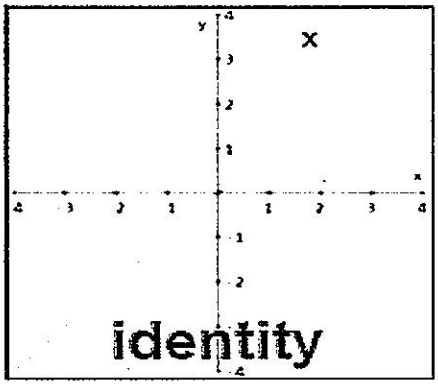
Functions Learned in Precalc Which are Needed in Calc

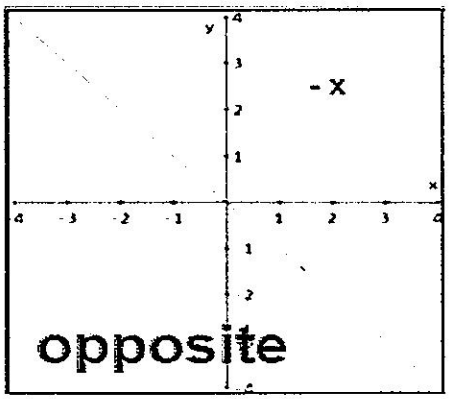
identity function	x
the opposite function	$-x$
the reciprocal function	$1/x$ or x^{-1}
a constant function	c, c = some constant
the "twice" function	$2x$
the squaring function	x^2
the square root function	$\sqrt{(x)}$, or $x^{1/2}$
the absolute value function	$\|x\|$
the greatert integer function	$[[x]]$
piece-wise defined functions	
a polynomial function	a polynomial function
a rational function	a rational function
an exponential or power function	c^x where $c > 0$ and $c \neq 1$
the exponential function	$\exp(x)$ or e^x
a lograthmic function	$\log_c(x)$, $c > 0$
the natual log function	$\ln(x)$ or $\log_e(x)$
sine function	$\sin(x)$
cosine function	$\cos(x)$
tangent function	$\tan(x)$
cosecant function	$\csc(x)$
secant function	$\sec(x)$
cotangent function	$\cot(x)$
Arcsine function	$\sin^{-1}(x)$
Arccosine function	$\cos^{-1}(x)$
Arctangent function	$\tan^{-1}(x)$
hyperbolic sine function	$\sinh(x)$
hyperboic cosine function	$\cosh(x)$
hyperbolic tangent function	$\tanh(x)$

function in words	the identity function
f(x) in symbols	x
domain	all reals (- ∞, + ∞)
range	all reals (- ∞, + ∞)
features	each y is identically equal to its x
period	none
x-intercept(s)	(0,0)
y-intercept(s)	(0,0)
reciprocal function	x, itself
inverse function	x, itself
asymptote(s), discontinuities	none
continuous?	yes
derivative	
anti-derivative	



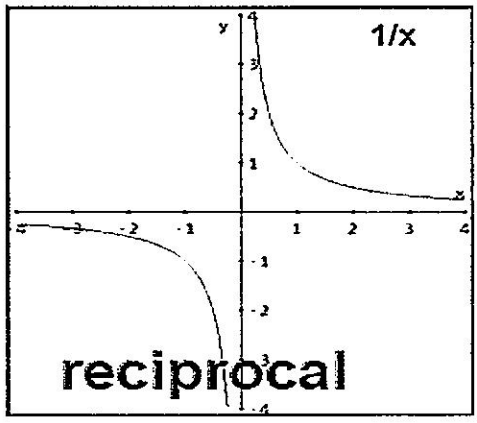
* to "undo," take the inverse, use the original number, x
* makes a 45° angle w/the positive x-axis

function in words	the opposite function
f(x) in symbols	- x
domain	all reals (- ∞, + ∞)
range	all reals (- ∞, + ∞)
features	each y is the opposite of its x
period	none
x-intercept(s)	(0,0)
y-intercept(s)	(0,0)
reciprocal function	- 1/x
inverse function	-x, itself
asymptote(s), discontinuities	none
continuous?	yes
derivative	
anti-derivative	



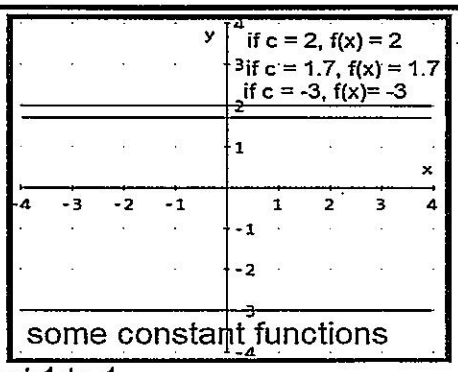
* to "undo," take the inverse, use the opposite of what you have, -x
* makes a 45° angle w/the positive negative x-axis

function in words	the reciprocal function
f(x) in symbols	1/x or x^{-1}
domain	all reals except 0, $x \neq 0$
range	all reals except 0, $y \neq 0$
features	a hyperbola w/2 branches
period	none
x-intercept(s)	none
y-intercept(s)	none
reciprocal function	1/x, itself
inverse function	1/x, itself
asymptote(s), discontinuities	vertical asymptote @ x=0
	horizontal asymptote at y= 0
continuous?	no
derivative	
anti-derivative	

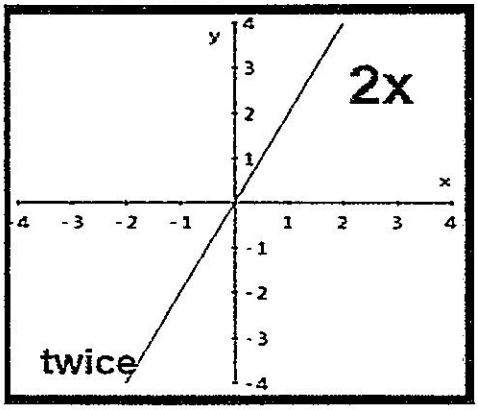


* the cosecant, secant, and cotangent are reciprocals of the sine, cosine, and tangent

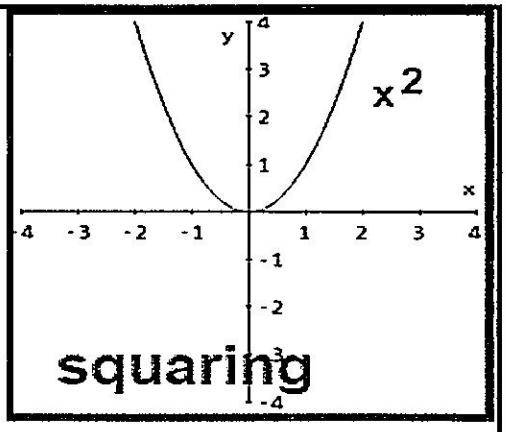
function in words	a constant function
f(x) in symbols	c, c = some constant
domain	all reals (- ∞, + ∞)
range	c, whatever constant is used
features	horizontal line
period	none
x-intercept(s)	only if c = 0 then every point
y-intercept(s)	(0, c)
reciprocal function	1/c
inverse function	none, doesn't pass horizontal line test, not 1-to-1
asymptote(s), discontinuities	no
continuous?	yes, it is a polynomial
derivative	
anti-derivative	



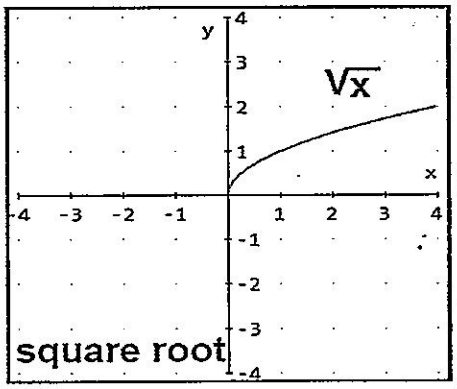
function in words	the "twice" function
f(x) in symbols	2x
domain	all reals (- ∞, + ∞)
range	all reals (- ∞, + ∞)
features	line w/a slope of 2
period	none
x-intercept(s)	(0, 0)
y-intercept(s)	(0, 0)
reciprocal function	x/2
inverse function	
asymptote(s), discontinuities	
period	
continuous?	
derivative	
anti-derivative	



function in words	the squaring function
f(x) in symbols	x^2
domain	all reals (- ∞, + ∞)
range	$y \geq 0$, [0. + ∞)
features	U-shaped, vertex at (0, 0)
period	none
x-intercept(s)	(0, 0)
y-intercept(s)	(0, 0)
reciprocal function	$1/x^2$
inverse function	restricted domain, square root function
asymptote(s), discontinuities	none
continuous?	yes
derivative	
anti-derivative	

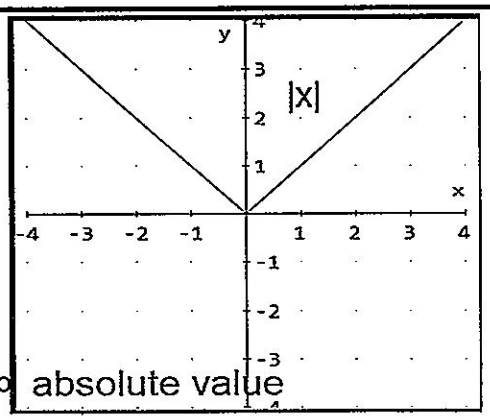


function in words	the square root function
f(x) in symbols	$\sqrt{(x)}$, or $x^{1/2}$
domain	*See note [0, ∞), x≥ 0
range	y ≥ 0, [0. + ∞)
features	looks like half a parabola on its side
period	none
x-intercept(s)	(0, 0)
y-intercept(s)	(0, 0)
reciprocal function	$1/\sqrt{(x)}$ is $\sqrt{(x)}/x$ is also $x^{-1/2}$
inverse function	x^2
asymptote(s), discontinuities	none
continuous?	yes
derivative	
anti-derivative	



* The square root of negative numbers are perfectly good numbers, but, here graphing is on the real plane and these are complex numbers.

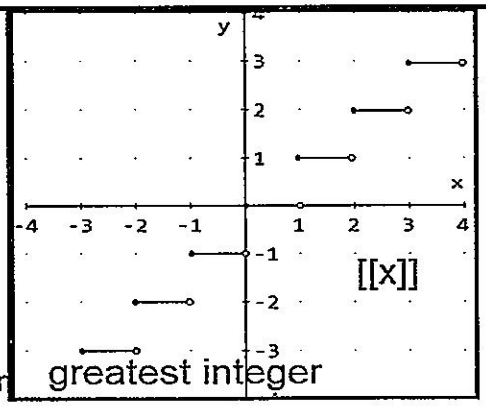
function in words	the absolute value function
f(x) in symbols	|x| *See note
domain	all reals (- ∞, + ∞)
range	y ≥ 0, [0. + ∞)
features	V-shaped, vertex at (0, 0)
period	none
x-intercept(s)	(0, 0)
y-intercept(s)	(0, 0)
reciprocal function	1/||x|
inverse function	none, doesn't pass horizontal line test, no
asymptote(s), discontinuities	no
continuous?	yes
derivative	
anti-derivative	



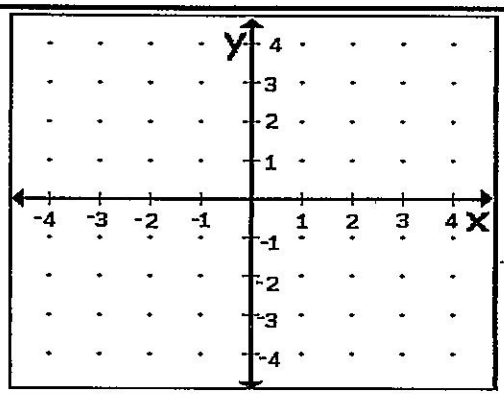
* This function is really $\sqrt{(x^2)}$

* See piece-wise below

function in words	the greatest integer function
f(x) in symbols	[[x]]
domain	all reals (- ∞, + ∞)
range	integers {..., -3, -2, -1, 0, 1, 2, 3, ...}
features	looks like steps
period	none
x-intercept(s)	each point 0 ≤ x < 1
y-intercept(s)	(0, 0)
reciprocal function	
inverse function	none, doesn't pass horizontal line test, n
asymptote(s), discontinuities	discontinuous, no asymptotes
continuous?	no
derivative	
anti-derivative	



function in words	a piece-wise defined function
f(x) in symbols	varies
domain	varies
range	varies
features	may be broken
period	maybe
x-intercept(s)	varies
y-intercept(s)	varies
reciprocal function	varies
inverse function	varies
asymptote(s), discontinuities	maybe
continuous?	maybe
derivative	
anti-derivative	



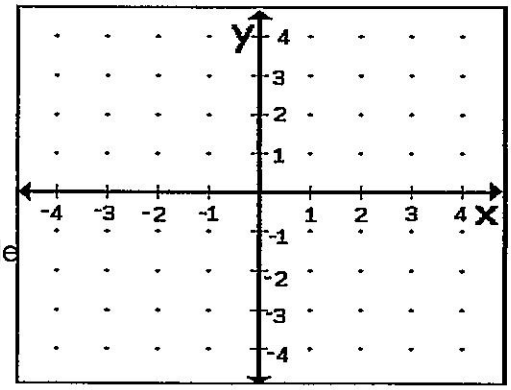
* the absolute value may be defined as a piece-wise defined function

as a piece-wise defined function

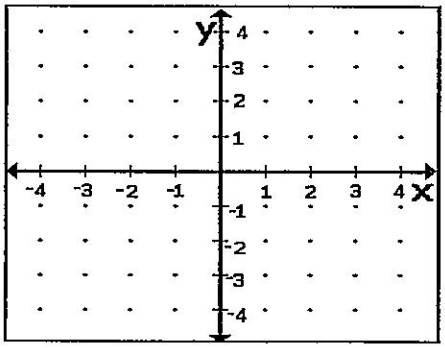
$f(x) = -x$, for $x < 0$

$f(x) = x$ for $x \geq 0$

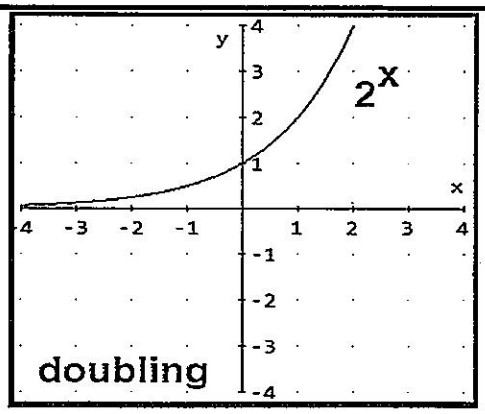
function in words	a polynomial function
f(x) in symbols	$a_nx^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_2x^2 + a_1x^1 + a_0x^0$
domain	all reals $(-\infty, +\infty)$
range	all reals $(-\infty, +\infty)$
features	
period	none
x-intercept(s)	at least one, probably many
y-intercept(s)	maybe one
reciprocal function	a rational function, not usually conside
inverse function	maybe
asymptote(s), discontinuities	no
continuous?	yes
derivative	
anti-derivative	



function in words	a rational function
f(x) in symbols	$\dfrac{a_nx^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_2x^2 + a_1x^1 + a_0x^0}{b_nx^n + b_{n-1}x^{n-1} + b_{n-2}x^{n-2} + \ldots + b_2x^2 + b_1x^1 + b_0x^0}$
domain	varies, check denominator function
range	varies
features	probably asymptotes, maybe discontinuities
x-intercept(s)	maybe
y-intercept(s)	maybe
reciprocal function	maybe a polynomial function
inverse function	not necessarily
asymptote(s), discontinuities	yes, maybe
period	not necessarily
continuous?	not likely
derivative	
anti-derivative	



function in words	an exponential or power function
f(x) in symbols	c^x where $c > 0$ and $c \neq 1$
domain	all reals $(-\infty, +\infty)$
range	$y > 0$, $(0, +\infty)$
features:	growth, reciprocal is decay, the halving function
period	no
x-intercept(s)	no
y-intercept(s)	(0, 1)
reciprocal function	c^{-x}
inverse function	$\log_c(x)$
asymptote(s), discontinuities	$y = 0$
continuous?	yes
derivative	
anti-derivative	

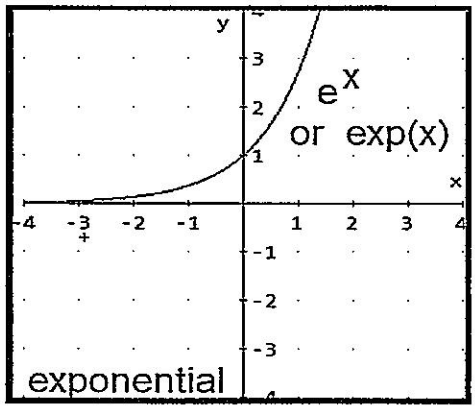


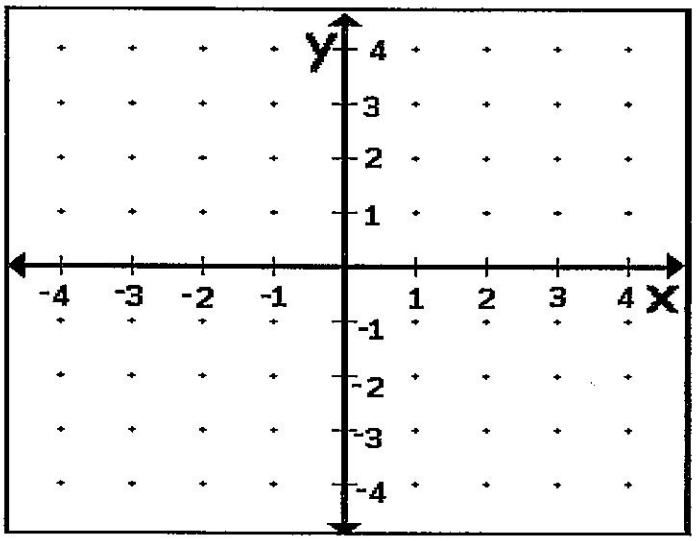
$f(x) = 2^x$

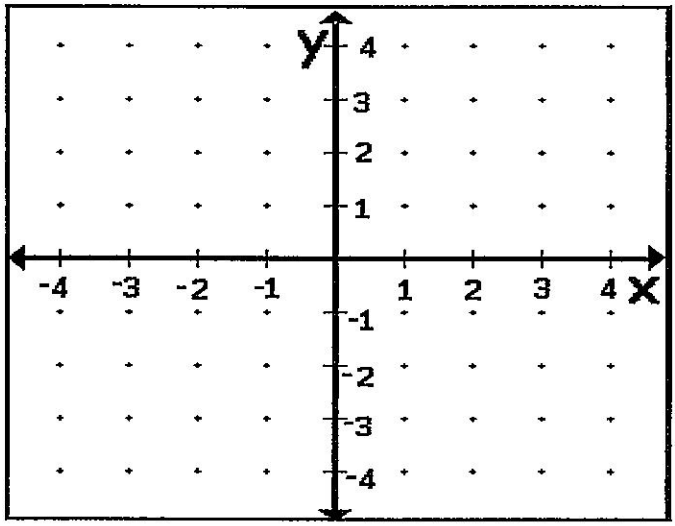
$reciprocal\ f(x) = 1/f(x) =$

$1/2^x = (1/2)^x = (2^{-1})^x = 2^{-x}$

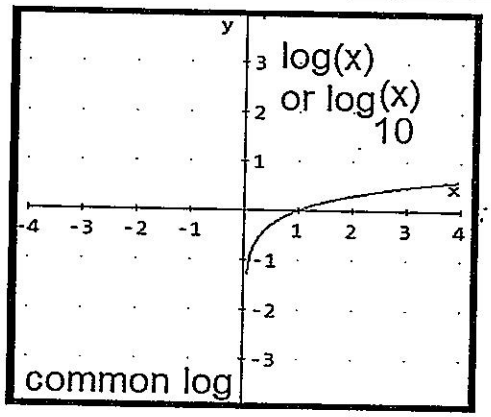
function in words	the exponential function
f(x) in symbols	exp(x) or e^x
domain	all reals $(-\infty, +\infty)$
range	$y > 0$, $(0, +\infty)$
features	used for growth and decay
period	no
x-intercept(s)	no
y-intercept(s)	(0, 1)
reciprocal function	e^{-x}
inverse function	$\log_e(x) = \ln(x)$
asymptote(s), discontinuities	$y = 0$
continuous?	yes
derivative	
anti-derivative	



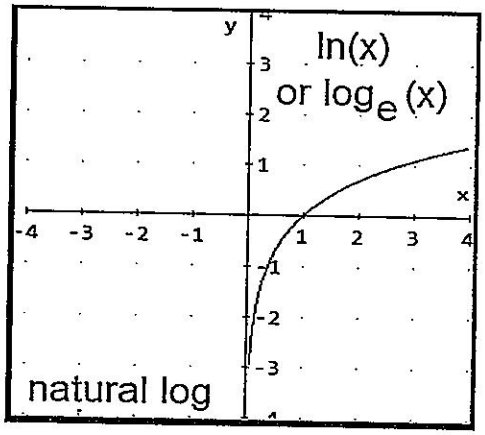


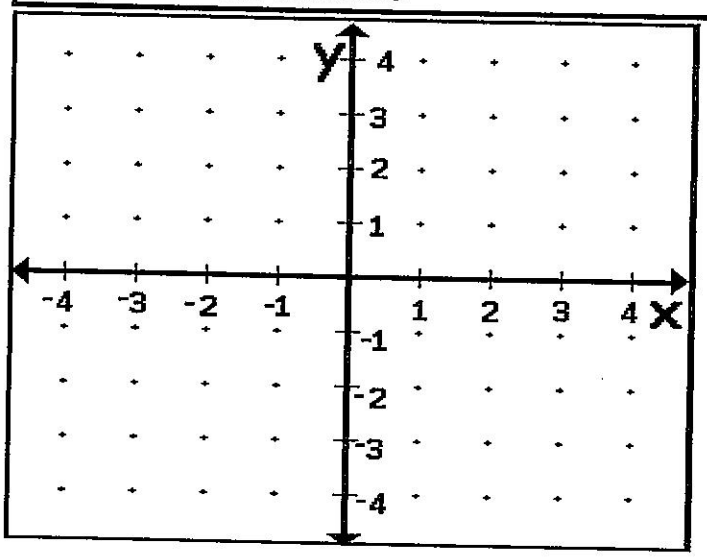


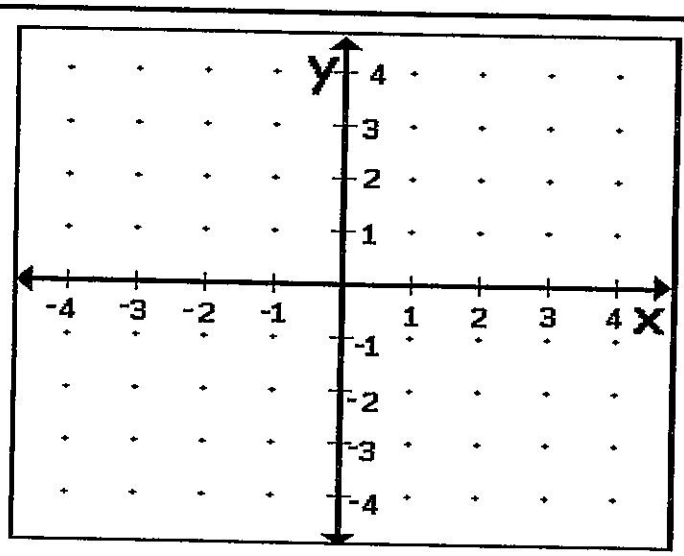
function in words	a lograthmic function
f(x) in symbols	$\log_c(x)$, c > 0 , here c = 10
domain	x > 0, (0, ∞)
range	all reals (-∞, + ∞)
features	
period	no
x-intercept(s)	(1, 0)
y-intercept(s)	none
reciprocal function	1/log(x)
inverse function	10^x
asymptote(s), discontinuities	x = 0, no discontinuities
continuous?	yes
derivative	
anti-derivative	



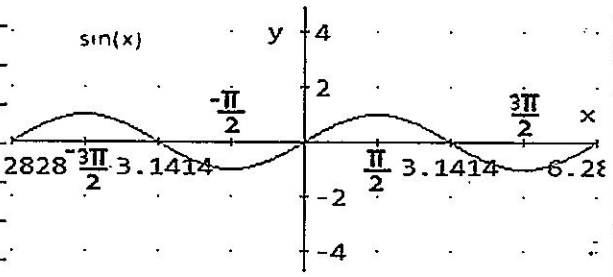
function in words	the natual log function
f(x) in symbols	ln(x) or $\log_e(x)$
domain	x > 0, (0, ∞)
range	all reals (-∞, + ∞)
features	
period	none
x-intercept(s)	(1, 0)
y-intercept(s)	none
reciprocal function	1/ln(x)
inverse function	e^x
asymptote(s), discontinuities	no discontinuities, y = 0
continuous?	yes
derivative	
anti-derivative	



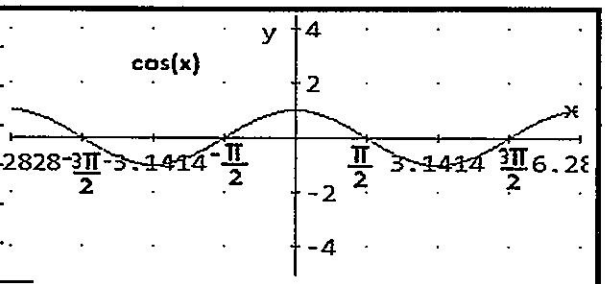




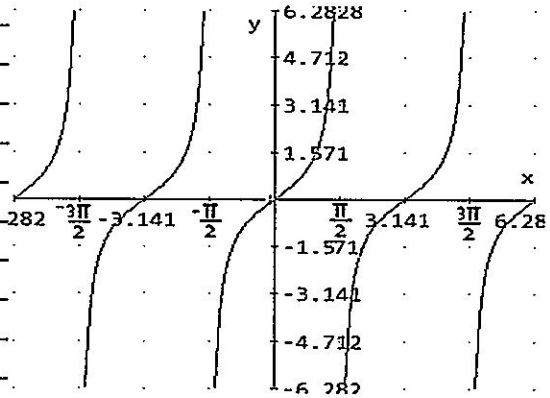
function in words	sine function
f(x) in symbols	sin(x)
domain	all reals (- ∞, + ∞)
range	- 1 ≤ x ≤ 1
features	it is the cosine function shifted
period	2π
x-intercept(s)	0 ± nπ
y-intercept(s)	(0, 0)
reciprocal function	cosecant, scs(x)
inverse function	Arcsine(x), $\sin^{-1}(x)$
asymptote(s), discontinuities	no
continuous?	yes
derivative	
anti-derivative	



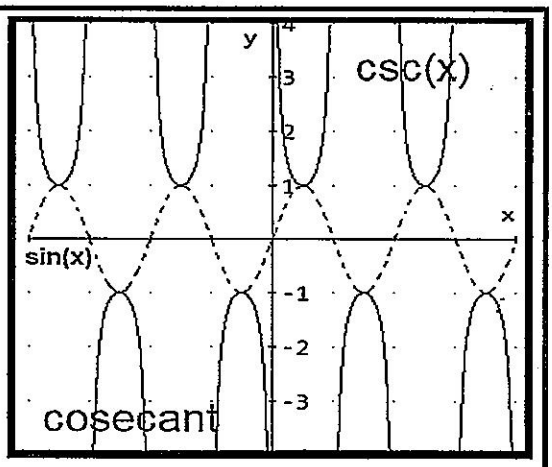
function in words	cosine function
f(x) in symbols	cos(x)
domain	all reals (- ∞, + ∞)
range	- 1 ≤ x ≤ 1
features	it is the sine function shifted
period	2π
x-intercept(s)	π/2 ± nπ
y-intercept(s)	(1, 0)
reciprocal function	secant, sec(x)
inverse function	Arccosine, $\cos^{-1}(x)$
asymptote(s), discontinuities	no
continuous?	yes
derivative	
anti-derivative	



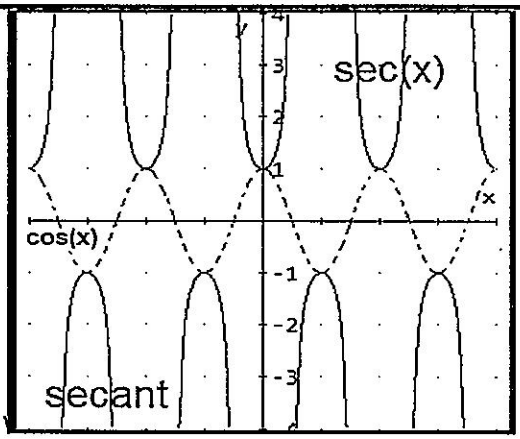
function in words	tangent function
f(x) in symbols	tan(x)
domain	all reals except x≠ π/2 ±nπ
range	all reals (- ∞, + ∞)
features	vertical asymptotes - see domain
period	π
x-intercept(s)	(0,0) and (0 ≠nπ, 0)
y-intercept(s)	(0,0)
reciprocal function	cotangent f(x), cot(x)
inverse function	Arctangent f(x)
asymptote(s), discontinuities	vertical asymptotes - see domain
continuous?	no
derivative	
anti-derivative	



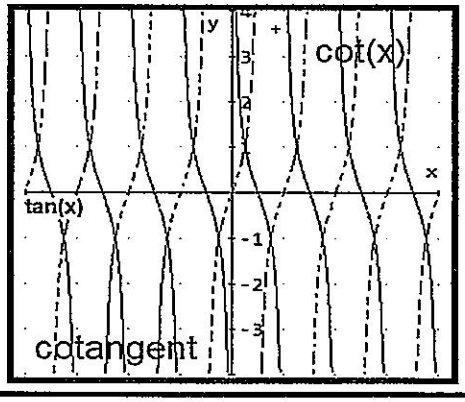
function in words	cosecant function
f(x) in symbols	csc(x)
domain	$x \neq 0 \pm n\pi$
range	$y \geq 1$ and $y \leq -1$
features	undefined when sine is 0
period	2π
x-intercept(s)	none
y-intercept(s)	none
reciprocal function	sine, sin(x)
inverse function	Arccosecant
asymptote(s), discontinuities	$x=0$, $x= 0 \pm n\pi$
period	2π
continuous?	none
derivative	
anti-derivative	



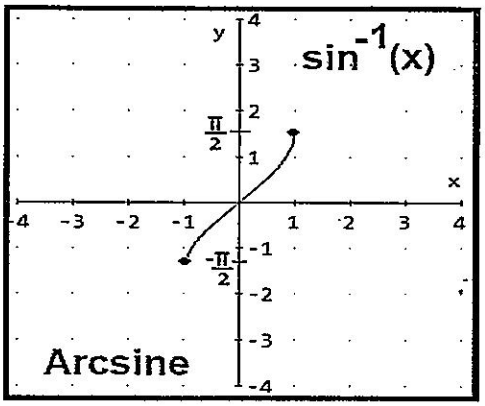
function in words	secant function
f(x) in symbols	sec(x)
domain	$x \neq \pi/2 \pm n\pi$
range	$y \geq 1$ and $y \leq -1$
features	undefined when cosine is 0
period	2π
x-intercept(s)	none
y-intercept(s)	(0, 1)
reciprocal function	cosine
inverse function	Arcsecant
asymptote(s), discontinuities	no discontinuities, vertical asymptotes
continuous?	no
derivative	
anti-derivative	



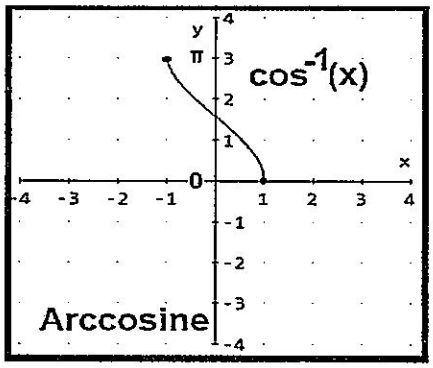
function in words	cotangent function
f(x) in symbols	cot(x)
domain	$x \neq 0 \pm n\pi$
range	all reals
features	whenever tangent is undefined, cotangent has 0
period	π
x-intercept(s)	$(\pi/2, 0)$, $(\pi/2 \pm n\pi, 0)$
y-intercept(s)	none
reciprocal function	tangent
inverse function	Arccotangent
asymptote(s), discontinuities	$x = \pi/2$, $x = \pi/2 \pm n\pi$
continuous?	no
derivative	
anti-derivative	



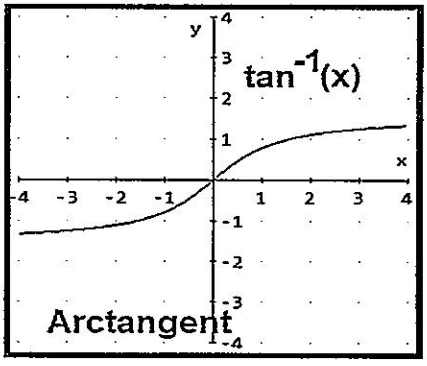
function in words	Arcsine function
f(x) in symbols	$\sin^{-1}(x)$
domain	$-1 \le x \le 1$
range	$-\pi/2 \le x \le \pi/2$
features	
period	none
x-intercept(s)	(0, 0)
y-intercept(s)	(0, 0)
reciprocal function	$1/\sin^{-1}(x)$
inverse function	sin(x) with domain restriction
asymptote(s), discontinuities	none
continuous?	yes
derivative	
anti-derivative	



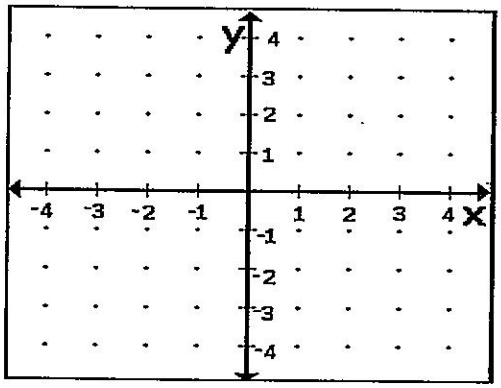
function in words	Arccosine function
f(x) in symbols	$\cos^{-1}(x)$
domain	$-1 \le x \le 1$
range	$0 \le x \le \pi$
features	
period	none
x-intercept(s)	(1, 0)
y-intercept(s)	$(0, \pi/2)$
reciprocal function	1/Arccos(x)
inverse function	cos(x) w/restricted domain
asymptote(s), discontinuities	none
continuous?	yes
derivative	
anti-derivative	



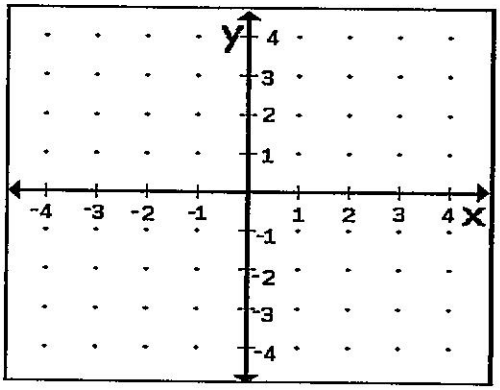
function in words	Arctangent function
f(x) in symbols	$\tan^{-1}(x)$
domain	all reals
range	(-1, 1)
features	
period	no
x-intercept(s)	(0, 0)
y-intercept(s)	(0, 0)
reciprocal function	1/Arctan(x)
inverse function	tan(x) for $(-\pi/2, \pi/2)$
asymptote(s), discontinuities	y = 1, y= -1
continuous?	yes
derivative	
anti-derivative	



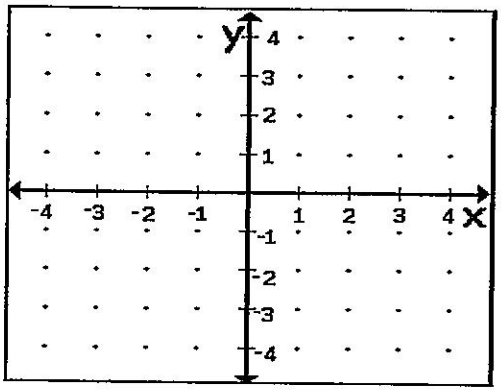
function in words	hyperbolic sine function
f(x) in symbols	sinh(x)
domain	
range	
features	
period	
x-intercept(s)	
y-intercept(s)	
reciprocal function	
inverse function	
asymptote(s), discontinuities	
period	
continuous?	
derivative	
anti-derivative	



function in words	hyperbolic cosine function
f(x) in symbols	cosh(x)
domain	
range	
features	
period	
x-intercept(s)	
y-intercept(s)	
reciprocal function	
inverse function	
asymptote(s), discontinuities	
period	
continuous?	
derivative	
anti-derivative	



function in words	hyperbolic tangent function
f(x) in symbols	tanh(x)
domain	
range	
features	
period	
x-intercept(s)	
y-intercept(s)	
reciprocal function	
inverse function	
asymptote(s), discontinuities	
continuous?	
derivative	
anti-derivative	



Symbols and Their Meanings

( ) -- parenthises, an inclusion mark meaning
THINK OF THE ENCLOSED AS ONE THING, as in
an expression like 4{(-2 + 5)+ 6}(3- 1)
often "of" as in "twice the sum of a number and 3 is 2(x+3)

_____ -- the bar, an inclusion mark, meaning
THINK OF THE ENCLOSED AS ONE THING, as in
a symbol to seperate the numerator from the denominator
of a fraction, or to indicate exactly what is "under the radical"

{ } -- braces, an inclusion mark, meaning
THINK OF THE ENCLOSED AS ONE THING, as in
an expression like 4{(-2 + 5)+ 6}(3- 1)

[ ] -- brackets, an inclusion mark, meaning
THINK OF THE ENCLOSED AS ONE THING, as in
an expression like 4[(-2 + 5)+ 6](3- 1)

x -- a variable number, or a number, or an unknown number or all numbers,
or the IDENTITY FUNCTION.
The letters x,y,z, and other letters in the end of the alphabet
are often used as variables, which sometimes vary WITHIN
a stituation as in $ax^2 + bx + c = 0$

c -- often a constant number, as in 5, 1/2, -8 which might be negative or
positive or 0.
The letters a, b, c, and other letters in the front of the alphabet
are often used as constants, but, they are constants within a
situation but vary FROM SITUATION TO SITUATION as in $ax^2 + bx + c = 0$

(x,y) -- a point, or an unknown point or all points as in
the line y=3x+2 is a line with slope 3, and y-intercept 2 and
the x and y comprise the points (x,y)

(x_1 , y_1) -- a specific point, as in (3,5)

f(x) -- "f of x" -- a function dependent on the variable x

-x -- the opposite (additive inverse) of a number or the OPPOSITE FUNCTION

1/x or x^{-1} -- the reciprocal (multiplicative inverse) of a number or the
RECIPROCAL FUNCTION, as in the reciprocal of 2 in 1/2,
and (3/4) -1 is 4/3 ("flip" the number)

$f^{-1}(x)$ -- the inverse of a function, as in the square root is used to "undo" the square

-- the opposite of a function
-- the function of the opposite
-- the function value increased (or perhaps decreased) by a number
-- the function of a number increased (or perhaps decreased) by a value