

**Calculus:**

Eq #	Expression Type	Form	First Derivative	Related Integral
1	Constant	$c$	$\frac{dy}{dx} = 0$	$\int c \, dx = cx + C$
2	Polynomial	$y = x^n$ Recall $1 = x^0, x = x^1$	$\frac{dy}{dx} = nx^{n-1}, \frac{dx}{dx} = 1$	$\int x^n \, dx = \frac{x^{n+1}}{n+1} + C$
3	Power of a Functions	$y = u^n$	$\frac{dy}{dx} = \frac{du}{dx} nu^{n-1}$	$\int u^n \, du = \frac{u^{n+1}}{n+1} + C \quad n \neq -1$
4	Log	$y = \ln u$	$\frac{dy}{dx} = \frac{1}{u} \frac{du}{dx}$	$\int u^{-1} \, du = \int \frac{du}{u} = \ln u  + C$
5	Sin(u)	$y = \sin u$	$\frac{dy}{dx} = \frac{du}{dx} \cos u$	$\int \cos u \, du = \sin u + C$
6	Cos(u)	$y = \cos u$	$\frac{dy}{dx} = -\frac{du}{dx} \sin u$	$\int \sin u \, du = -\cos u + C$
7	Exponent	$y = e^u$	$\frac{dy}{dx} = \frac{du}{dx} e^u$	$\int e^u \, du = e^u + C$
8	Product of Constant and Function	$y = cu$	$\frac{dy}{dx} = c \frac{du}{dx}$	$\int cf(u) \, du = c \int f(u) \, du$
9	Sum of two functions	$y = u + v$	$\frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}$	$\int \{f(u) + g(u)\} \, du = \int f(u) \, du + \int g(u) \, du$
10	Product of two functions	$y = uv$	$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$	Integration by parts: $\int u \, dv = uv - \int v \, du$
11	Quotient of two Functions	$y = \frac{u}{v}$	$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$	
12	Chain Rule	$y = f(u(x))$	$\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$	$\int f(u(x)) \left( \frac{du}{dx} \right) dx = \int f(u) \, du$

**Partial fractions** – there are three types. Combine RHS over LCD then equate numerators then pick convenient values of  $s$  to find  $A, B, C$ . Or, use the TI-89 F2/Expand.

Type
Product of simple linear factors: $\frac{7s-1}{(s+1)(s-3)} = \frac{A}{s+1} + \frac{B}{s-3} \rightarrow 7s-1 = A(s-3) + B(s+1)$
Repeated linear factor: $\frac{7s-1}{(s+1)^2(s-3)} = \frac{A}{s-3} + \frac{B}{s+1} + \frac{C}{(s+1)^2}$ Quadratic factor: $\frac{7s-1}{(s^2+1)(s-3)} = \frac{As+B}{s^2+1} + \frac{C}{s-3}$

**Algebra Rules**

Distributive Law			FOIL
$a(b \pm c) = ab \pm ac$	$(a+b)(a-b) = a^2 - b^2$	$(a \pm b)^2 = a^2 \pm 2ab + b^2$	$(a+b)(c+d) = ac + ad + bc + bd$

**Completing the square** - A TI-89 program: <http://uhaweb.hartford.edu/ltownsend/comsqr.zip>

**Problem:** transform a quadratic as follows:  $Ax^2 + Bx + C = A\{(x+a)^2 + b^2\}$

**Solution:**

1) Expand the right hand side:  $Ax^2 + Bx + C = A\{x^2 + 2ax + a^2 + b^2\}$

2) Match coefficient of  $x$  to find  $a$ :  $B = 2Aa$  so  $a = \frac{B}{2A}$

3) The constant is  $b^2$   $C = A\{a^2 + b^2\}$  so  $b^2 = \frac{C}{A} - a^2$

**Properties of Logarithms and Exponents**

$v = \log_b u$       $u = b^v$

Name	Exponents	Logs
Product Rule	$b^u b^v = b^{u+v}$	$\log_b u + \log_b v = \log_b uv$
Division Rule	$\frac{b^u}{b^v} = b^{u-v}$ $b^{-v} = \frac{1}{b^v}$	$\log_b u - \log_b v = \log_b \frac{u}{v}$
Power Rule	$(b^u)^v = b^{uv}$	$\log_b u^v = v \log_b u$
Unity	$b^0 = 1$	$\log_b 1 = 0$
Identity	$u = b^{\log_b u}$	$\log_b b = 1$
Equality: $u = v$ $b^u = b^v$ $\log_b u = \log_b v$		Base Conversion: $\log_b u = \frac{\log_a u}{\log_a b}$

**Trig**

SOHCAHTOA:  $\sin u = \frac{opp}{hyp}$       $\cos u = \frac{adj}{hyp}$       $\tan u = \frac{opp}{adj} = \frac{\sin u}{\cos u}$

Law of sines  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$  (side  $a$  is opposite angle  $A$ , etc.)

Law of cosines  $a^2 = b^2 + c^2 - 2bc \cos A$  (side  $a$  is opposite angle  $A$ )

$\cos^2 A + \sin^2 A = 1$      All Students Take Calculus:  (positive trig functions)

$\sin(A+B) = \sin A \cos B + \cos A \sin B$       $\cos(A+B) = \cos A \cos B - \sin A \sin B$

*Caveat:* When using inverse trig functions, beware - the calculator returns only one of the possible two answers – you need to figure out the other one.

$a \cos \omega t + b \sin \omega t = A \sin(\omega t + \phi)$  with  $A = \sqrt{a^2 + b^2}$       $\tan \phi = a/b$

**Other**

Arc length:  $s = r\theta$      Sector area:  $A = \frac{1}{2} r^2 \theta$

$\sqrt{a} = a^{\frac{1}{2}}$       $\sqrt[n]{a^m} = a^{\frac{m}{n}}$       $\frac{1}{a^n} = a^{-n}$

FOIL (First, Outer, Inner, Last) = how to multiply two binomials

PEMDAS (Parentheses, Exponents, Multiply, Divide, Add, Subtract) = order of operations

Quadratic equation:  $ax^2 + bx + c = 0$      solution:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$