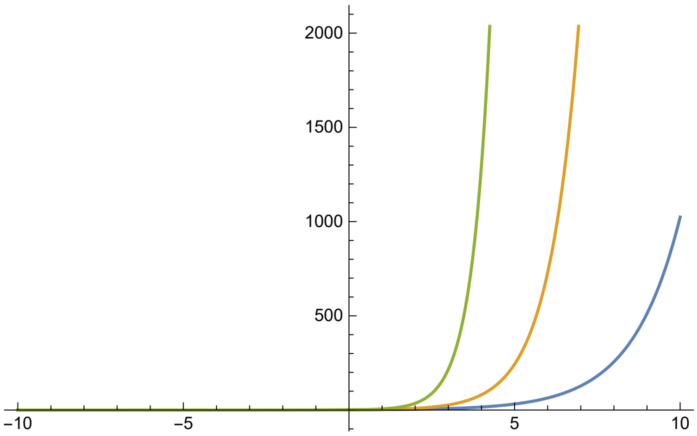
Basic function shapes

Power function

Approximates a constantly increasing rate of change.

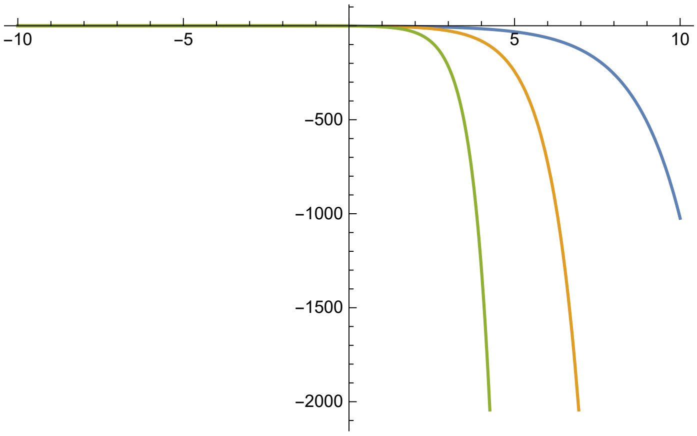
$$f(x) = a\,x^b$$

Out[293]=



The “negative version” of the above is not a different function, it’s just the above multipled by -1:

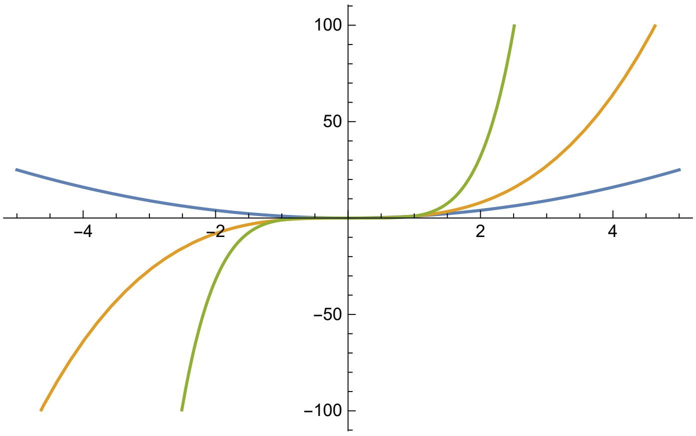
Out[249]=



Exponential function

$$f(x) = a\,b^x$$

Out[300]=



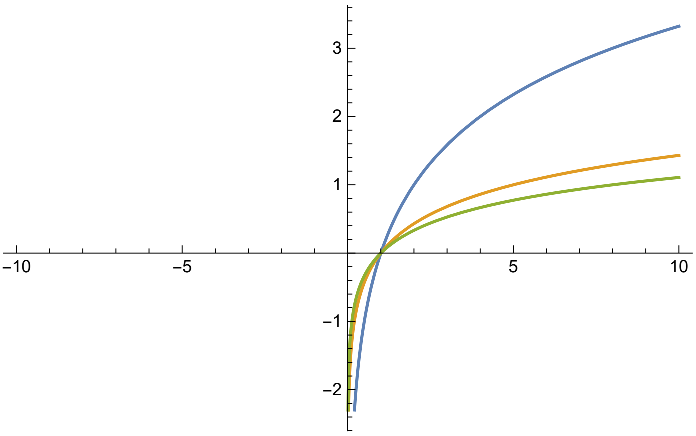
Logarithmic function

Approximates a constantly decreasing rate of change.

Informally, a logarithm is an “inverse” of an exponentiation.
An exponentiated variable is the value the variable assumes when exponentiated (that is, multiplied by itself) a certain number of times.
The logarithm of a variable is the **exponent** a variable must exhibit (that is, how many times it must be multiplied by itself) to assume a certain value.

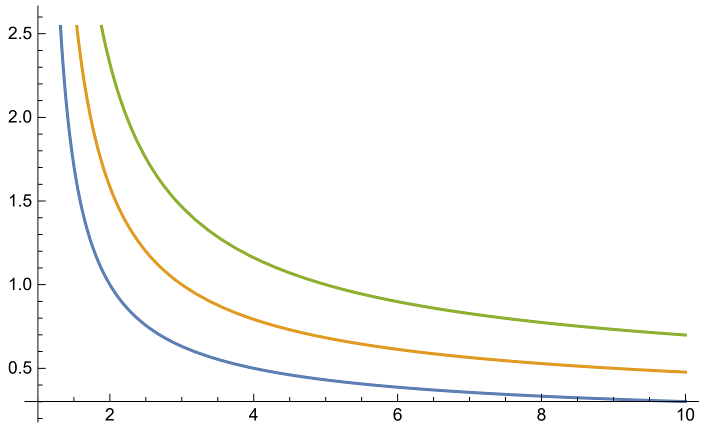
$f(x) = \log_b x$

Out[299]=



$f(x) = \log_b x$

Out[254]=



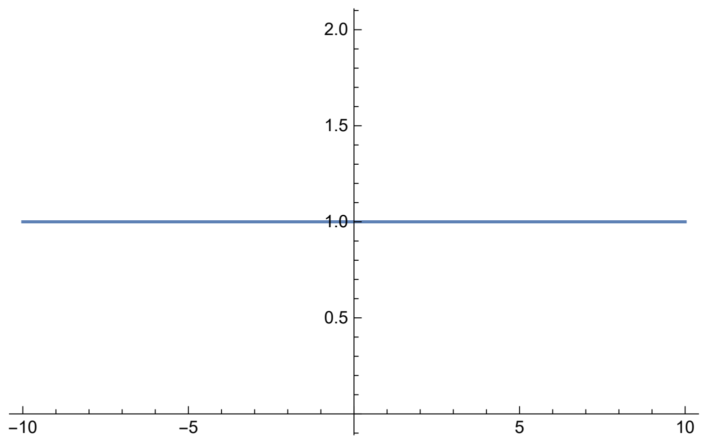
Polynomial function

The polynomial function possesses a degree value indicated by the highest exponent in all of its terms.
It exhibits an added inflection point or, informally, is a "one step" more complex curve with each higher degree.

Degree 0 polynomial

$f(x) = x^0$

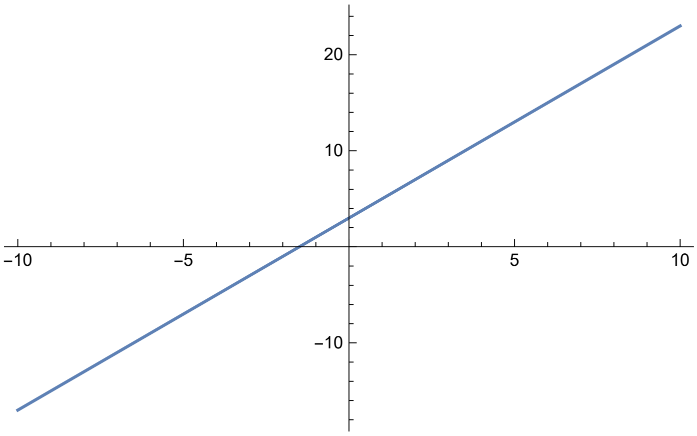
Out[298]=



Degree 1 polynomial

$f(x) = 2\,x^1 + 3\,x^0$

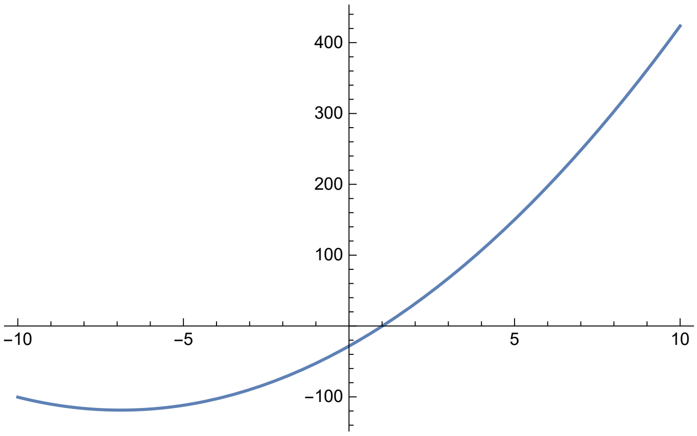
Out[294]=



Degree 2 polynomial

Curve of interest: $1.9\,x^2 + 26.2\,x^1 - 28.4\,x^0$.

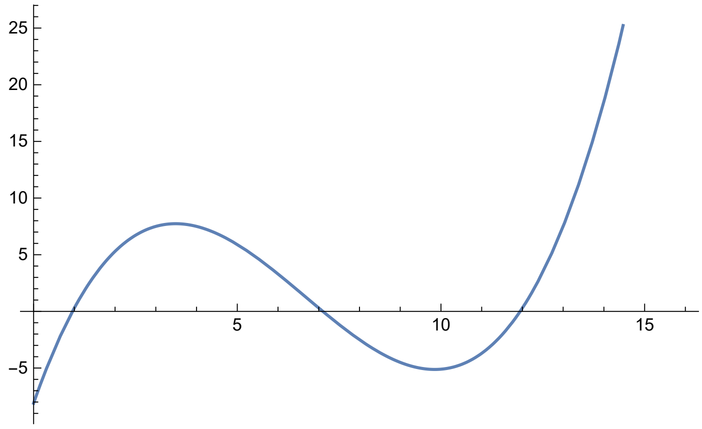
Out[260]=



Degree 3 polynomial

Curve of interest: $0.1\,x^3 - 2\,x^2 + 10.3\,x^1 - 8.1\,x^0$.

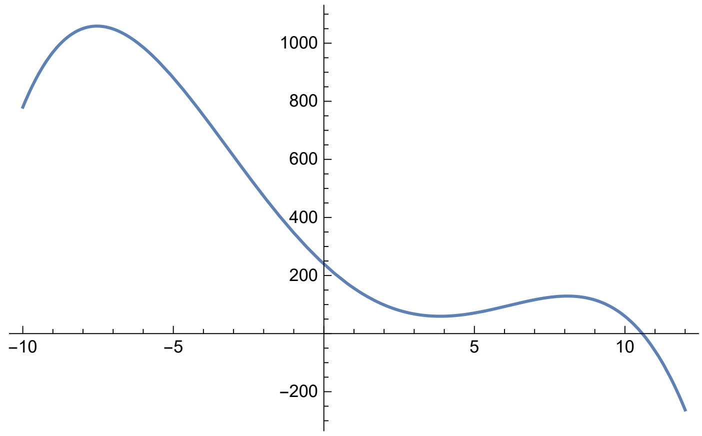
Out[263]=



Degree 4 polynomial

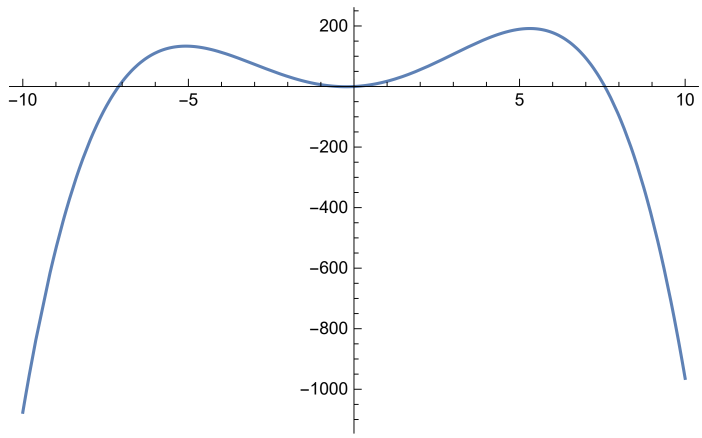
Curve of interest: $-0.102\,x^4 + 0.6\,x^3 + 12\,x^2 - 96\,x^1 + 239.7\,x^0$.

Out[266]=



Curve of interest: $-0.222\,x^4 + 0\,x^3 + 12\,x^2 + 5.6\,x^1 + 0\,x^0$.

Out[267]=



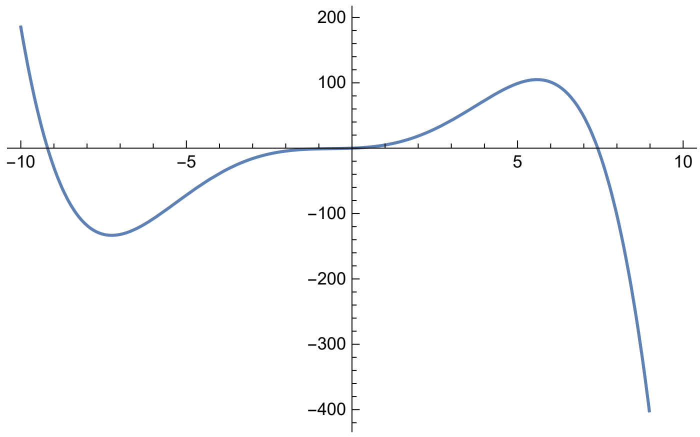
Degree 5 polynomial

With each higher degree, the input into the complexity of the shape becomes greater of the highest parameters in the polynomial, that is, the terms with highest coefficients.

The lower degree terms necessitate exhibiting higher magnitude coefficients to impart the same effect on the shape of the curve, than the higher degree terms can with just lower magnitude coefficients.

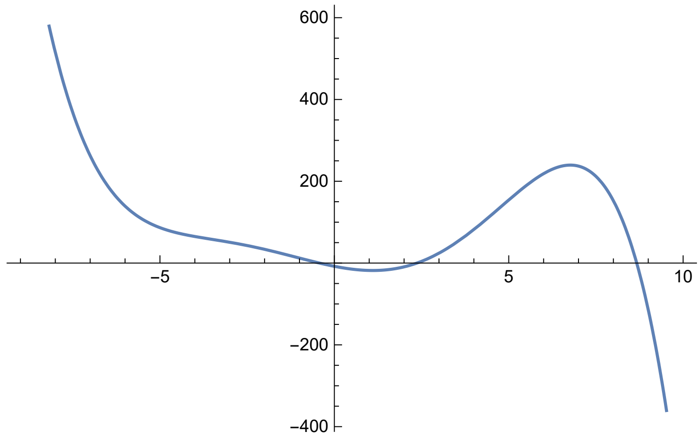
Curve of interest: $-0.015873\,x^5 - 0.0582011\,x^4 + 1\,x^3 + 2\,x^2 + 2\,x^1 + 0\,x^0$.

Out[270]=



Curve of interest:
$-0.026455\,x^5 + 0.0052909\,x^4 + 1.6\,x^3 + 5\,x^2 - 16.7\,x^1 - 7.9\,x^0$.

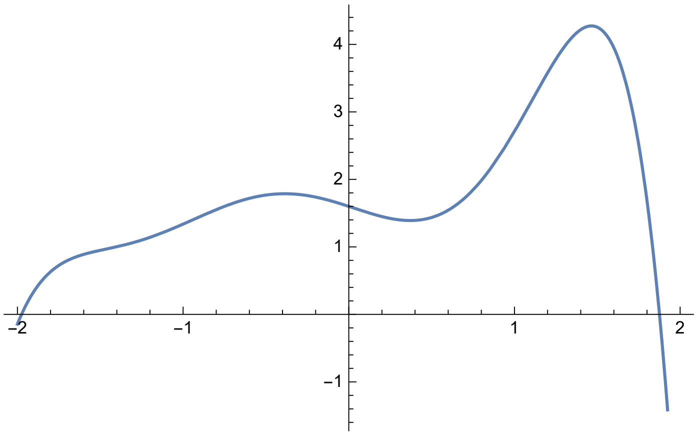
Out[271]=



Degree 6 polynomial

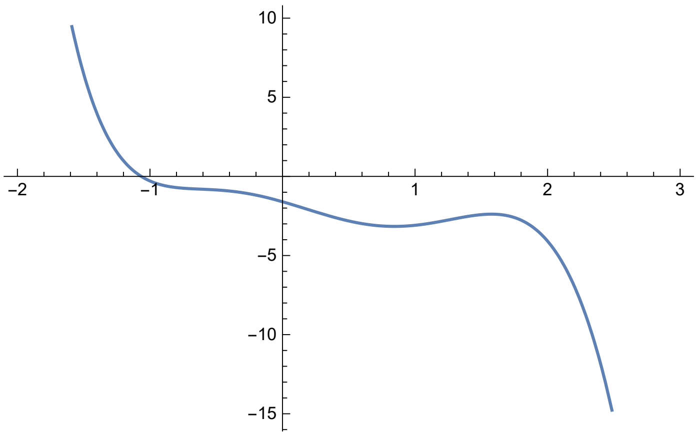
Curve of interest: $-0.269841\,x^6 - 0.51323\,x^5 + 0.8939\,x^4 + 2\,x^3 - 0.2\,x^2 - 0.8\,x^1 + 1.6\,x^0$.

Out[274]=



Curve of interest:
$0.111111\,x^6 - 1\,x^5 + 0.9999\,x^4 + 2\,x^3 - 1.2\,x^2 - 2.4\,x^1 - 1.6\,x^0$.

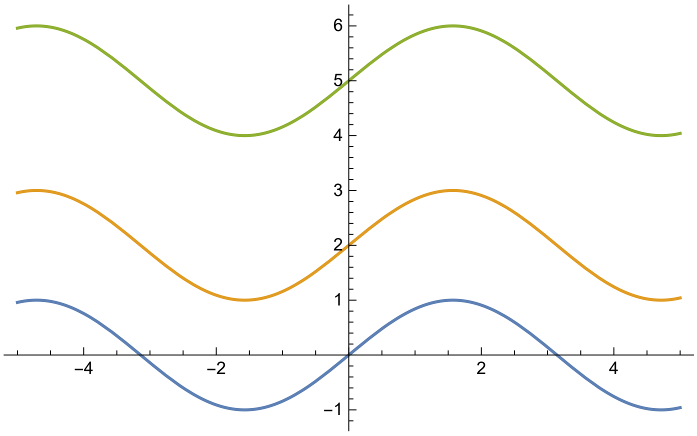
Out[275]=



Sinusoidal function

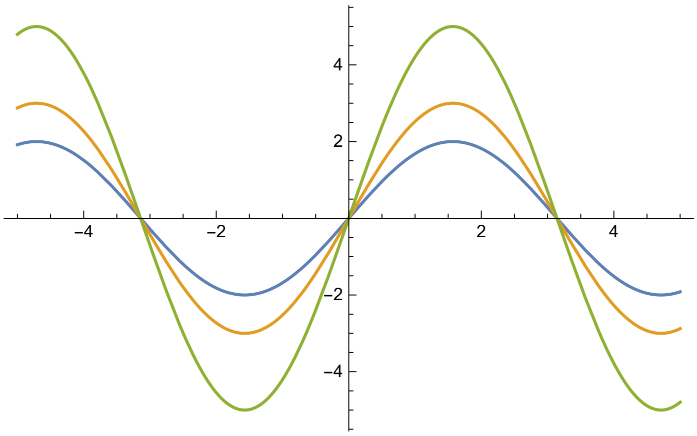
$$f(x) = a + b\sin(c\,x + d)$$

Out[277]=



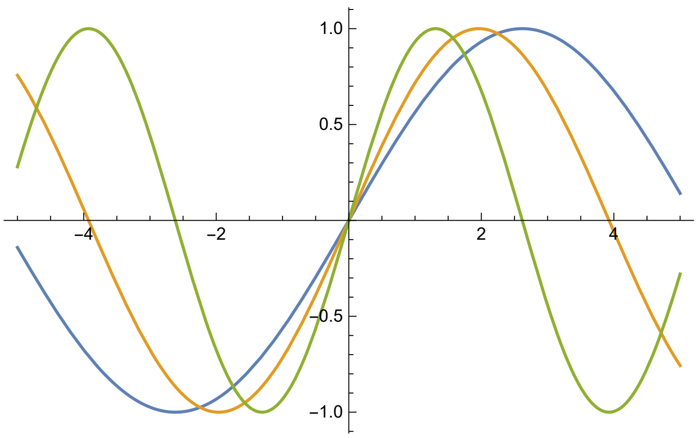
$f(x) = a + b \sin(c x + d)$

Out[278]=



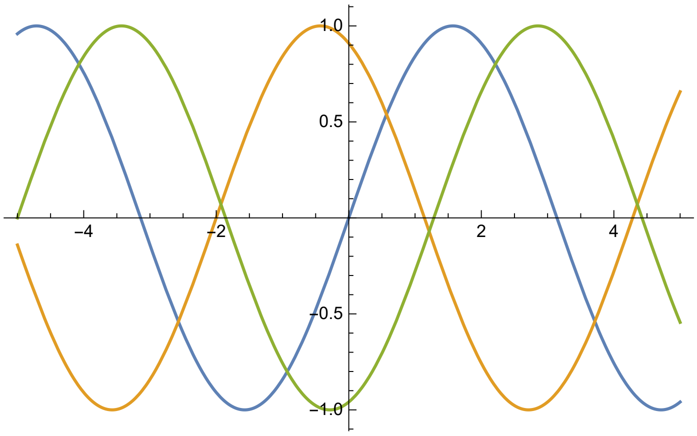
$f(x) = a + b \sin(c x + d)$

Out[279]=



$f(x) = a + b \sin(c x + d)$

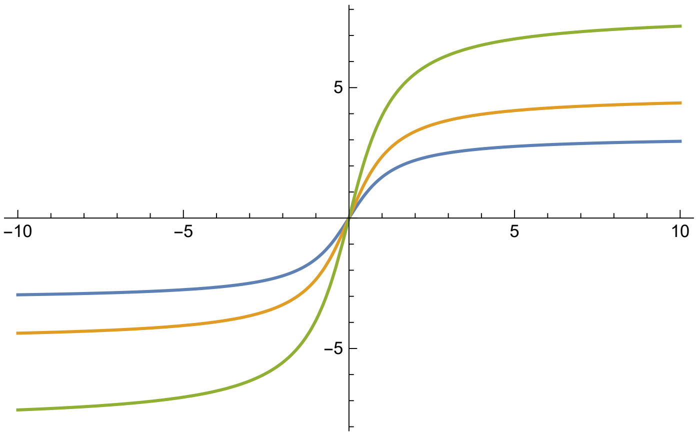
Out[280]=



Arc tangent

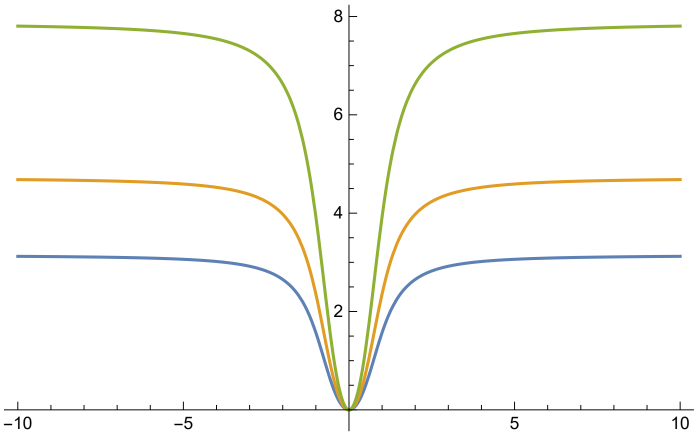
$$f(x) = a \arctan(x)$$

Out[178]=



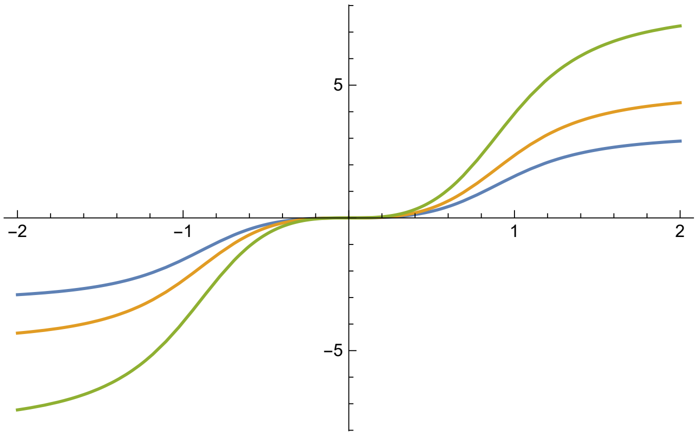
$$f(x) = a \arctan(x^2)$$

Out[200]=



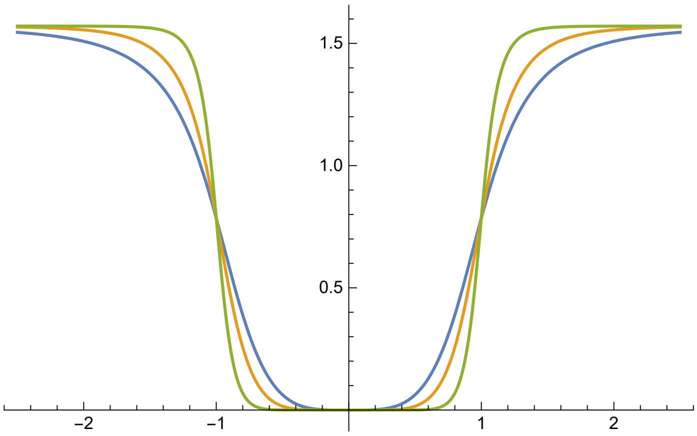
$$f(x) = a \arctan(x^3)$$

Out[198]=



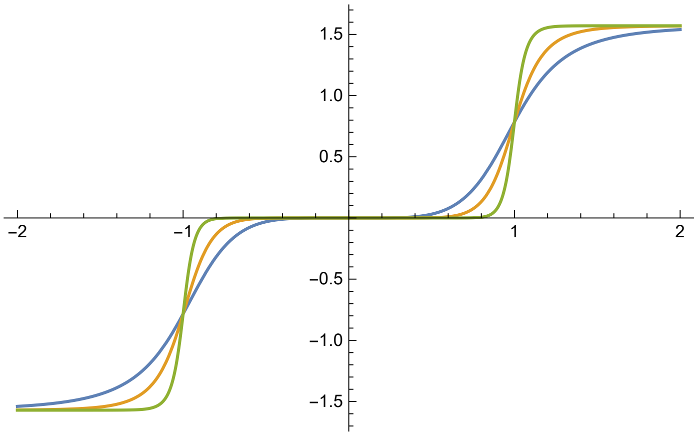
$f(x) = \arctan(x^{n}), n$ even

Out[210]=



$f(x) = \arctan(x^{n}), n$ odd

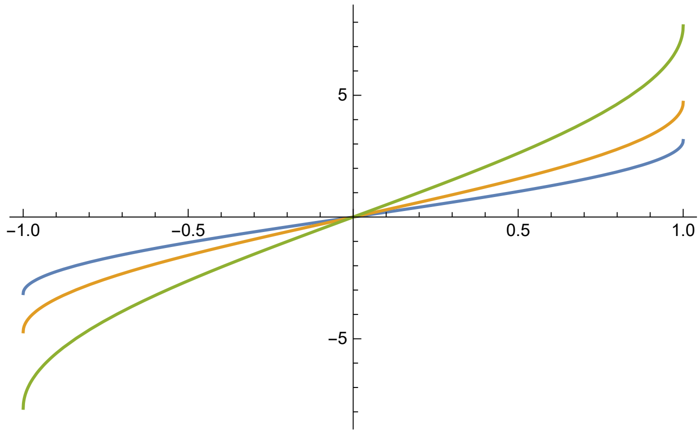
Out[221]=



Arc sine

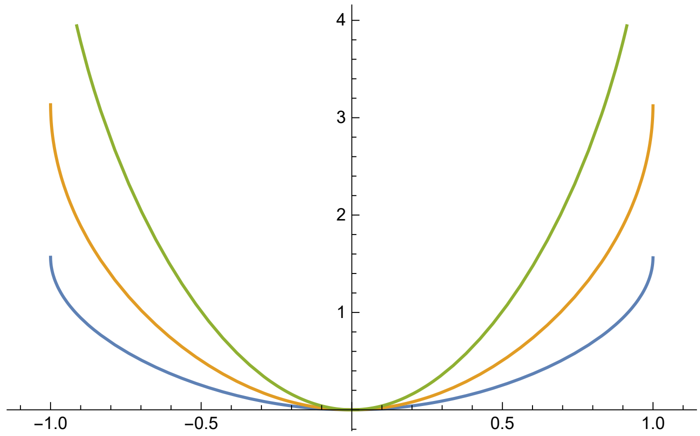
$f(x) = a \arcsin(x)$

Out[193]=



$$f(x) = a\ \arcsin(x^2)$$

Out[230]=



Hyperbolic secant

Hyperbolic secant and inverse hyperbolic secant.

In[158]:=
```
Row@{Plot[Sech[x], {x, -10, 10}, ImageSize → Medium],
  Plot[ArcSech[x], {x, -1, 1}, ImageSize → Medium]}
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Out[158]=