sin(t)$ instead of $\sin t$ or $\sin t$ even though WeBWork is smart enough to usually accept $\sin t$ or even $\sin t$. For example, $\sin 2t$ is interpreted as $\sin(2)t$, i.e. $(\sin(2))^t$ so be careful.
- You can enter $\sin^2(t)$ as a short cut although mathematically speaking $\sin^2(t)$ is shorthand for $(\sin(t))^2$ (the square of \sin of t). (You can enter it as $\sin(t)^2$ or even $\sin t^2$, but don't try such things unless you really understand the precedence of operations. The "sin" operation has highest precedence, so it is performed first, using the next token (i.e. t) as an argument. Then the result is squared.) You can always use the Preview button to see a typeset version of what you entered and check whether what you wrote was what you meant. :-)
- For example $2+3\sin^2(4x)$ will work and is equivalent to $2+3(\sin(4x))^2$ or $2+3\sin(4x)^2$. Why does the last expression work? Because things in parentheses are always done first [i.e. $(4x)$], next all functions, such as \sin , are evaluated [giving $\sin(4x)$], next all exponents are taken [giving $\sin(4x)^2$], next all multiplications and divisions are performed in order from left to right [giving $3\sin(4x)^2$], and finally all additions and subtractions are performed [giving $2+3\sin(4x)^2$].
- Is -5^2 positive or negative? It's negative. This is because the square operation is done before the negative sign is applied. Use $(-5)^2$ if you want to square negative 5. When in doubt use parentheses!!! :-)