U6D1_T_Periodic Behaviour

Tuesday, April 30, 2019 7:15 PM

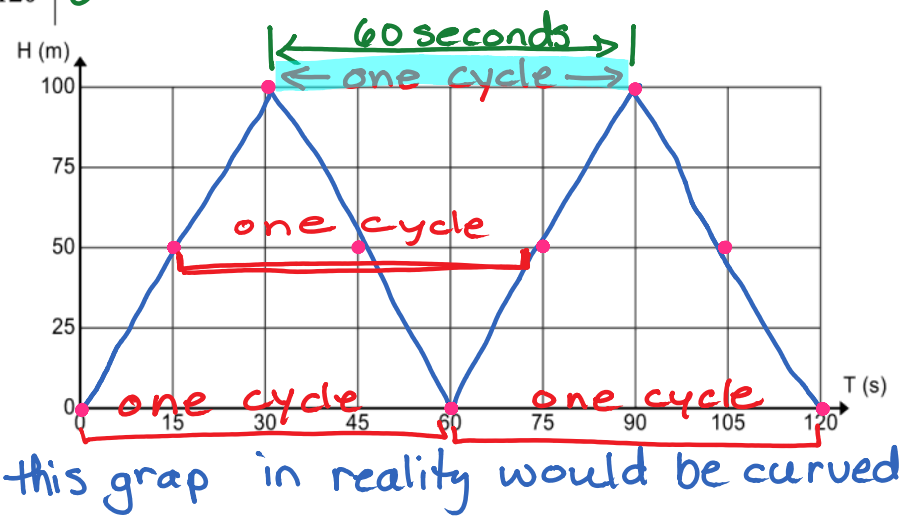
U6D1_T_Periodic Beh...

U6D1 MCR3UI **UNIT 6** QUIZ IS ON: Mon. May 13/19 **UNIT 6** TEST IS ON: Wed May 22/19

MCR 3UI **Periodic Behaviour** **Date:**

Suppose you are on a Ferris wheel that has a radius of 50m. It takes 1 minute to complete a full revolution. If you get on the wheel at base (0, 0), graph your distance above the ground for two minutes. Use the table of values to assist you. (you will need to visualize yourself getting into a Ferris wheel and determining your height every 15 seconds)

Time(s)	Height(m)
0	0
15	50
30	100
45	50
60	0
75	50
90	100
105	50
120	0



* this grap in reality would be curved.

6-1

This graph/function (*height as a function of time)* is said to be **periodic**. That means the function has a pattern of y-values that repeat at regular intervals.

On the graph above, the y-value of 100m repeats itself every 60 seconds.

If there is no pattern of y-values that repeat themselves, the function is not periodic.

One full completed pattern is called a **cycle**. (A cycle may begin at any point on the graph and is measured until the pattern starts to repeat itself).

The horizontal length of one cycle is called the **period** of the function. The period of the function above is 60 seconds.

In any periodic function, the **amplitude** of the function is defined as half of the difference between the max y-value and the minimum y-value. The amplitude of the above graph is 50 m. $\frac{\text{max} - \text{min}}{2}$

In general, a function *f* is periodic if there exists a positive number *p*, such that the value of *f(x + p)* = value of *f(x)*, for every *x* in the domain. *f(x + p) = f(x), where p is the length of the period*

Understand the general idea on this page???

Using your graph, when $x = 15$ seconds, the height (or $f(x)$) is 50m. We said the period length, $p =$ 60.

So, $f(15\text{seconds}) = 50$ metres

$f(15) = 50$

If it's periodic, then $f(15 + p)$ should equal 50. $f(15+60) = f(75) = 50$

Does it? Yes! (Add p to 15, and read off its corresponding height from the graph)

Examples

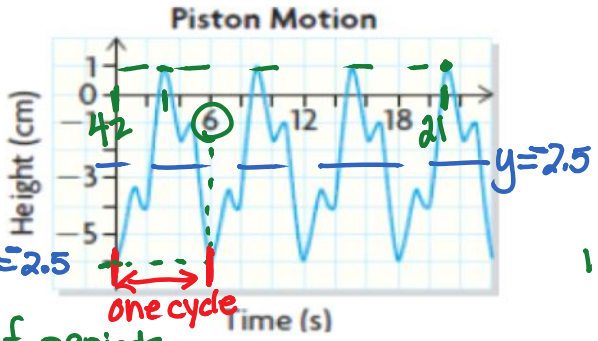
a)

Amplitude = $\frac{\text{max}-\text{min}}{2} \Rightarrow \frac{1-(-6)}{2}$

$a = 3.5$

Equation of Axis $\Rightarrow y = \frac{\text{max}+\text{min}}{2}$

$y = \frac{1+(-6)}{2} \Rightarrow y = -2.5$



Period = 6

So, $f(x) = f(x + k[$ 6 $])$ ← number of periods before or after the point of interest.

i) $f(6)$ ii) $f(21)$ iii) $f(45)$ iv) $f(30)$

45 ← go back 7 cycles

$= 45 - 42$

$= 3$

$= -6$ (from graph) $= 1$ (from graph)

$= f(45-42)$

$= f(3)$

$= 1$

$= f(30-30)$

$= f(0)$

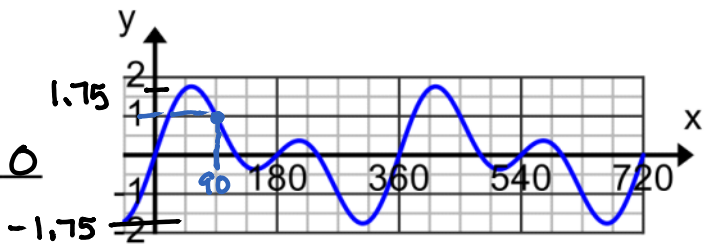
$= -6$

b)

Amplitude = 1.75

Equation of Axis ⇒ $y = 0$

Period = 360



So, $f(x) = f(x + k[\ 360\ ])$

Notice: $f(180) =$ 0 , $f(90) =$ 1

Find the value of:

i) $f(540) =$ 0

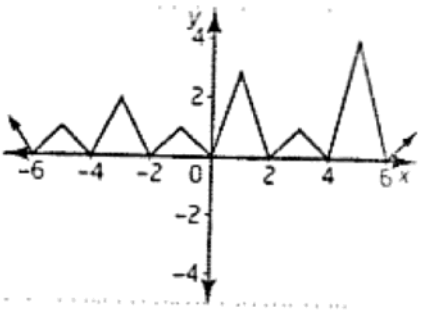
ii) $f(3690) = f(3690 - 3600)$
$= f(90)$
$= 1$

iii) $f(4410)$
$\frac{4410}{360} = 12.25$
$= f(4410 - 12[360])$
$= f(90)$
$= 1$

iv) $f(-540) = f(-540 + 2[360])$
$= f(180)$
$= 0$

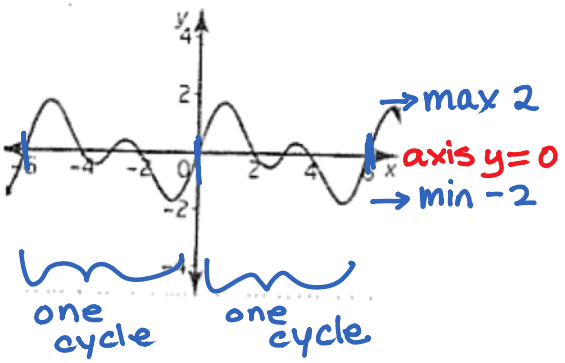
Examples: Determine if the following graphs are periodic. If so, determine the period length and amplitude for each.

1.



NOT PERIODIC.

2.



Periodic

Amplitude: $\frac{2-(-2)}{2}$

$a = 2$

Period: 6 (horizontal length of one segment).

Homework: p 359 #1, 2, 3b, 4, 5