# 7.6 Exploring Periodic Data

Identifying Cycles and Periods of a Function
- A periodic function is a function that repeats a pattern of ___y-values___ (or outputs) at regular intervals.
- One complete pattern is a ___cycle___. A cycle may begin at any point on the graph of a function.
- The period of a function is the horizontal length of one cycle. Periodic behavior is behavior that repeats over intervals of ___equal length___.

Example 1: Analyze the periodic function below. Identify the cycle in two different ways. What is the period of this function?
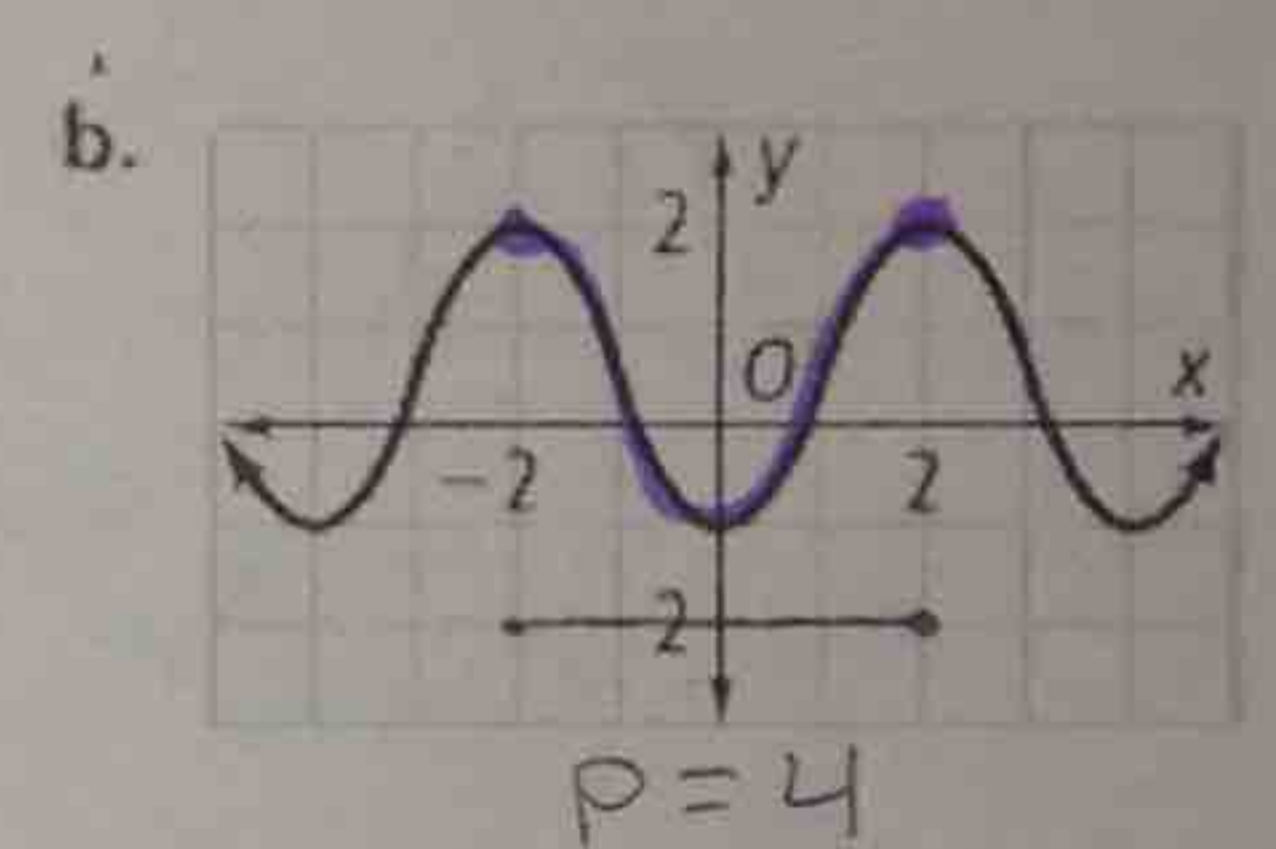

one cycle   one cycle
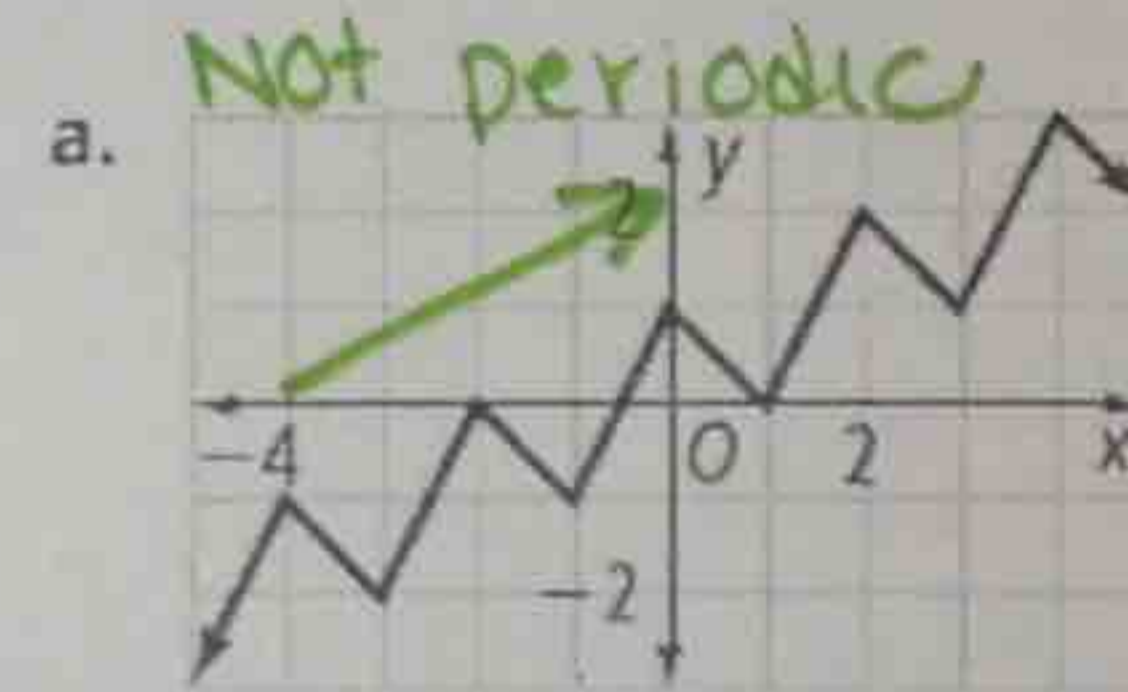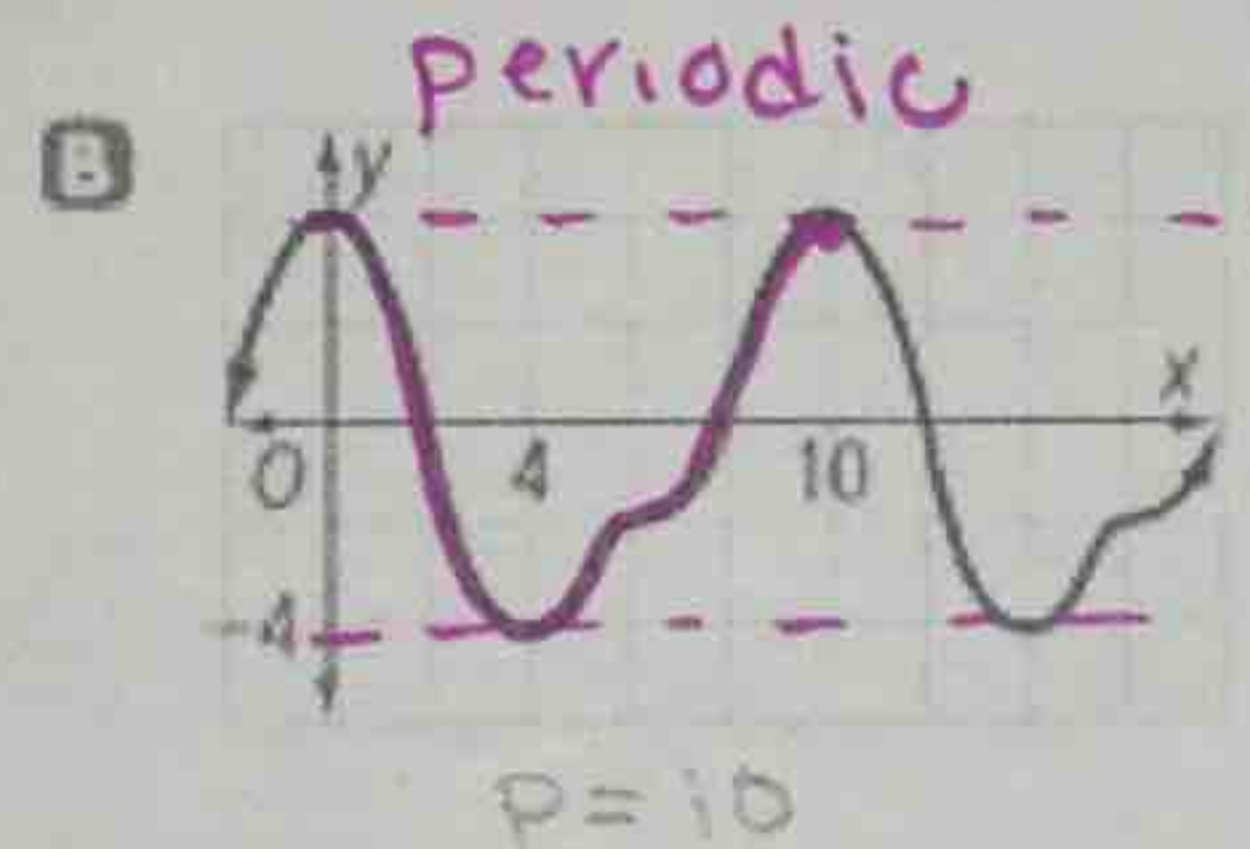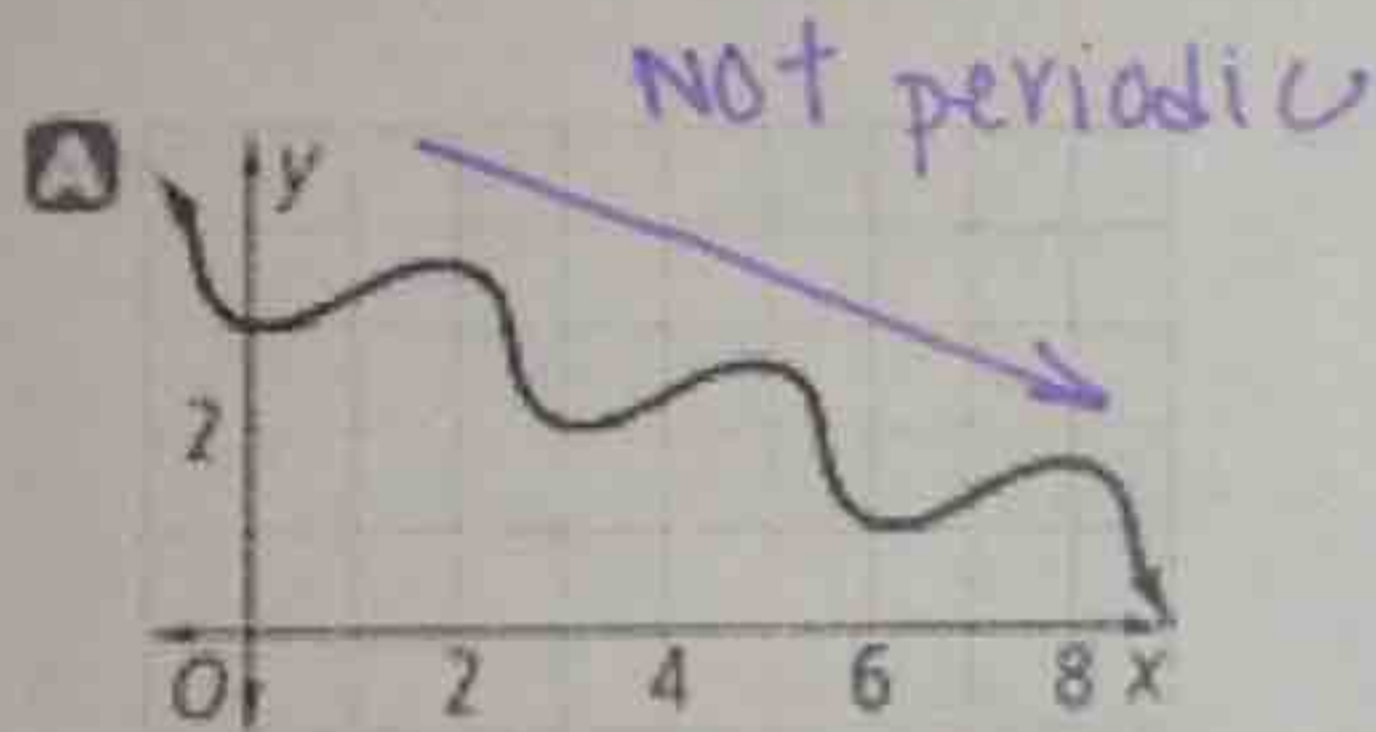
P = 4

period   period

a.

P = 4

b.

P = 3
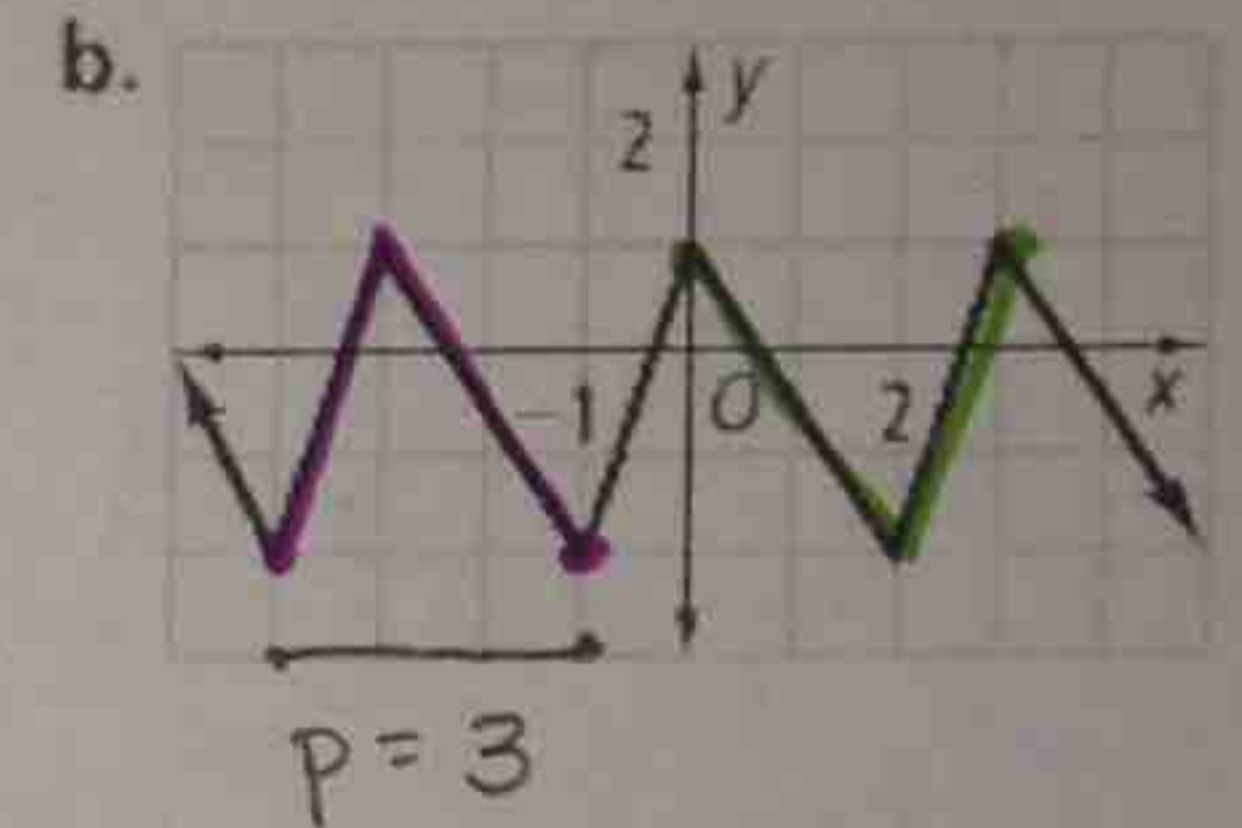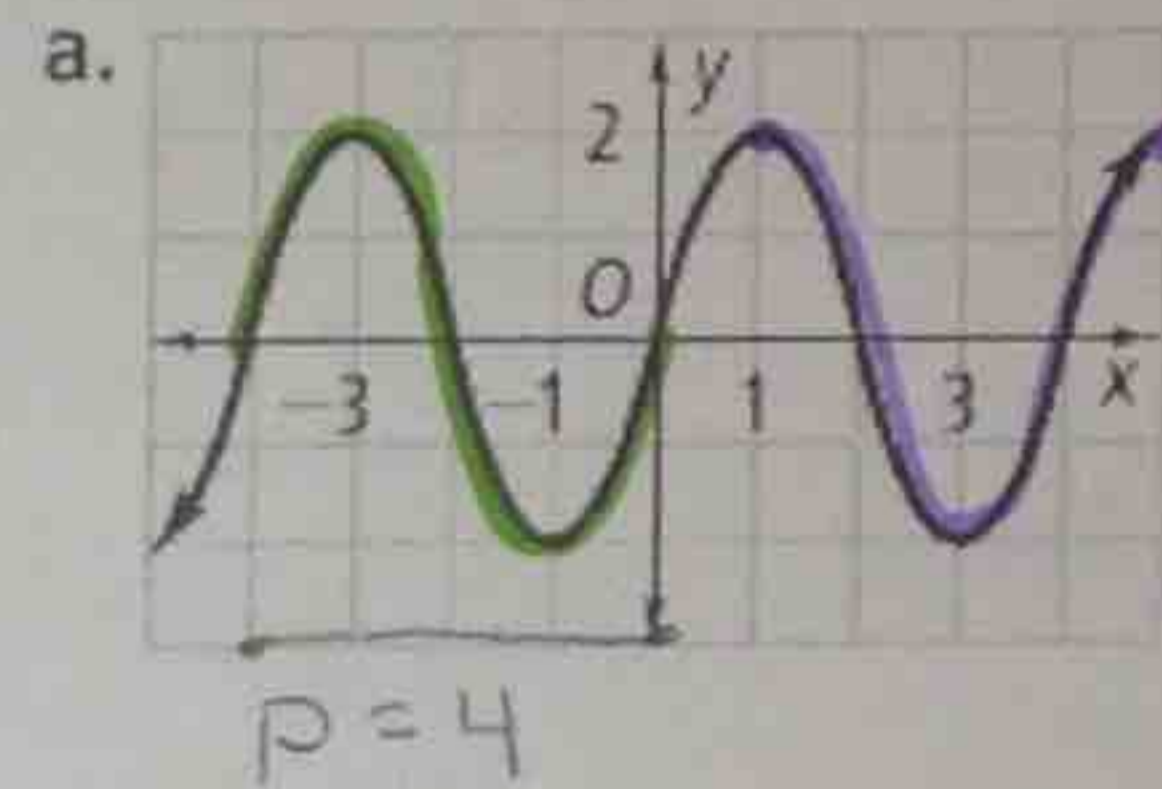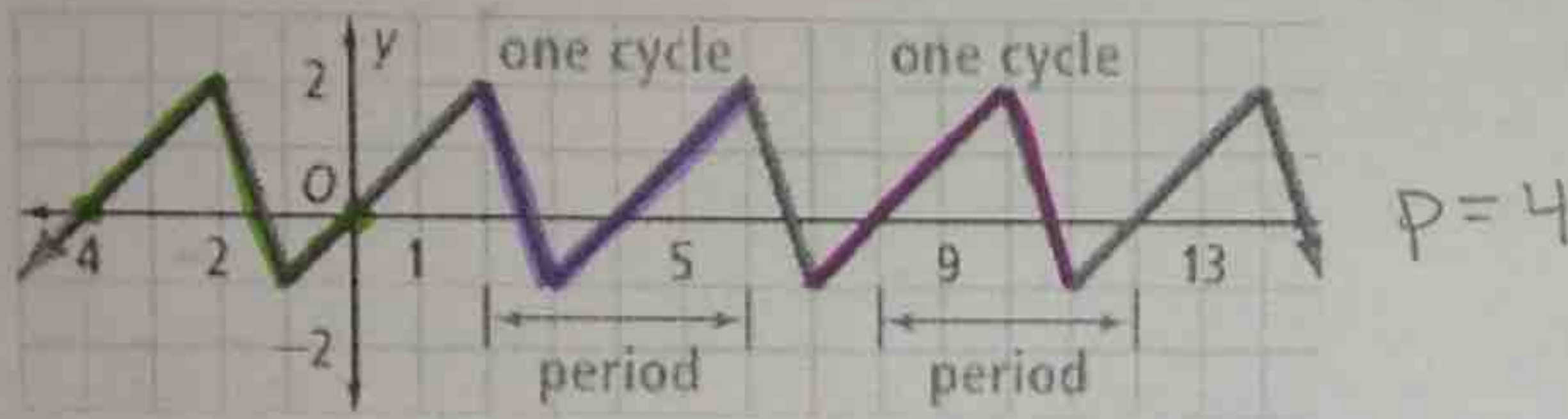
Identifying Periodic Functions
To determine if a function is periodic, analyze the functions graph to see if the y-values (or outputs) of the graph repeat.

**Example 2**: Is the function periodic? If it is, what is its period?

Not periodic

periodic

P = 10

You Try! Is the function periodic? If is it, what is its period?

a. Not periodic

b.

P = 4

Amplitude: The amplitude of a periodic function measures the amount of variation in the function values. The amplitude can be found by find the ___difference___ between the maximum and minimum value and dividing it by 2.
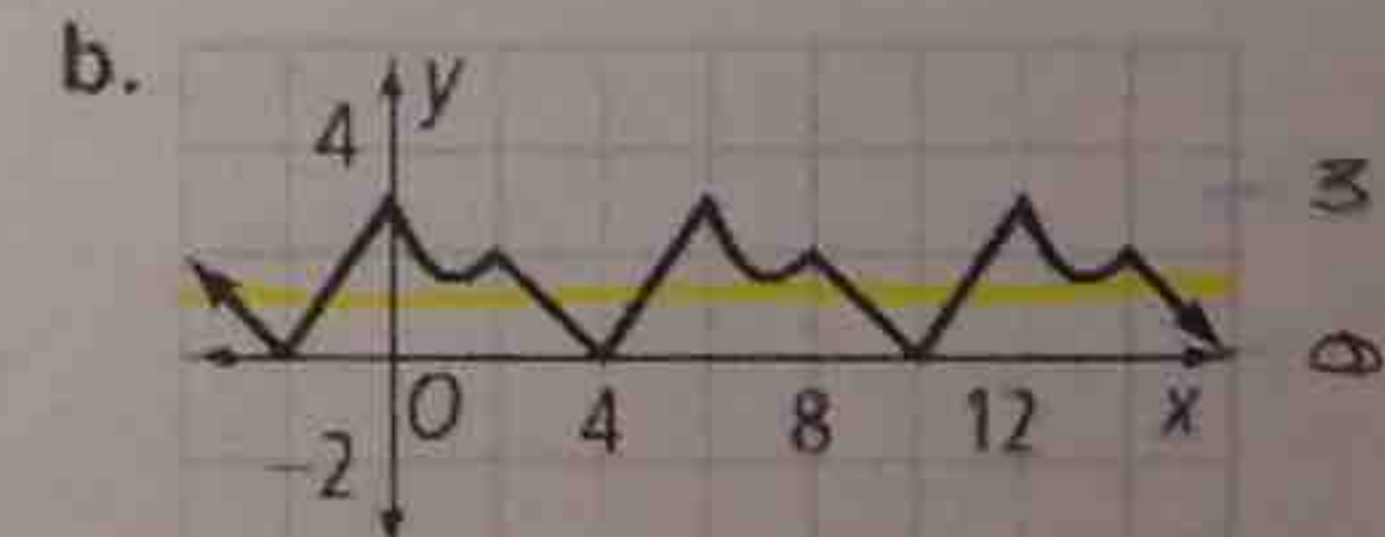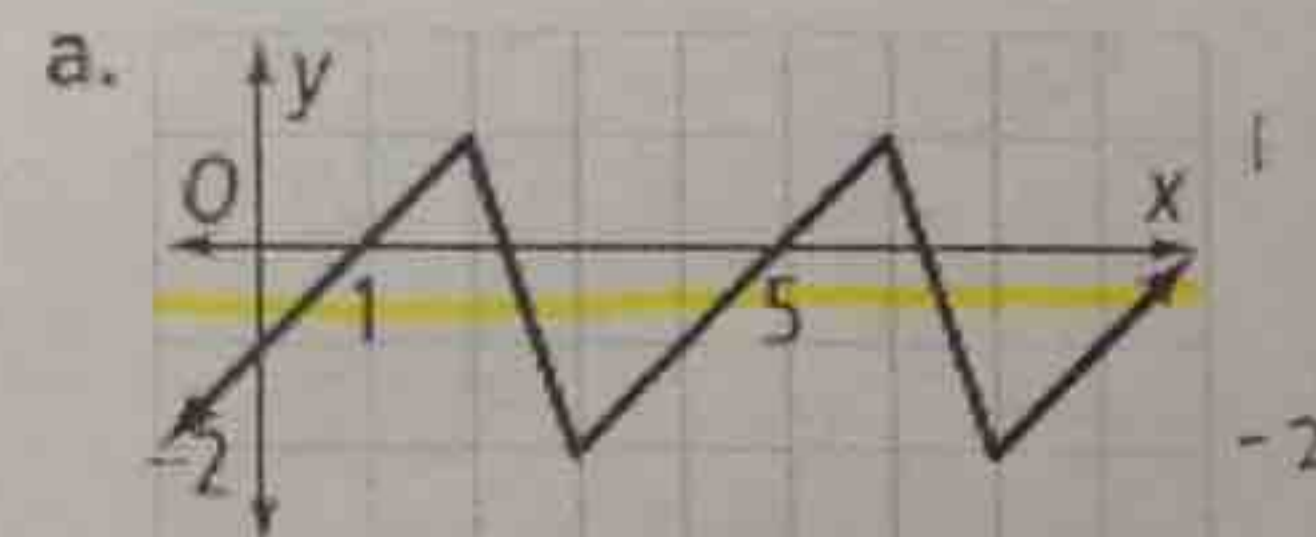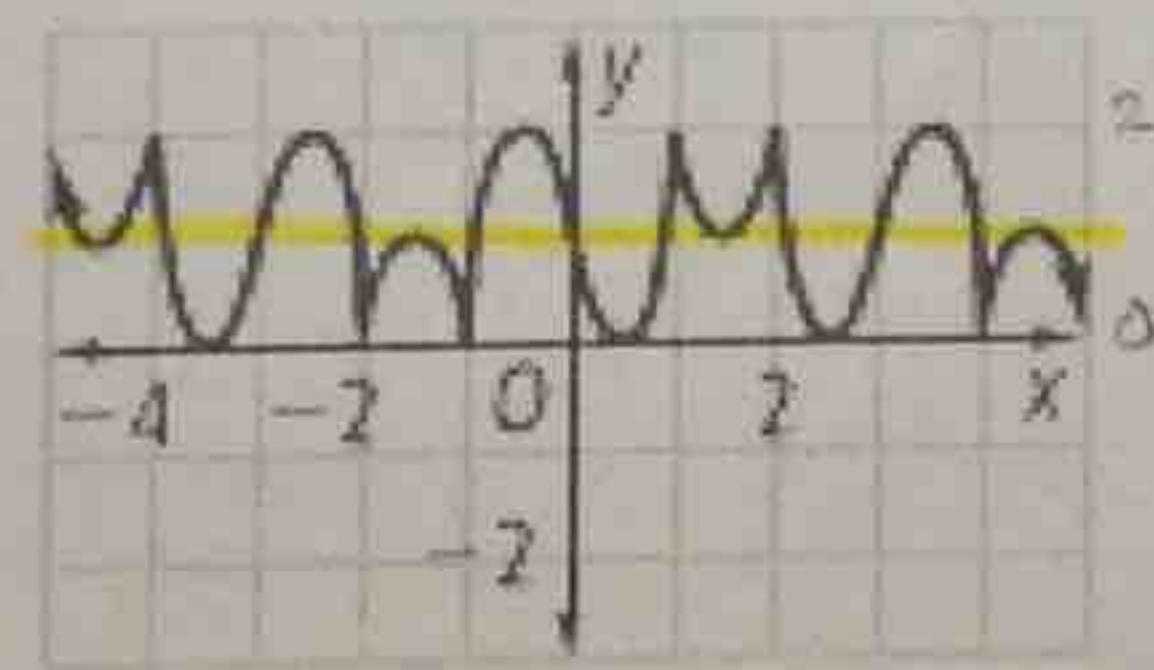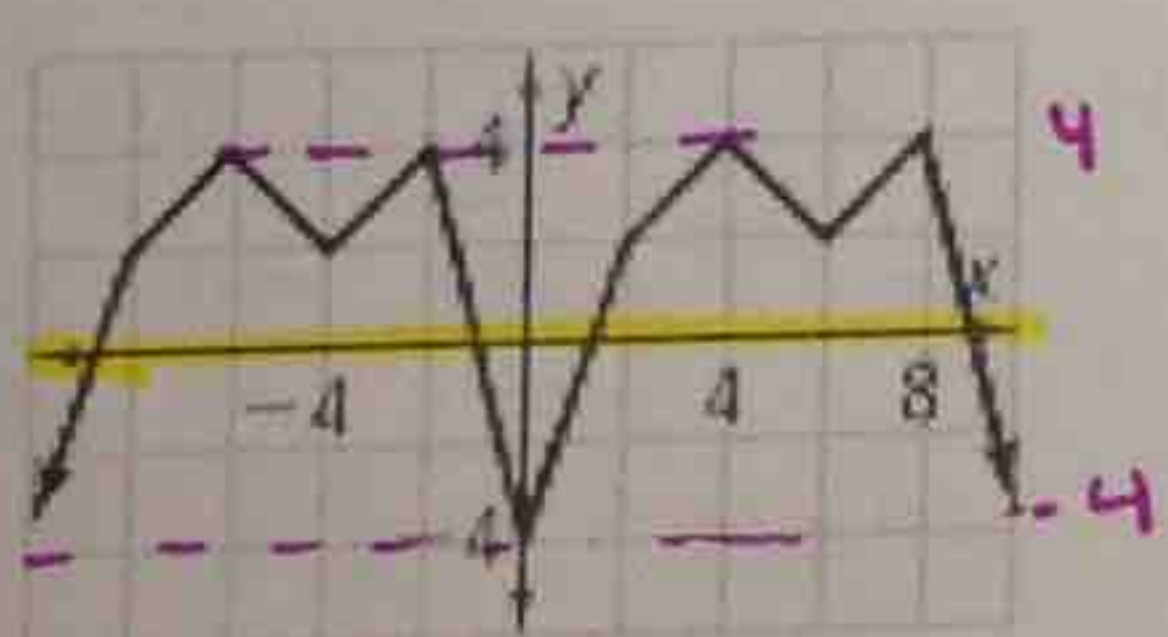
Amplitude= $\dfrac{\text{Maximum} - \text{minimum}}{2}$

from the midline

maximum
midline
minimum
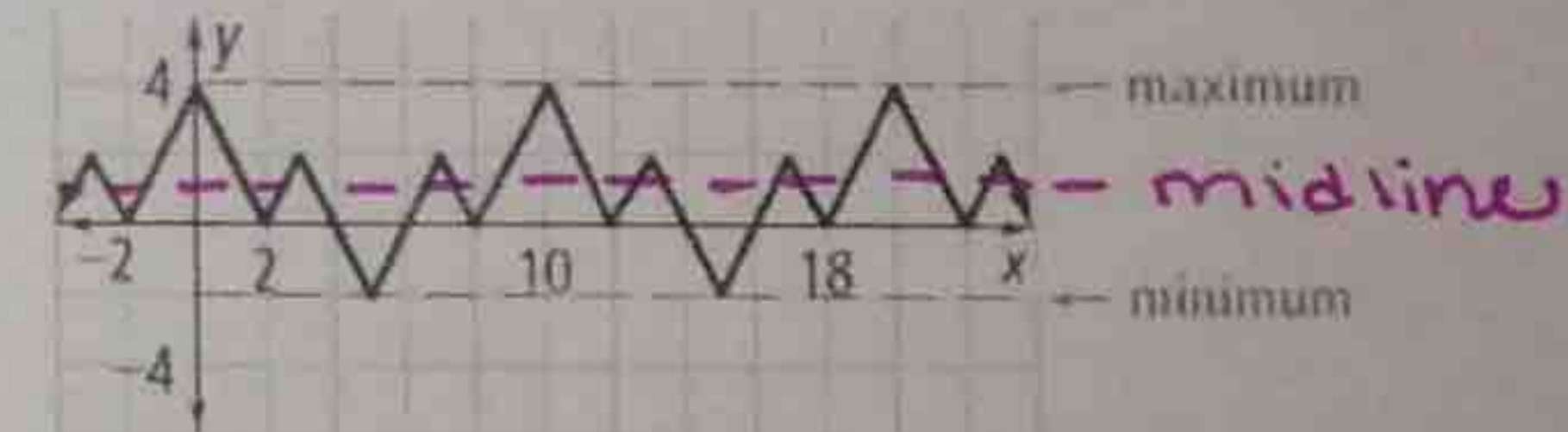
midline = $\dfrac{max + min}{2}$

Example 3: What is the amplitude of the periodic function below?

amp = 1   mid = 1
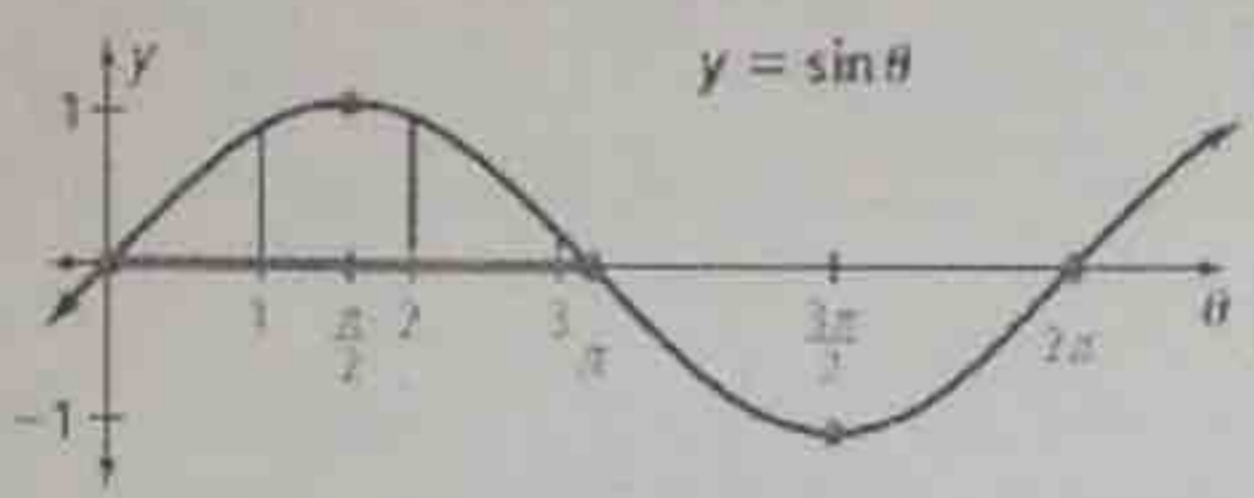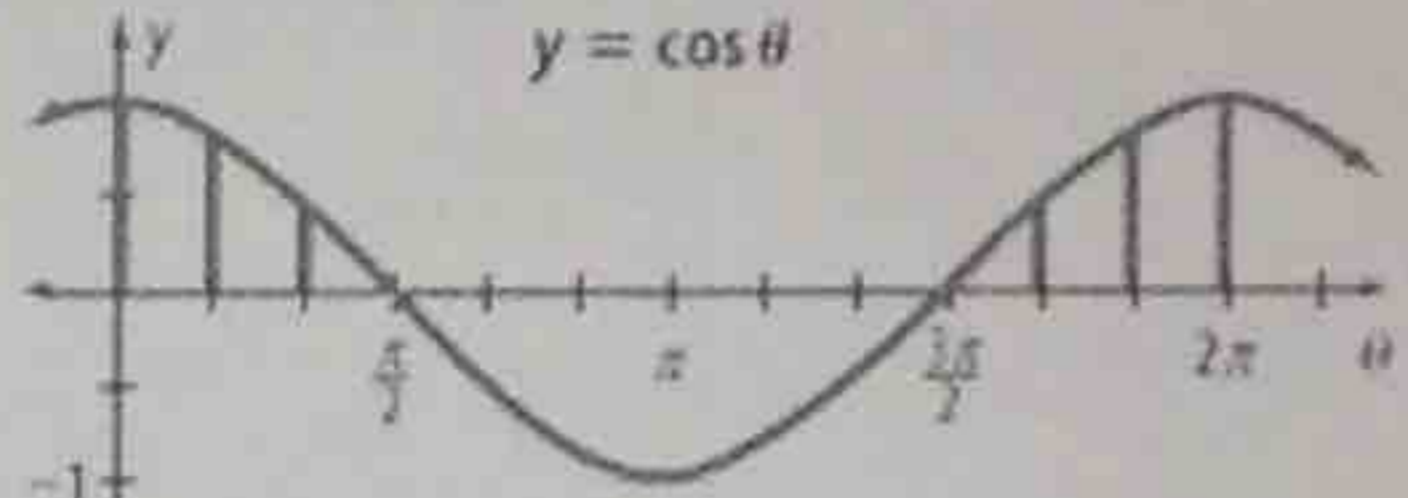
You Try! What is the amplitude of each periodic function?

a.

amp = $\dfrac{3}{2}$ mid = $-\dfrac{1}{2}$

b.

amp= $\dfrac{3}{2}$ mid = $3/2$

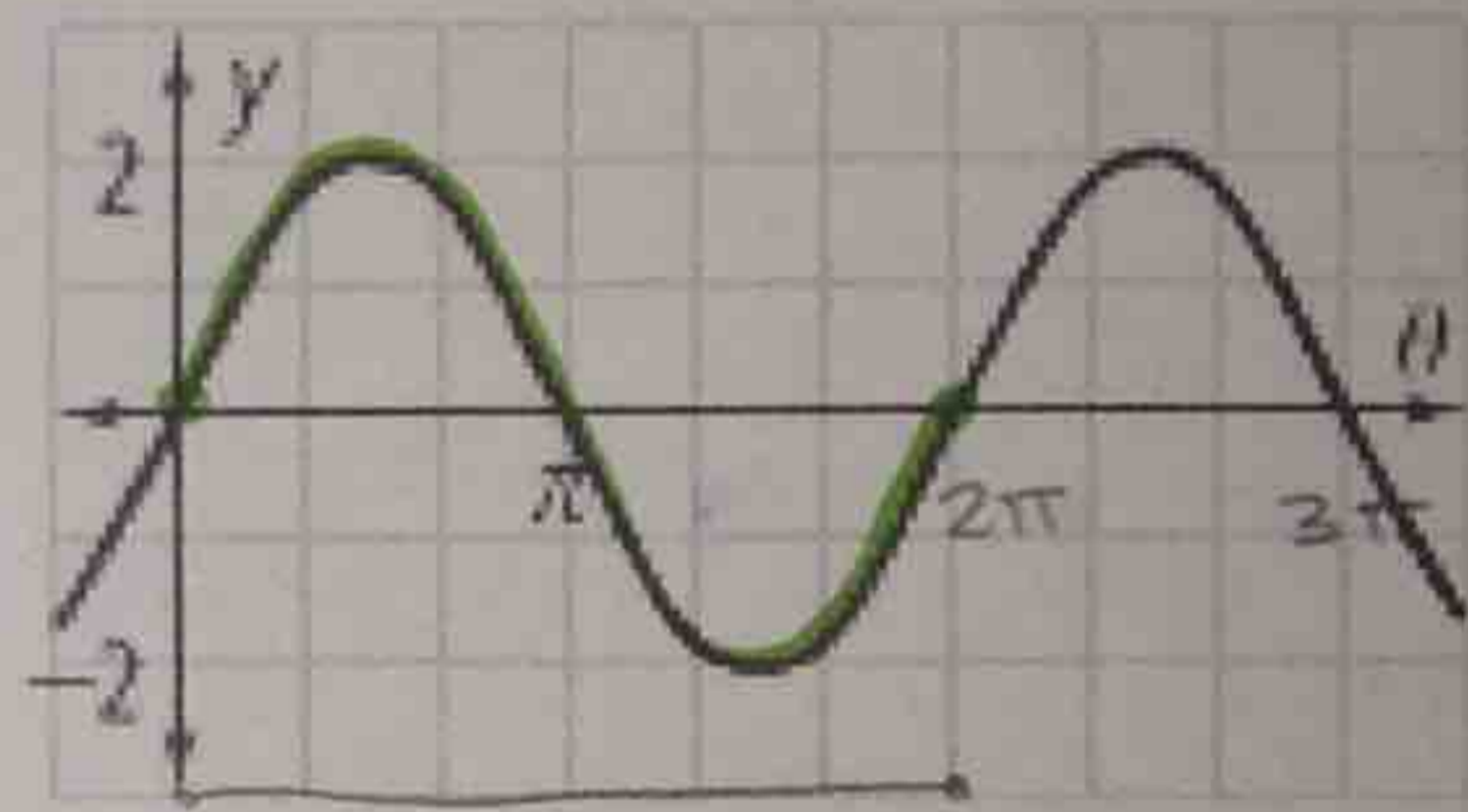|	**The Sine Function**	**The Cosine Function**
Equation	$y = a \sin b\theta$	$y = a \cos b\theta$
Graph	$y = \sin\theta$	$y = \cos\theta$

Key Ideas

$|a|$ is the amplitude of the function

b is the number of cycles in the interval from 0 to 2π

$b = {}^{2\pi}/_{period}$

Period $= {}^{2\pi}/_b$

Example 4: Find the period of the sine curve. Then write an equation for the function.

Period = 2π Amplitude = $\dfrac{2+2}{2} = 2$ a = 2   b = $\dfrac{2\pi}{2\pi} = 1$
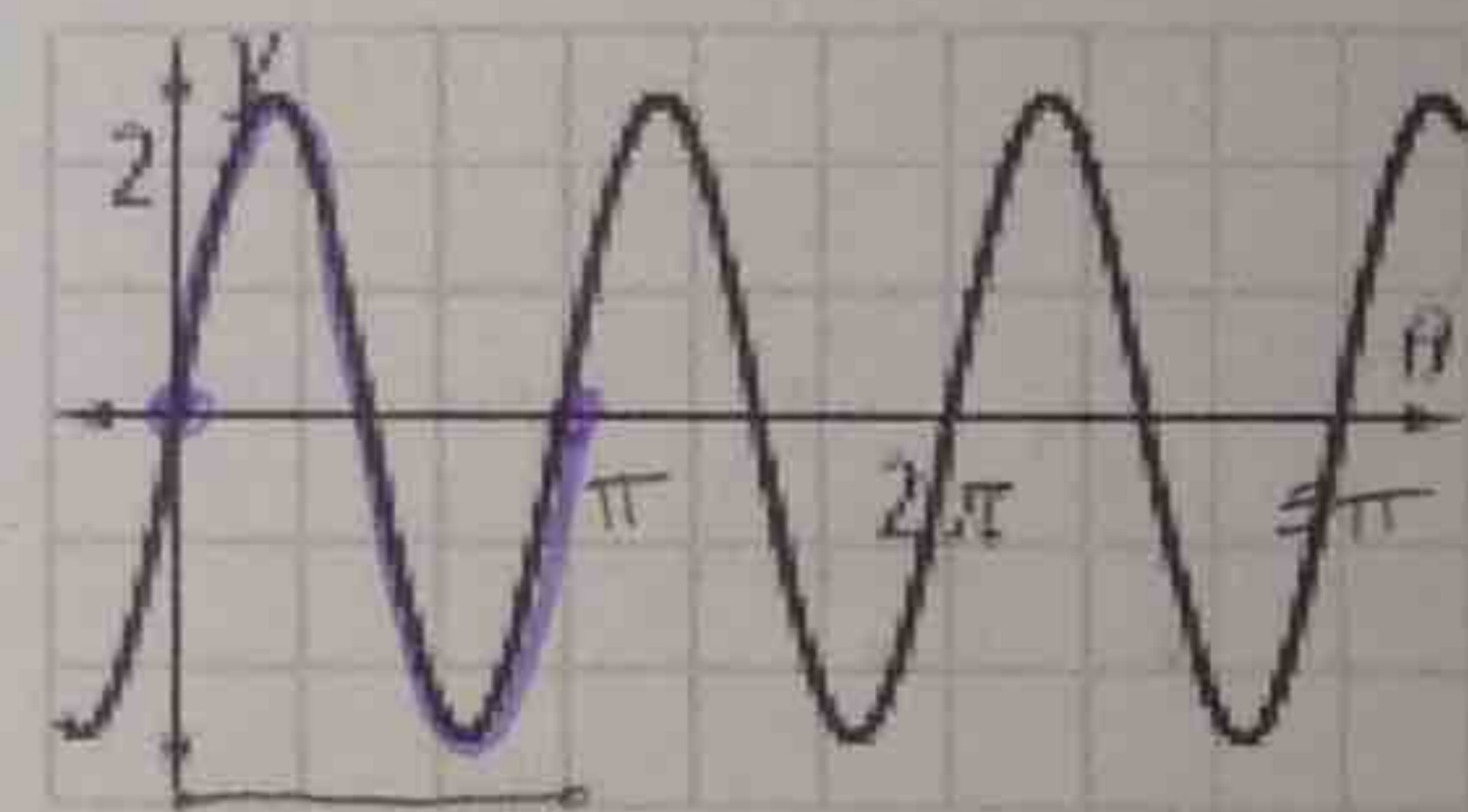
Equation: $y = a \sin b\theta$

$y = 2 \sin 1\theta$

You Try! Find the period of the sine curve. Then write an equation for the function.

Period = π Amplitude = $\dfrac{2.5+2.5}{2} = 2.5$ a = 2.5   b = $\dfrac{2\pi}{\pi} = 2$

Equation: $y = 2.5 \sin 2\theta$

Example 5: Find the period of the cosine curve. Then write an equation for the function.

Period = π Amplitude = $\dfrac{3+3}{2} = 3$ a = -3 b = $\dfrac{2\pi}{\pi} = 2$

Equation: $y = a \cos b\theta$ graph starts low

$y = -3 \cos 2\theta$