

# The General Equation for Trigonometric Functions 80

The general equation for a cosine curve is:

$$y = A \cos(k(x - b)) + h$$

The letters represent the following:

**A** is the amplitude. It is the height of the curve above the middle. It is always positive.

**k** determines how much the curve is stretched or compressed. It determines the **period** of the curve. The period is the length of one repeating unit.

The **period** is equal to  $\frac{2\pi}{k}$ .

**b** is an angle called the phase shift. A positive value of b means a shift to the right. A negative value means a shift to the left.

**h** is the vertical shift. Up is positive and down is negative.

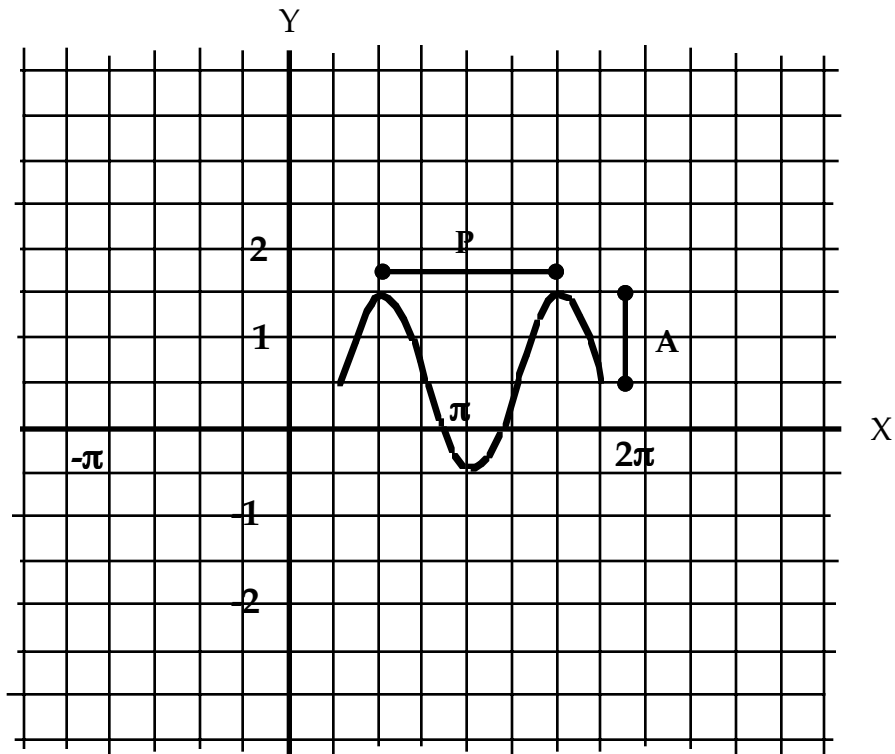
example:

Find A, k, b, h, and the period for the equation:  $y = 3 \sin(4(x + \pi)) - 1$ .

A = 3, k = 4, b = -  $\pi$ , h = - 1, period =  $\pi/2$ .

example

Find A, k, b, h and the period for the cosine curve shown below.



$A = 1, k = 2, b = \pi/2, h = 0.5, \text{ period} = \pi.$

Problems:

1) Find the amplitude.

a)  $y = 6 \sin x$

b)  $y = -3 \cos x$

c)  $2y = \sin x$

d)  $y = 5.4 \cos x$

e)  $y + 1 = 2 \sin (2x)$

f)  $y = -5 \sin (3x)$

2) Find  $k$  and the period.

a)  $y = \sin x$

b)  $y = -\sin 3x$

c)  $y = \cos (x/2)$

d)  $y = \cos((x - \pi)/3)$

e)  $y = 3 \cos(2x) - 5$

f)  $y = \sin 2\pi(x)$

3) Find the phase shift.

a)  $y = \sin(x - \pi/2)$

b)  $y = \sin(x + \pi)$

c)  $y = \sin(2x + \pi)$

d)  $y = -\cos((x - \pi)/4)$

4) Find the vertical shift.

a)  $y + 2 = \sin(x)$

b)  $y = \cos(x) + 5$

5) Given the equation:  $y = 7 \sin 2(x + \pi/2) - 3$ .

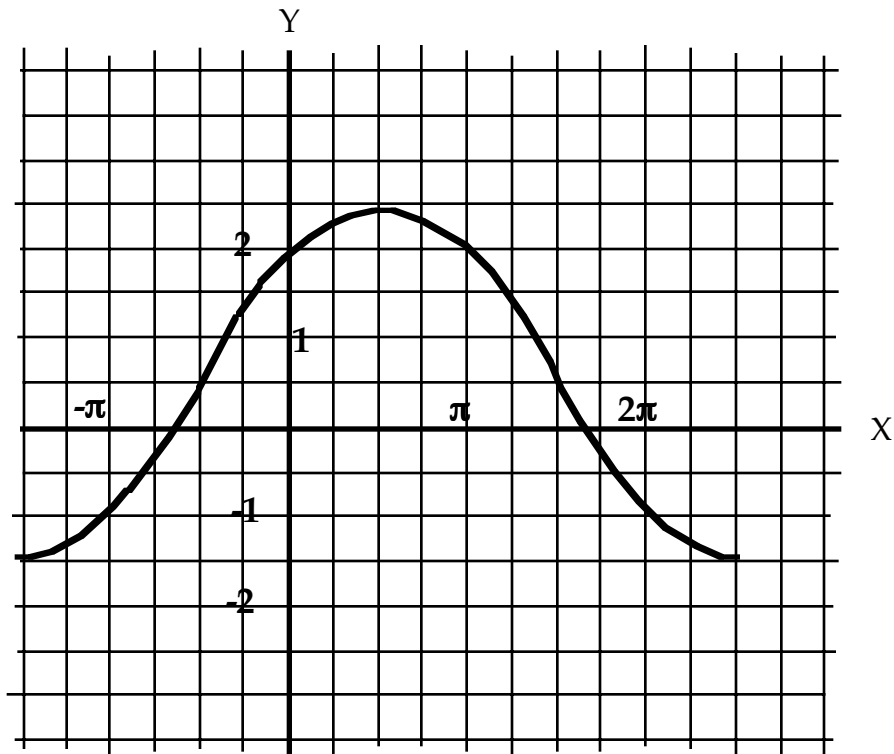
a) The amplitude is \_\_\_\_\_

b) The period is \_\_\_\_\_

c) The phase shift is \_\_\_\_\_

d) The vertical shift is \_\_\_\_\_ .

6) Find the amplitude, period, phase shift, and vertical shift, for the following cos function.



7) Write down the sine function with the following characteristics:

amplitude = 3, period =  $\pi$ , phase shift =  $-\pi/2$ , vertical shift = - 5.

Answers: 1)a) 6, b) 3, c) 0.5, d) 5.4, e) 2, f) 5, 2)a)  $2\pi$ , b)  $2\pi/3$ , c)  $4\pi$ , d)  $6\pi$ , e)  $\pi$ , f) 1, 3)a)  $\pi/2$ , b)  $-\pi$ , c)  $-\pi/2$ , d)  $\pi$ , 4)a) - 2, b) 5, 5)a) 7, b)  $\pi$ , c)  $-\pi/2$ , d) - 3, 6)a) 2, b)  $4\pi$ , c)  $\pi/2$ , d) + 0.5, 7)  $y = 3 \sin 2(x + \pi/2) - 5$ .