

Hyperbolic Functions

Hyperbolic Functions

The hyperbolic functions are certain combinations of exponentials e^x and e^{-x} .

$$\sinh x = (e^x - e^{-x}) / 2 \quad (1)$$

$$\cosh x = (e^x + e^{-x}) / 2 \quad (2)$$

$$\tanh x = \sinh x / \cosh x = (e^x - e^{-x}) / (e^x + e^{-x}) \quad (3)$$

Values for Hyperbolic Functions

x	sinh x	cosh x	tanh x
0	0	1	0
0.1	0.10017	1.005	0.09967
0.3	0.30452	1.04534	0.29131
0.4	0.41075	1.08107	0.37995
0.5	0.5211	1.12763	0.46212
0.6	0.63665	1.18547	0.53705
0.7	0.75858	1.25517	0.60437
0.8	0.88811	1.33743	0.66404
0.9	1.02652	1.43309	0.7163
1	1.1752	1.54308	0.76159
1.1	1.33565	1.66852	0.8005
1.2	1.50946	1.81066	0.83365
1.3	1.69838	1.97091	0.86172
1.4	1.9043	2.1509	0.88535
1.5	2.12928	2.35241	0.90515
1.6	2.37557	2.57746	0.92167
1.7	2.64563	2.82832	0.93541
1.8	2.94217	3.10747	0.94681
1.9	3.26816	3.41773	0.95624
2	3.62686	3.7622	0.96403
2.5	6.0502	6.13229	0.98661
3	10.0179	10.0677	0.99505
3.5	16.5426	16.5728	0.99818
4	27.2899	27.3082	0.99933
4.5	45.003	45.0141	0.99975
5	74.2032	74.2099	0.99991

Inverse Hyperbolic Functions

$$\sinh^{-1} x = \log_e(x + (x^2 + 1)^{1/2}) \quad (4)$$

$$\cosh^{-1} x = \log_e(x \pm (x^2 - 1)^{1/2}) \quad x \geq 1 \quad (5)$$

$$\tanh^{-1} x = 1/2 \log_e((1 + x) / (1 - x)) \quad x^2 < 1 \quad (6)$$