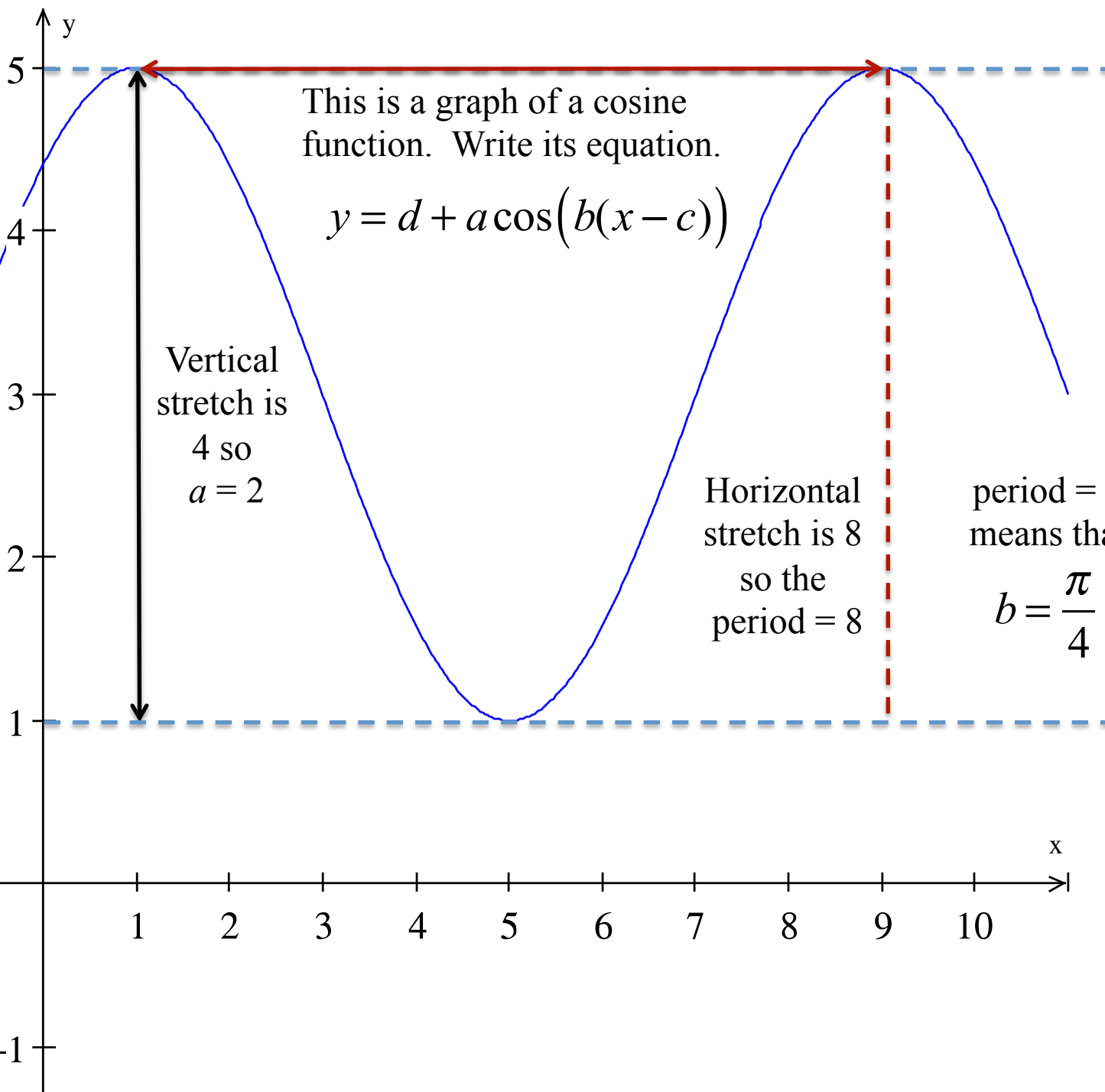


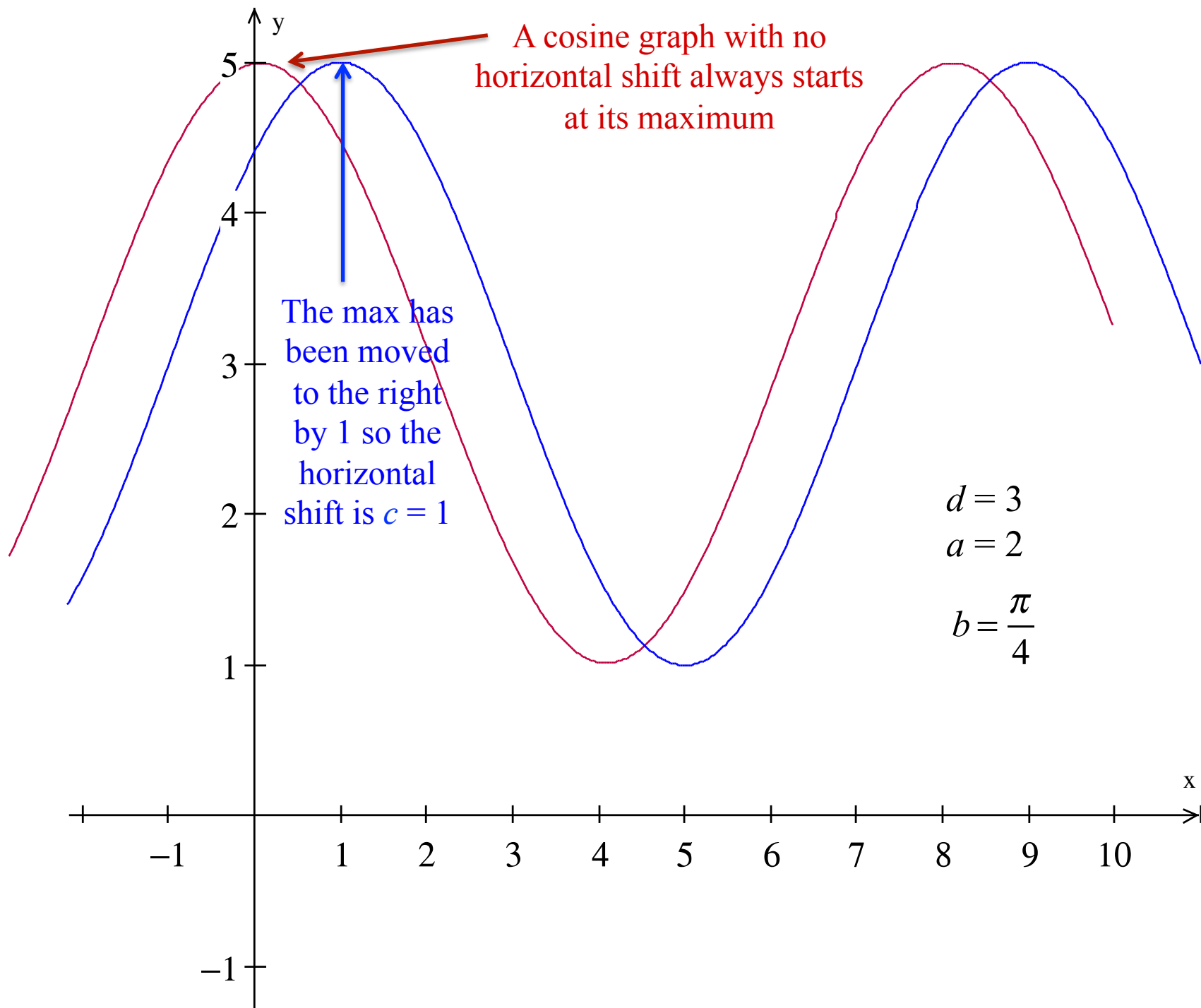
# Sinusoidal Graphs and Values

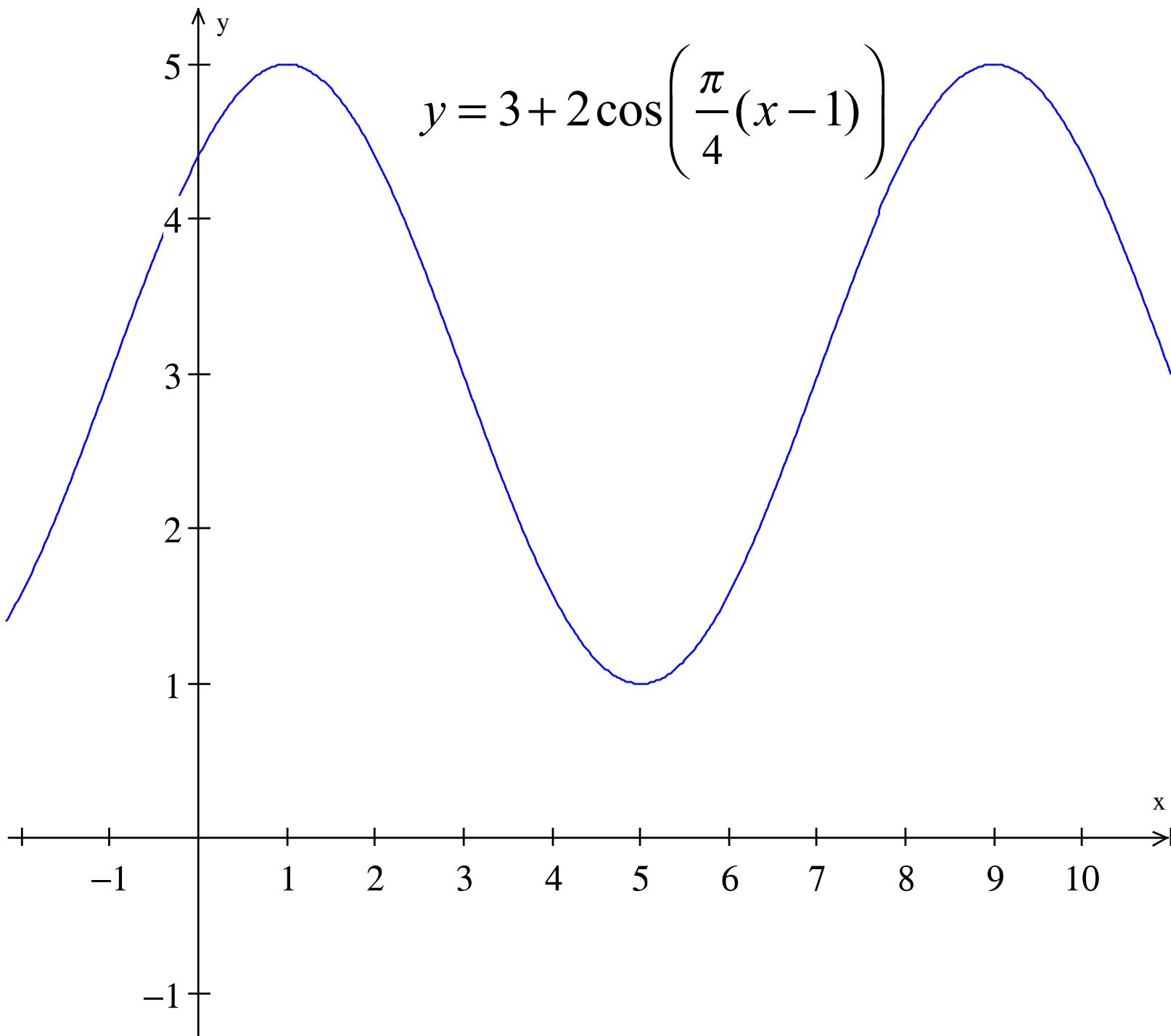
...and how to apply them to real-life  
problems

$a = 2$  but the  
max is 5 so  
there is a  
vertical shift  
of 3 meaning  
that  $d = 3$



-1





## Example on Pg 65

In a Chemistry experiment, researchers find that the temperature of a compound varies sinusoidally with time. 17 minutes after they started timing, the temperature is its highest, which is  $56^\circ$  Celsius. 12 minutes after it has reached its maximum, the temperature hits its minimum which is  $40^\circ$

Find the sinusoidal function  $y$  in terms of time  $t$

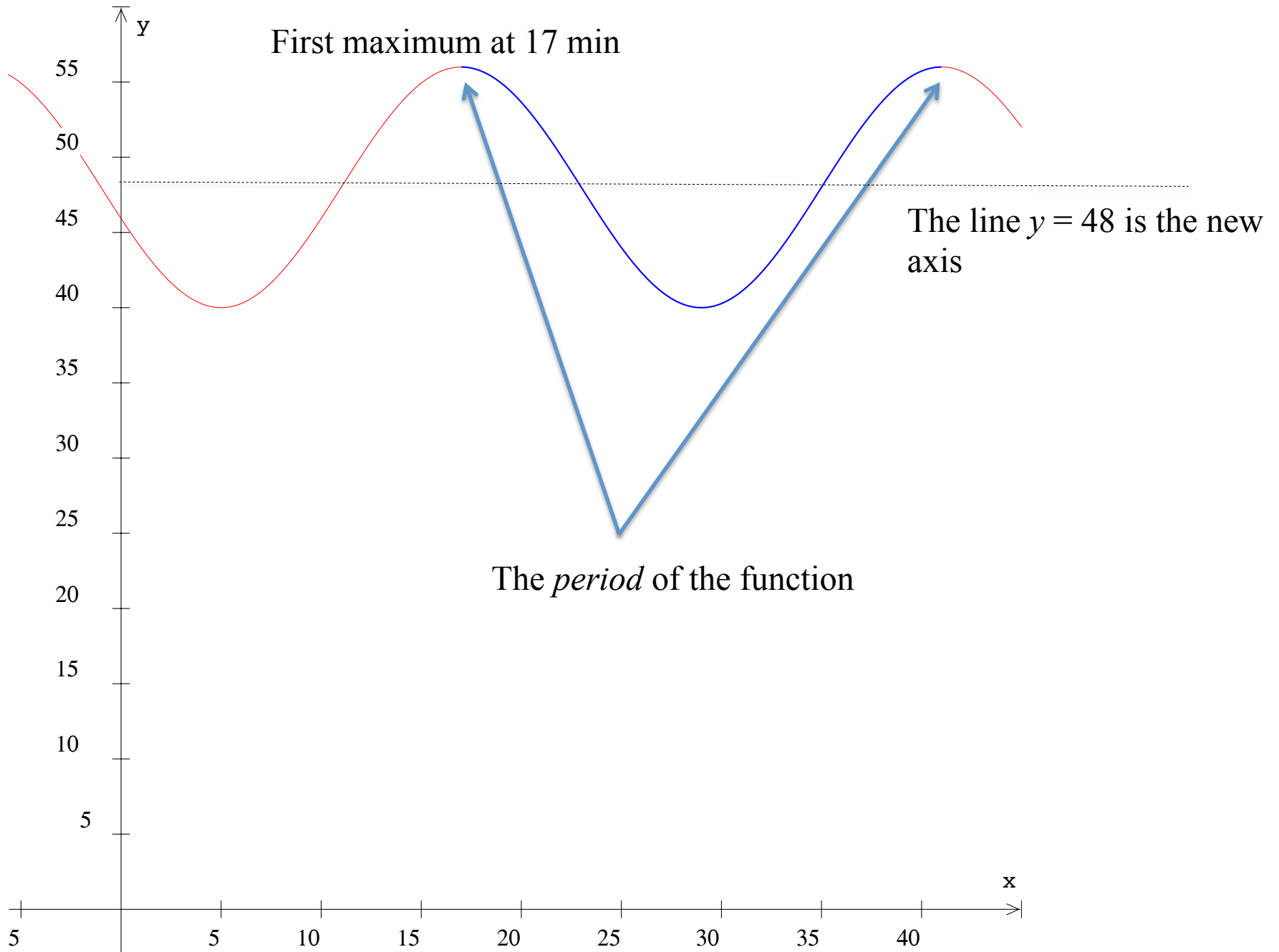
$$y = d + a \cos[b(x - c)]$$

Sinusoidal Axis  
(vertical shift)

amplitude

Period =  $\frac{2\pi}{b}$

Horizontal shift  
(always opposite the  
sign in the parentheses)



First maximum at 17 min

The line  $y = 48$  is the new axis

The *period* of the function

In a Chemistry experiment, researchers find that the temperature of a compound varies sinusoidally with time. 17 minutes after they started timing, the temperature is its highest, which is  $56^{\circ}$  Celsius. 12 minutes after it has reached its maximum, the temperature hits its minimum which is  $40^{\circ}$

Find the sinusoidal function  $y$  in terms of time  $t$

$$y = 48 + 8 \cos \left[ \frac{\pi}{12} (t - 17) \right]$$

48 is halfway between the max and minimum temp

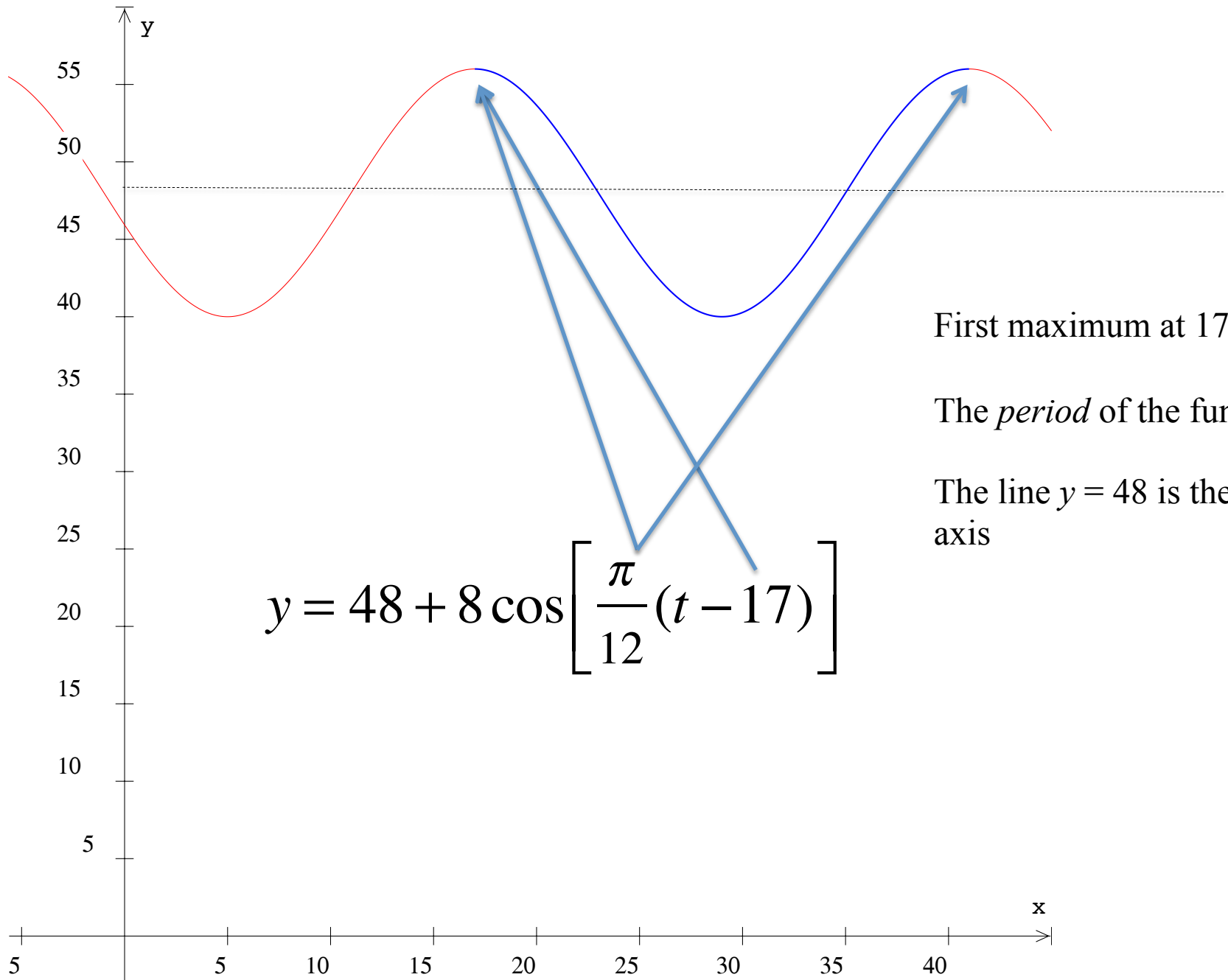
max temp is  $56^{\circ}$  and the min temp is  $40^{\circ}$ . Since this makes the graph's vertical length 16, the amplitude is 8

It takes 12 minutes to go from max to min so the whole period is twice that.

And remember that

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

The top of the cosine graph occurs 17 minutes later



$$y = 48 + 8 \cos\left[\frac{\pi}{12}(t - 17)\right]$$

First maximum at 17 min  
The *period* of the function  
The line  $y = 48$  is the new axis



In a Chemistry experiment, researchers find that the temperature of a compound varies sinusoidally with time. 10 minutes after they started timing, the temperature is its highest, which is  $26^{\circ}$  Celsius. 9 minutes after it has reached its maximum, the temperature hits its minimum which is  $-10^{\circ}$

Find the sinusoidal function  $y$  in terms of time  $t$

$$y = 8 + 18 \cos \left[ \frac{\pi}{9} (t - 10) \right]$$

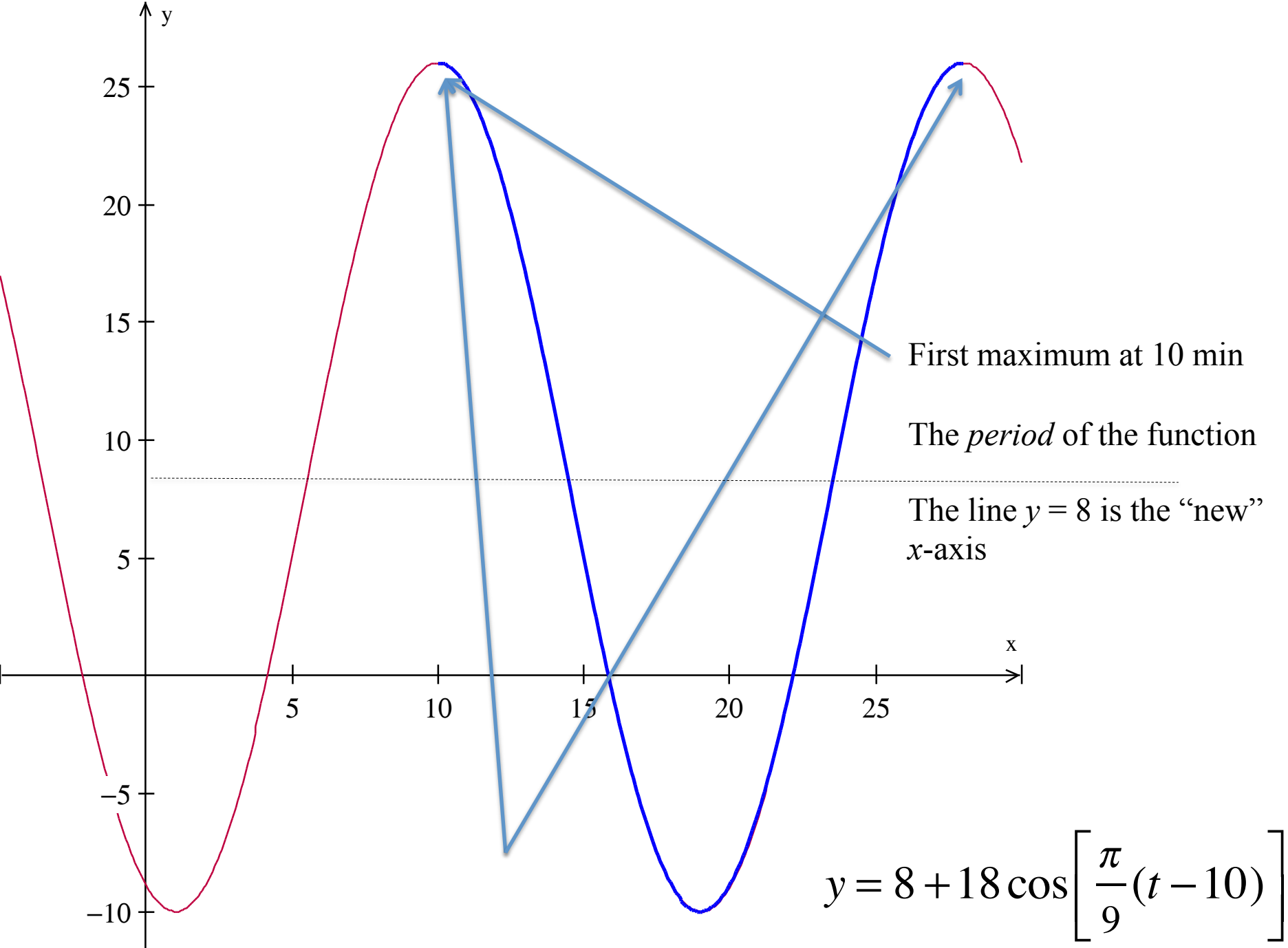
8 is halfway between the max and minimum temp

max temp is  $26^{\circ}$  and the min temp is  $-10^{\circ}$ . Since this makes the graph's vertical length 36, the amplitude is 18

The top of the cosine graph occurs 10 minutes later

It takes 9 minutes to go from max to min so the whole period is twice that. And remember that

$$b = \frac{2\pi}{18}$$



$$y = d + a \cos[b(x - c)]$$

Sinusoidal Axis  
(vertical shift)

amplitude

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

Horizontal shift  
(always opposite the  
sign in the parentheses)

Average of the  
the Max and Min  
Values

Half the  
distance  
from the  
max to the  
min

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

Period is  
twice the  
time it takes  
to go from  
max to min

Where does the  
problem say the  
first maximum  
value occurs?

Or just find  
Max minus  
amplitude

