GRAPH OF TRIGONOMETRIC FUNCTIONS

TRIGONOMETRIC FUNCTION OF ANGLES

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TOPIC OUTLINE

Graph of Trigonometric Functions

Amplitude and Period of Sine Function

GRAPH OF TRIGONOMETRIC FUNCTIONS

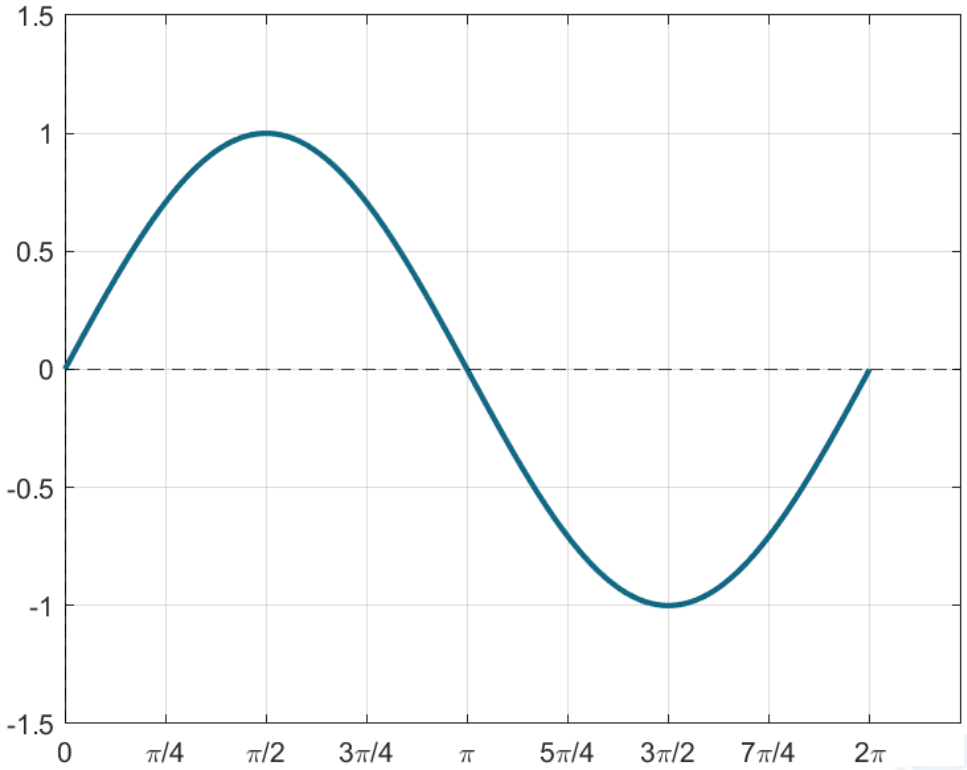
SINE FUNCTION

$f(x) = \sin x$

x	$f(x)$
0	
$\pi/6$	
$\pi/4$	
$\pi/3$	
$\boldsymbol{\pi/2}$	
$2\pi/3$	
$3\pi/4$	
$5\pi/4$	
$\boldsymbol{\pi}$	

x	$f(x)$
$7\pi/6$	
$5\pi/4$	
$4\pi/3$	
$\boldsymbol{3\pi/2}$	
$5\pi/3$	
$7\pi/4$	
$11\pi/6$	
$\boldsymbol{2\pi}$	

Graph of $\sin x$



Domain: All real numbers $(-\infty, \infty)$

Range: $[-1, 1]$

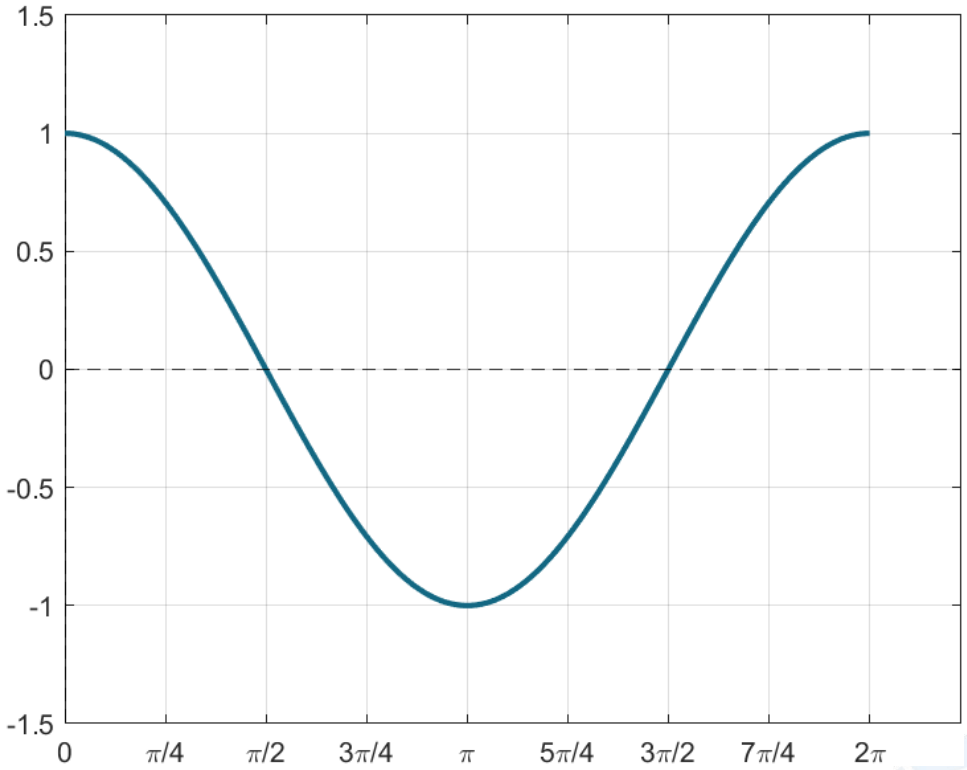
COSINE FUNCTION

$f(x) = \cos x$

x	$f(x)$
0	
$\pi/6$	
$\pi/4$	
$\pi/3$	
$\boldsymbol{\pi/2}$	
$2\pi/3$	
$3\pi/4$	
$5\pi/4$	
$\boldsymbol{\pi}$	

x	$f(x)$
$7\pi/6$	
$5\pi/4$	
$4\pi/3$	
$\boldsymbol{3\pi/2}$	
$5\pi/3$	
$7\pi/4$	
$11\pi/6$	
$\boldsymbol{2\pi}$	

Graph of $\cos x$



Domain: All real numbers $(-\infty, \infty)$

Range: $[-1, 1]$

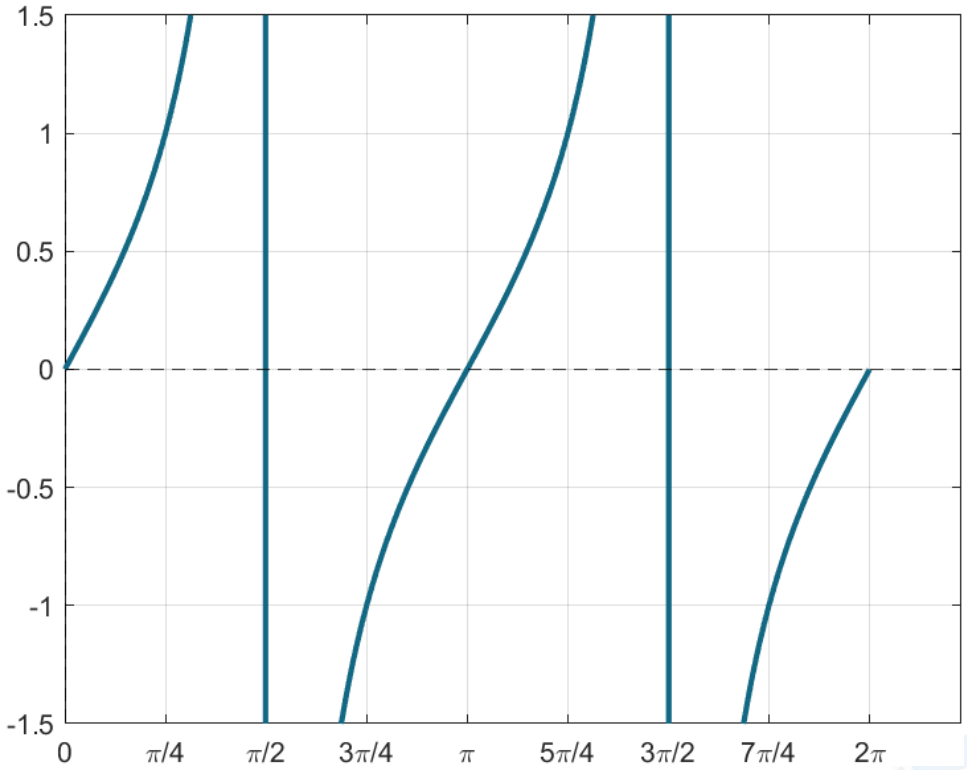
TANGENT FUNCTION

$f(x) = \tan x$

x	$f(x)$
0	
$\pi/6$	
$\pi/4$	
$\pi/3$	
$\boldsymbol{\pi/2}$	
$2\pi/3$	
$3\pi/4$	
$5\pi/4$	
$\boldsymbol{\pi}$	

x	$f(x)$
$7\pi/6$	
$5\pi/4$	
$4\pi/3$	
$\boldsymbol{3\pi/2}$	
$5\pi/3$	
$7\pi/4$	
$11\pi/6$	
$\boldsymbol{2\pi}$	

Graph of $\tan x$



Domain: All real numbers except odd multiples of $\pi/2$

Range: $[-\infty, \infty]$

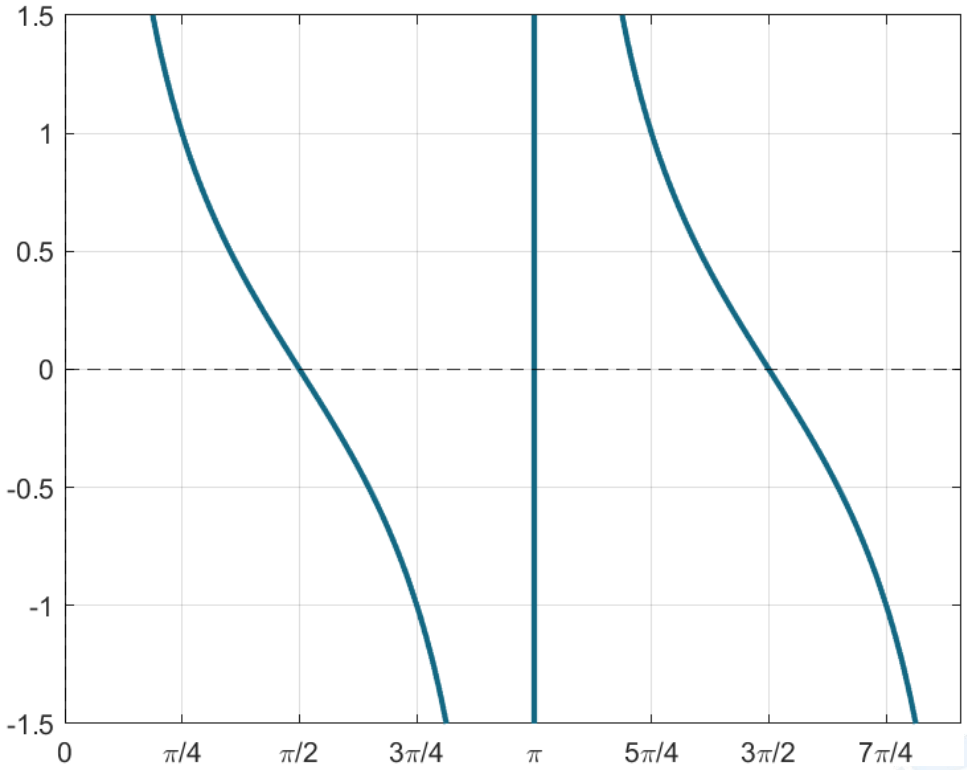
COTANGENT FUNCTION

$f(x) = \cot x$

x	$f(x)$
0	
$\pi/6$	
$\pi/4$	
$\pi/3$	
$\boldsymbol{\pi/2}$	
$2\pi/3$	
$3\pi/4$	
$5\pi/4$	
$\boldsymbol{\pi}$	

x	$f(x)$
$7\pi/6$	
$5\pi/4$	
$4\pi/3$	
$\boldsymbol{3\pi/2}$	
$5\pi/3$	
$7\pi/4$	
$11\pi/6$	
$\boldsymbol{2\pi}$	

Graph of $\cot x$



Domain: All real numbers except integer multiples of π

Range: $[-\infty, \infty]$

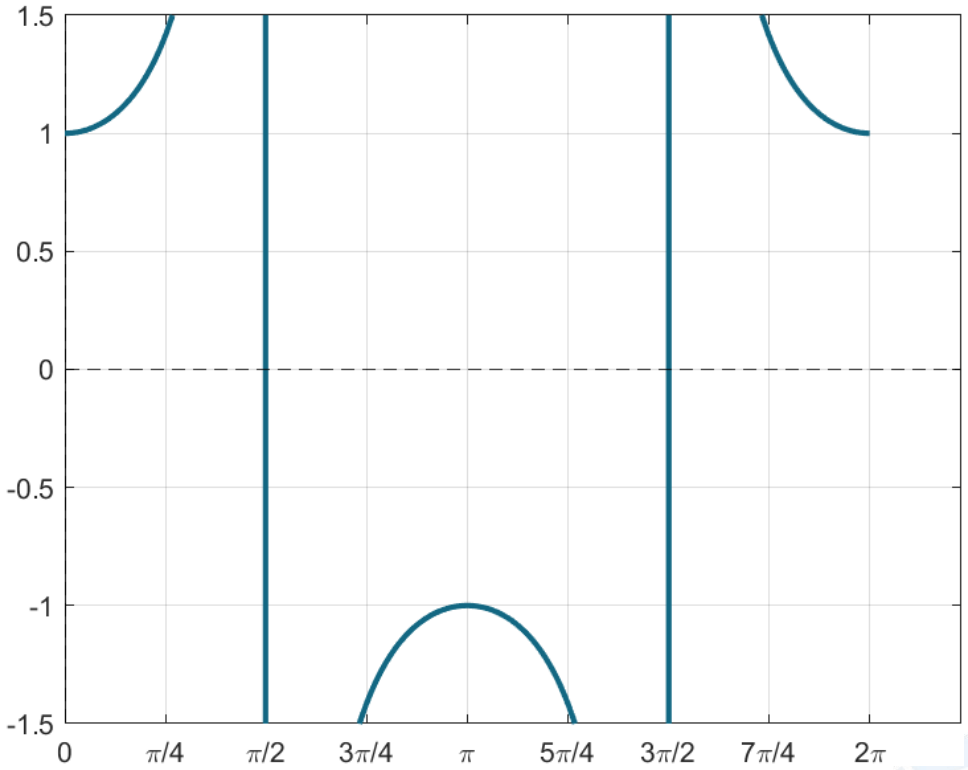
SECANT FUNCTION

$f(x) = \sec x$

x	$f(x)$
0	
$\pi/6$	
$\pi/4$	
$\pi/3$	
$\boldsymbol{\pi/2}$	
$2\pi/3$	
$3\pi/4$	
$5\pi/4$	
$\boldsymbol{\pi}$	

x	$f(x)$
$7\pi/6$	
$5\pi/4$	
$4\pi/3$	
$\boldsymbol{3\pi/2}$	
$5\pi/3$	
$7\pi/4$	
$11\pi/6$	
$\boldsymbol{2\pi}$	

Graph of $\sec x$



Domain: All real numbers except odd multiples of $\pi/2$

Range: $(-\infty, -1] \cup [1, \infty)$

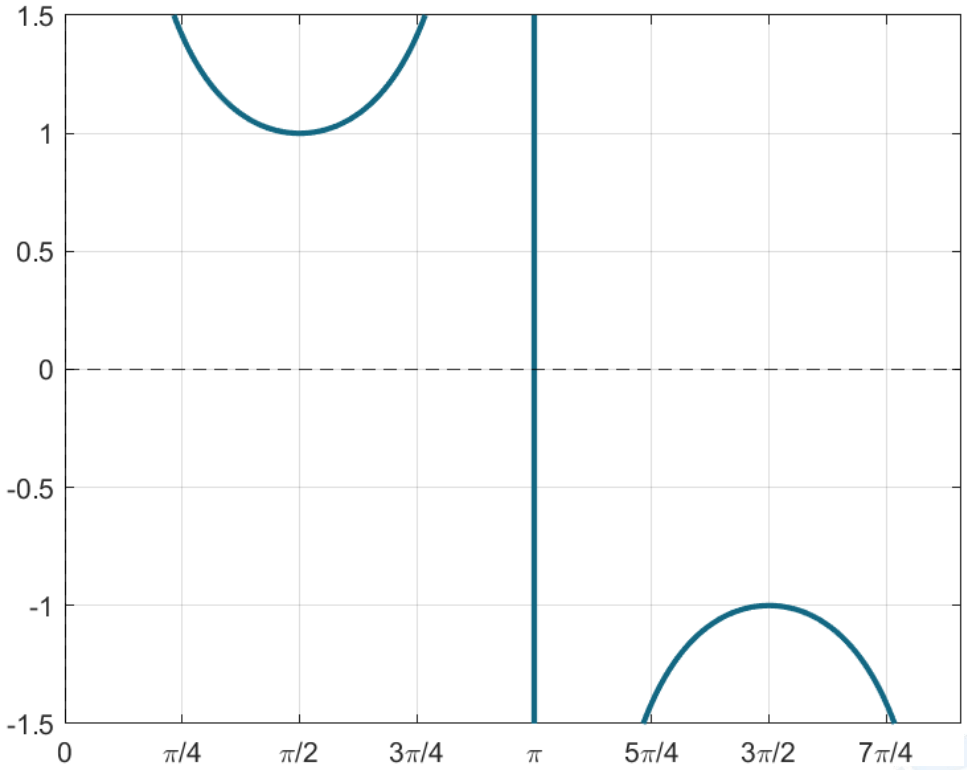
COSECANT FUNCTION

$f(x) = \csc x$

x	$f(x)$
0	
$\pi/6$	
$\pi/4$	
$\pi/3$	
$\boldsymbol{\pi/2}$	
$2\pi/3$	
$3\pi/4$	
$5\pi/4$	
$\boldsymbol{\pi}$	

x	$f(x)$
$7\pi/6$	
$5\pi/4$	
$4\pi/3$	
$\boldsymbol{3\pi/2}$	
$5\pi/3$	
$7\pi/4$	
$11\pi/6$	
$\boldsymbol{2\pi}$	

Graph of $\csc x$



Domain: All real numbers except odd multiples of π

Range: $(-\infty, -1] \cup [1, \infty)$

AMPLITUDE AND PERIOD OF SINE FUNCTION

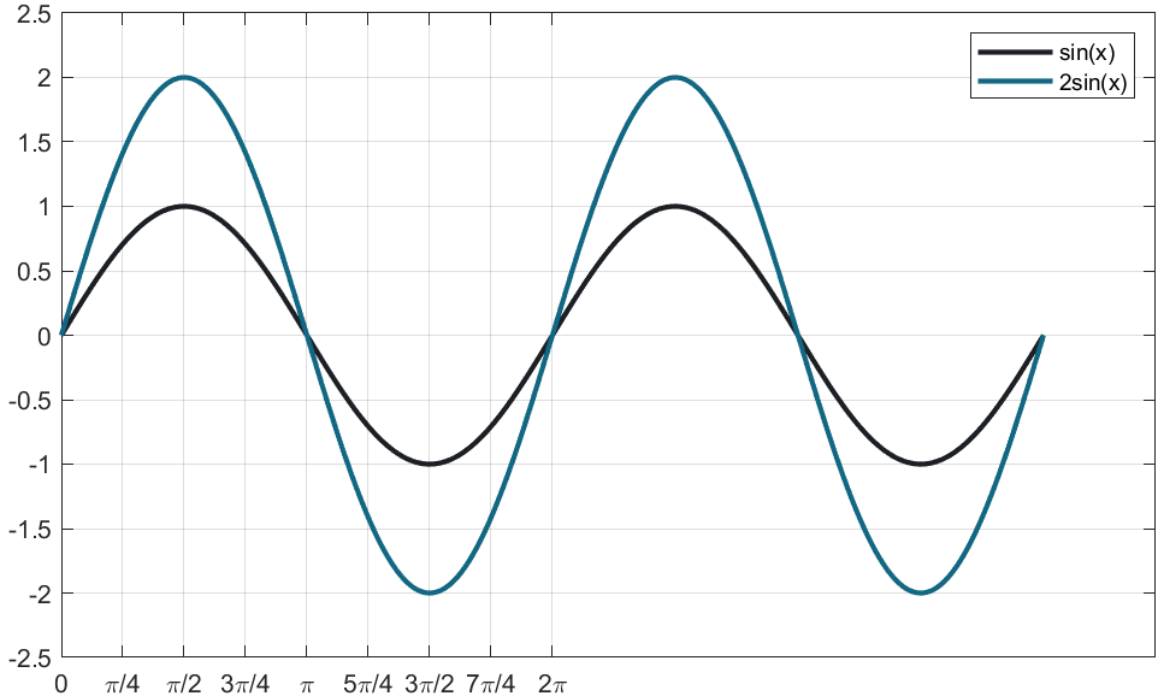
AMPLITUDE

$f(x) = a \sin x$

Let the amplitude $a = 2$

x	$\sin x$	$2 \sin x$
0		
$\pi/4$		
$\boldsymbol{\pi/2}$		
$3\pi/4$		
$\boldsymbol{\pi}$		
$5\pi/4$		
$\boldsymbol{3\pi/2}$		
$7\pi/4$		
$\boldsymbol{2\pi}$		

Graph of $2 \sin x$



What would be the graph of $3 \sin x$?

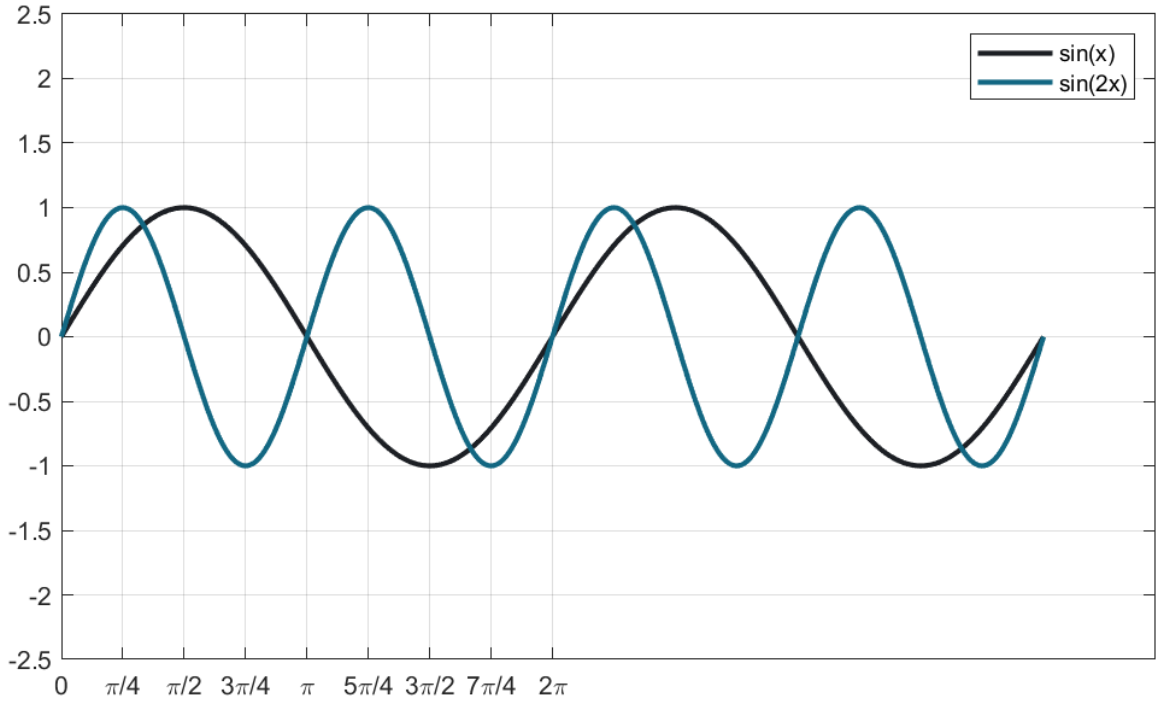
PERIOD

$f(x) = \sin bx$

Let $b = 2$

x	$\sin x$	$\sin 2x$
0		
$\pi/4$		
$\boldsymbol{\pi/2}$		
$3\pi/4$		
$\boldsymbol{\pi}$		
$5\pi/4$		
$\boldsymbol{3\pi/2}$		
$7\pi/4$		
$\boldsymbol{2\pi}$		

Graph of $\sin 2x$



$$\text{period} = \frac{2\pi}{b}$$

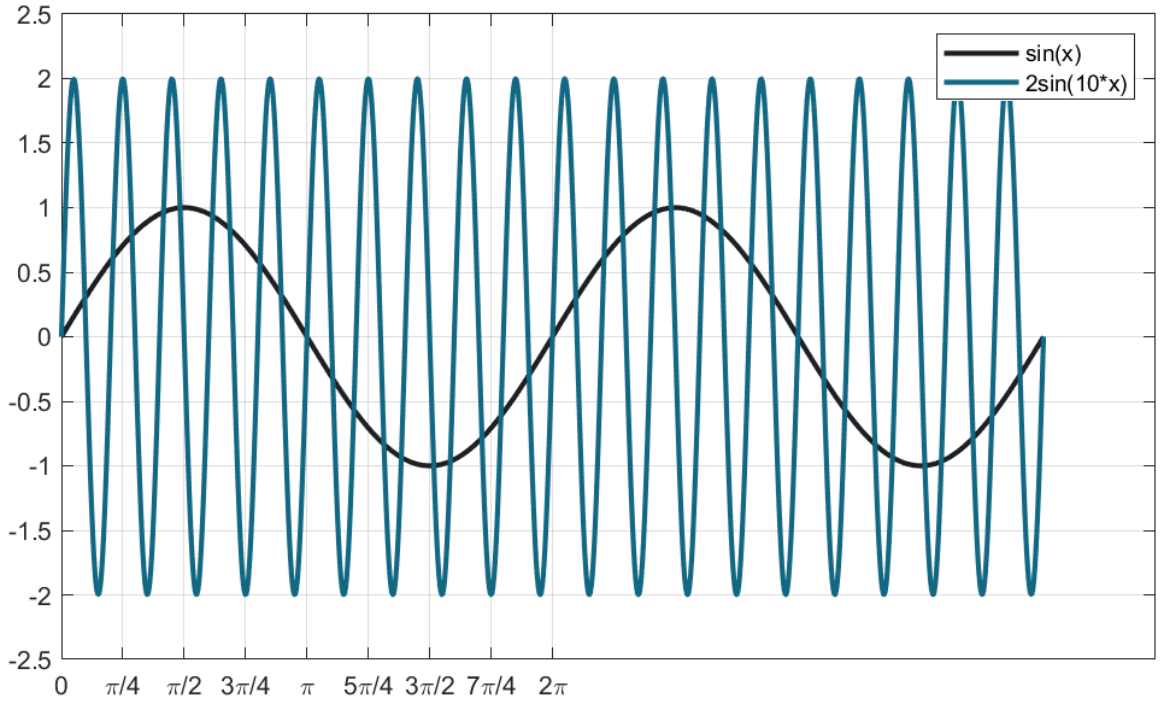
AMPLITUDE AND PERIOD

$f(x) = a \sin bx$

Let a $= 2$, $b = 10$

x	$\sin x$	$2 \sin 10x$
0		
$\pi/4$		
$\boldsymbol{\pi/2}$		
$3\pi/4$		
$\boldsymbol{\pi}$		
$5\pi/4$		
$\boldsymbol{3\pi/2}$		
$7\pi/4$		
$\boldsymbol{2\pi}$		

Graph of $\sin 10x$



$$\text{period} = \frac{2\pi}{b}$$

EXERCISE

The average temperature (in °F) at Mould Bay, Canada, can be approximated by the function

$$f(x) = 34 \sin\left[\frac{\pi}{6}(x - 4.3)\right]$$

where x is the month and $x = 1$ corresponds to January, $x = 2$ to February, and so on.

Using this model:

a. What is the maximum temperature predicted?

b. What is the period of the temperature cycle?

c. What is the average temperature in May?

Solution

EXERCISE

The light from the moon, in lux, on the night of the day t^{th} of 2016, is

$$\boldsymbol{L(t) = 0.25 - sin\left(\frac{2\pi(t-2)}{28.5}\right)}$$

What is the period of the light from the moon?

Solution

EXERCISE

The solar constant S is the amount of energy per unit area that reaches Earth's atmosphere from the sun. It is equal to 1367 watts per m^2 but varies slightly throughout the seasons. This fluctuation ΔS in S can be calculated using the formula

$$\Delta S = 0.034S \sin\left[\frac{2\pi(82.5 - N)}{365.25}\right]$$

In this formula, N is the day number covering a four-year period, where $N = 1$ corresponds to January 1 of a leap year and $N = 1461$ corresponds to December 31 of the fourth year.

a. Calculate ΔS for $N = 80$, which is the spring equinox in the first year.

b. Calculate ΔS for $N = 1268$, which is the summer solstice in the fourth year.

c. What is the maximum value of ΔS?

d. Find a value for N where ΔS is equal to 0.

SEATWORK