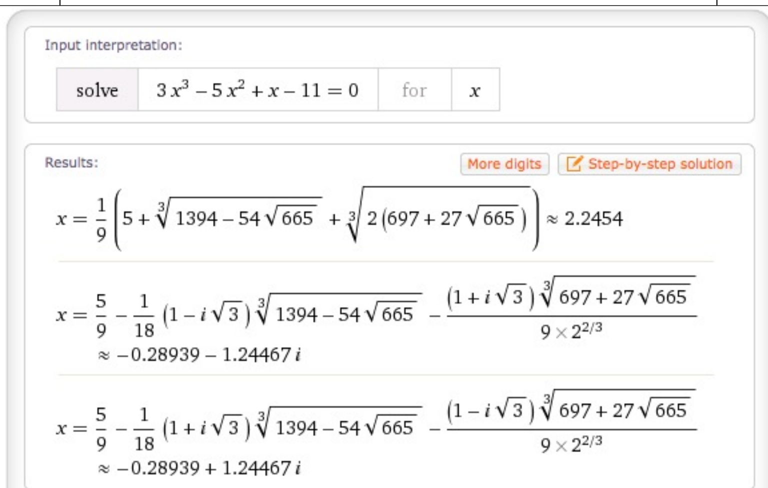
Wolfram|Alpha (W|A) is a free utility available on the Internet. It is published by Wolfram Alpha LLC and was developed by Wolfram Research, Inc.

Wolfram|Alpha is one of the most extraordinary utilities on the Internet, and is capable of organizing and delivering a staggering amount of information. However, we are going to focus on its mathematical abilities as they apply to our calculus course.

When asked to perform a mathematical operation, W|A calls on *Mathematica*, a computer algebra system developed by Wolfram Research, Inc. While it is certainly possible to use vernacular language with W|A (indeed, this is one of the most amazing of W|A's abilities) knowing a little of the specific format used by *Mathematica* can help to speed up W|A and to insure that we will get the results that we desire.

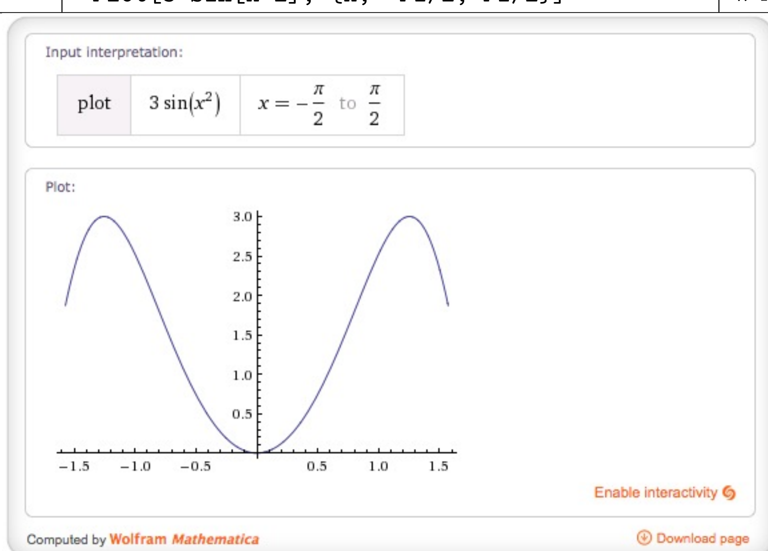
Solving Equations

Traditional	Wolfram|Alpha or *Mathematica*	Comments
$3x^3 - 5x^2 + x - 11 = 0$	`Solve[3x^3-5x^2+x-11==0, x]`	Note the double equal sign for Wolfram|Alpha



Graphing Functions

Traditional	Wolfram|Alpha or *Mathematica*	Comments
$f(x) = 3\sin(x^2)$	`Plot[3*Sin[x^2], {x, -Pi/2, Pi/2}]`	π is written `Pi`



Differentiation

Traditional	Wolfram|Alpha or *Mathematica*	Comments
$\frac{\mathrm{d}}{\mathrm{d}x}\left[x^2 - 3x + \ln(2x)\right]$	`D[x^2 - 3x + Log[2x], x]`	For Mathematica, the natural logarithm, $\ln(x)$, is written `Log[x]`.
	Derivative: Step-by-step solution $\frac{d}{dx}\left(x^2 - 3\,x + \log(2\,x)\right) = 2\,x + \frac{1}{x} - 3$ $\log(x)$ is the natural logarithm »	
$\frac{\mathrm{d}^4}{\mathrm{d}x^4}\left[\mathrm{e}^{x^2}\cos(3x)\right]$	`D[E^(x^2)*Cos[3x], {x,4}]`	For Mathematica, the natural exponential base, e, is written `E`. Note the computation of the fourth derivative.
	Derivative: $\frac{d^4}{dx^4}\left(e^{x^2}\cos(3\,x)\right) = e^{x^2}\left(24\,x\left(3 - 4\,x^2\right)\sin(3\,x) + \left(16\,x^4 - 168\,x^2 - 15\right)\cos(3\,x)\right)$ Open code	
$\frac{\mathrm{d}}{\mathrm{d}x}\left[\sin(xy) = 2x + 3y^2\right]$	`D[Sin[x*y] == 2x+3y^2, x]`	Implicit differentiation; note that xy must be written as `x*y`.
	Result: Step-by-step solution $y'(x) = \frac{y\cos(x\,y) - 2}{6\,y - x\cos(x\,y)}$	

Summation

Traditional	Wolfram|Alpha or *Mathematica*	Comments
$\sum_{k=2}^{9}\left(5k^2 - 7k + 1\right)$	`Sum[5k^2-7k+1, {k,2,9}]`	The choice of letter for the counter variable is unimportant. Many books use k or i or n.
	Sum: $\sum_{k=2}^{9}\left(5\,k^2 - 7\,k + 1\right) = 1120$	
$\sum_{k=1}^{\infty}\frac{1}{k^2}$	`Sum[1/(k^2), {k, 0, Infinity}]`	How about that!
	Infinite sum: $\sum_{k=1}^{\infty}\frac{1}{k^2} = \frac{\pi^2}{6}$	

Integration

<table>
<tr><td>Traditional</td><td>Wolfram|Alpha or Mathematica</td><td>Comments</td></tr>
<tr><td>$\int \frac{2}{3}t^4 - \tan^{-1}(t)\ \mathrm{d}t$</td><td><code>Integrate[(2/3)t^4 - ArcTan[t], t]</code></td><td>Note how inverse trig. functions are written.</td></tr>
<tr><td></td><td>Indefinite integral: Step-by-step solution
$\int \left(\frac{2\,t^4}{3} - \tan^{-1}(t)\right) dt = \frac{2\,t^5}{15} + \frac{1}{2}\log(t^2+1) - t\tan^{-1}(t) + \text{constant}$
$\tan^{-1}(x)$ is the inverse tangent function »
$\log(x)$ is the natural logarithm »</td><td></td></tr>
<tr><td>$\int_0^{\pi/4} \sin^2(x)\cos^3(x)\ \mathrm{d}x$</td><td><code>Integrate[Sin[x]^2*Cos[x]^3, {x, 0, Pi/4}]</code></td><td>Definite integrals use the list <code>{variable, lower limit, upper limit}</code></td></tr>
<tr><td></td><td>Definite integral: More digits
$\int_0^{\frac{\pi}{4}} \sin^2(x)\cos^3(x)\,dx = \frac{7}{60\sqrt{2}} \approx 0.0824958$</td><td></td></tr>
</table>