

Periodic Behaviour

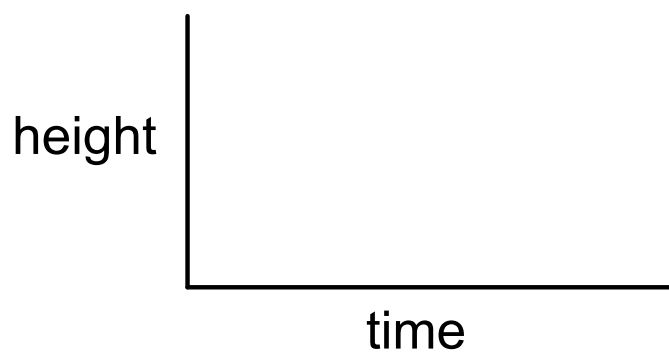
Do the first few slides before
turning on the video

Activity - On Your Own

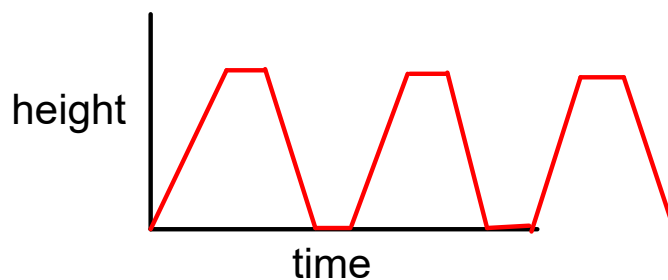
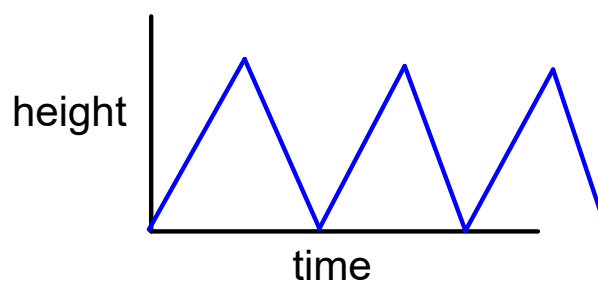
- draw a graph to represent the height of an individual person on a Ferris wheel with respect to time
- label your graph
- explain your reasoning



Did you start like this?

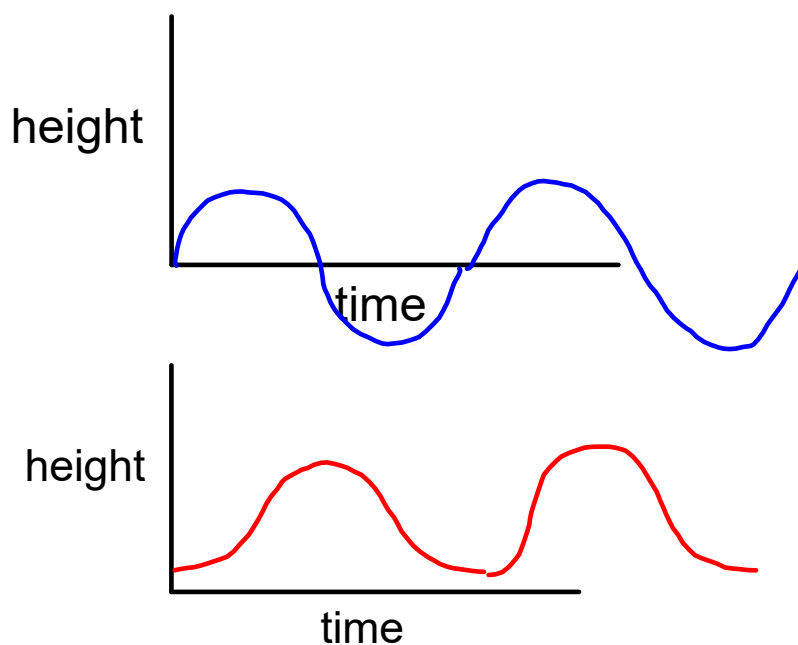


Did you get something like this?



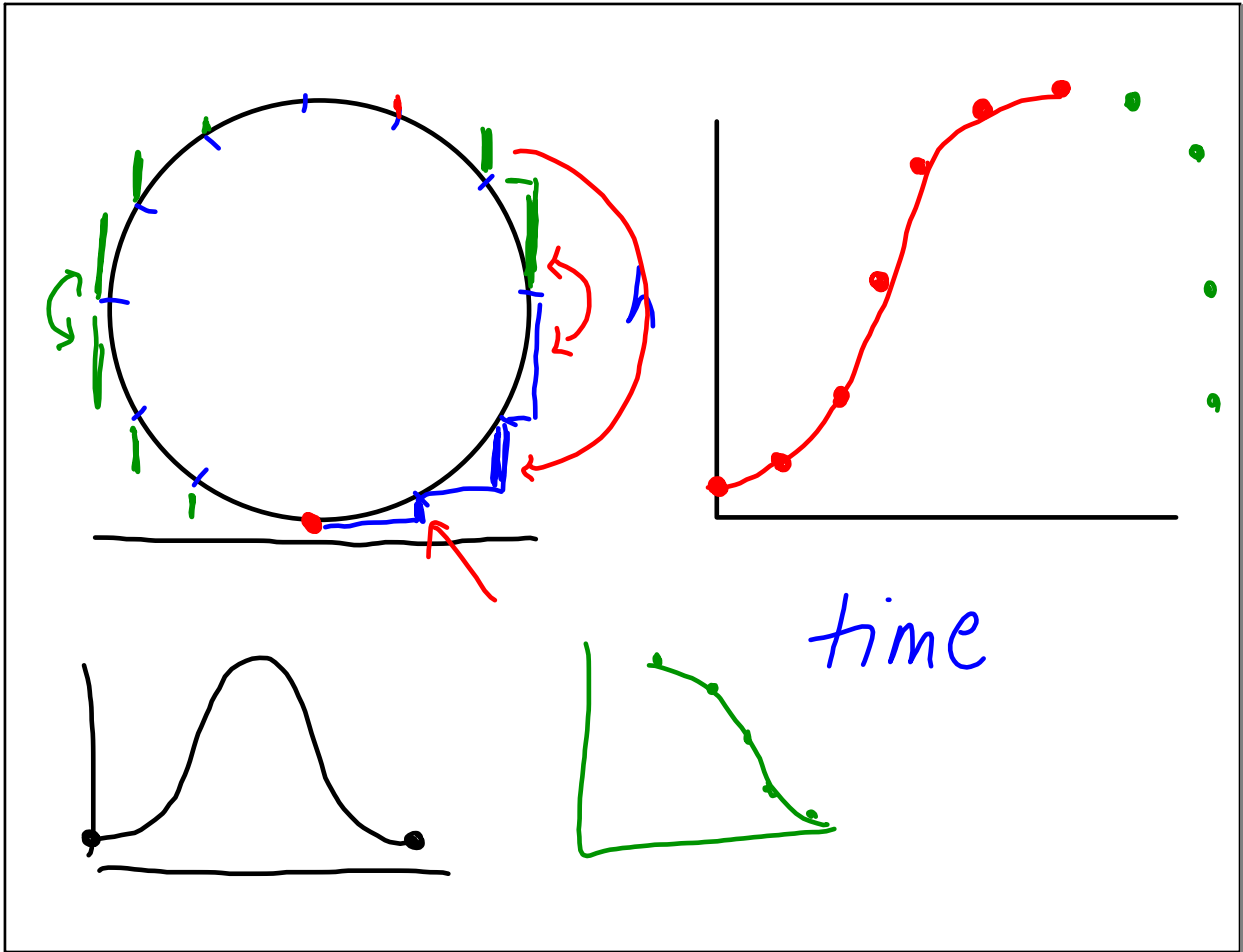
What do straight lines represent in a graph?

Did you get something like this?



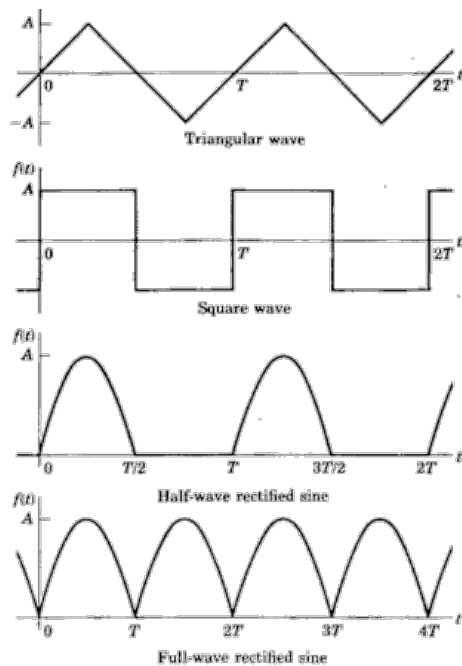
What do curved lines represent?

Turn on the video



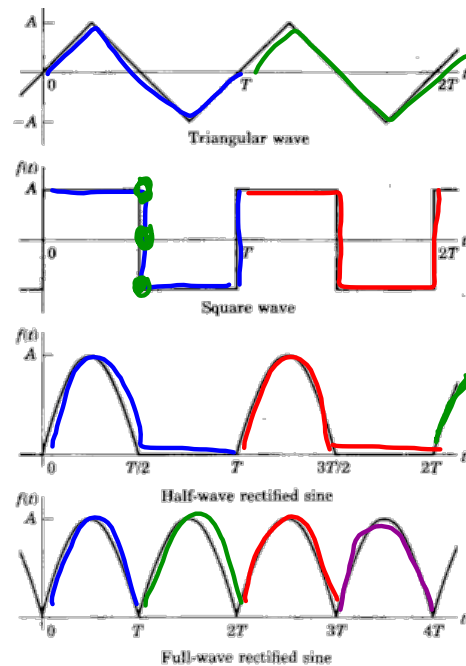
Periodic Function - a function that produces a self-repeating graph

Pause the video to find repeating sections



Periodic Function - a function that produces a self-repeating graph

not a function



Periodic Functions

<http://www.youtube.com/watch?v=S-88Y2QxZPo>

swimmer - period



<http://www.youtube.com/watch?v=51aivZiP9vA>

tide - period, application



What really happens as a wheel goes around?

<http://www.upscale.utoronto.ca/GeneralInterest/Harrison/Flash/ClassMechanics/Circular2SHM/rcular2SHM.html>

circle



<http://www.youtube.com/watch?v=IVimuh1xWf4>

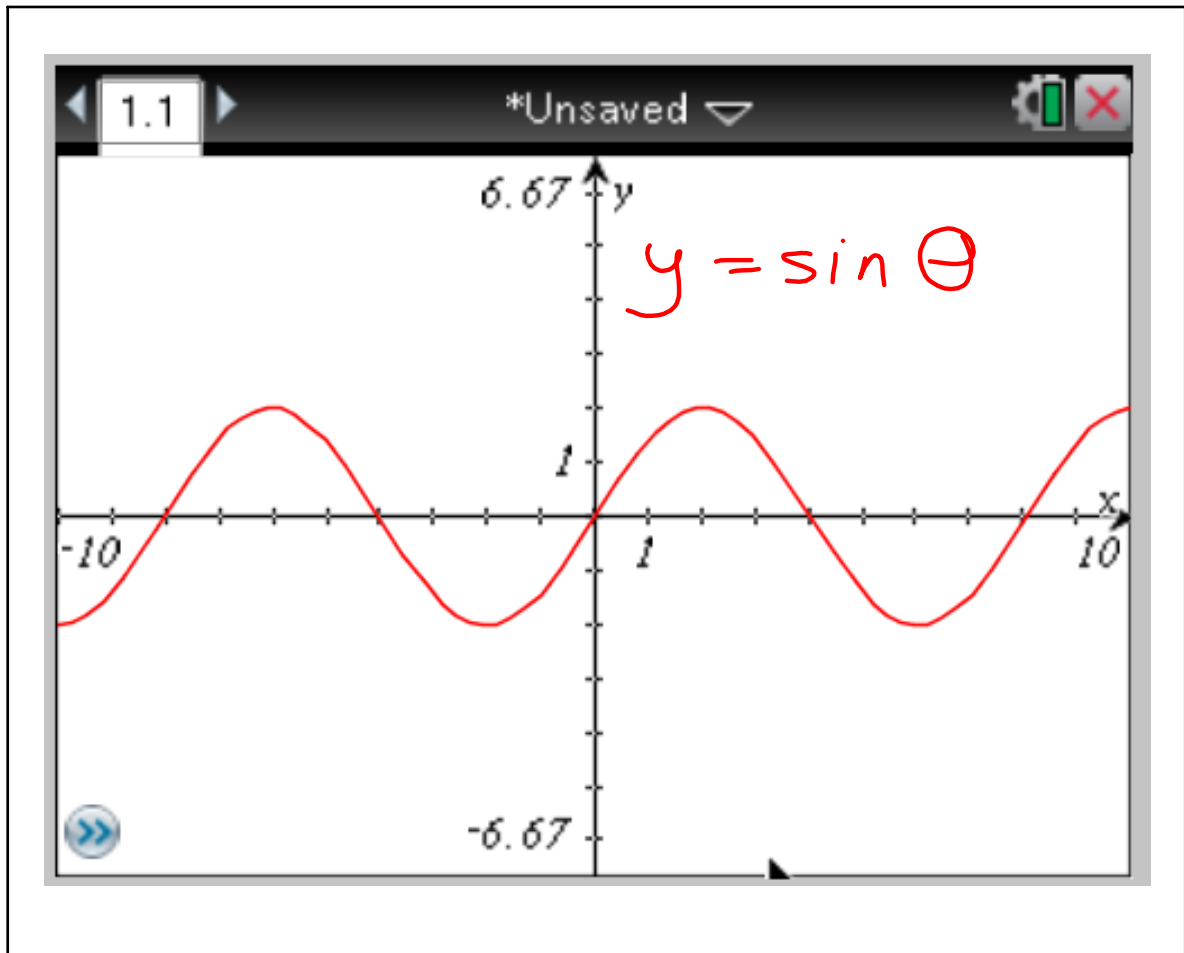
bicycle wheel - triangles shown



<https://www.youtube.com/watch?v=FJBPNJR2QJU>

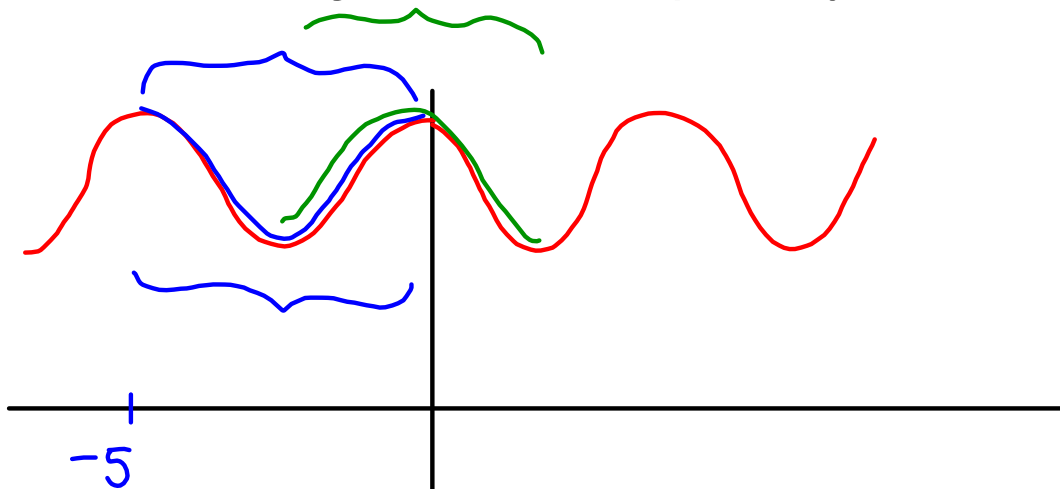
spring - first 30 seconds





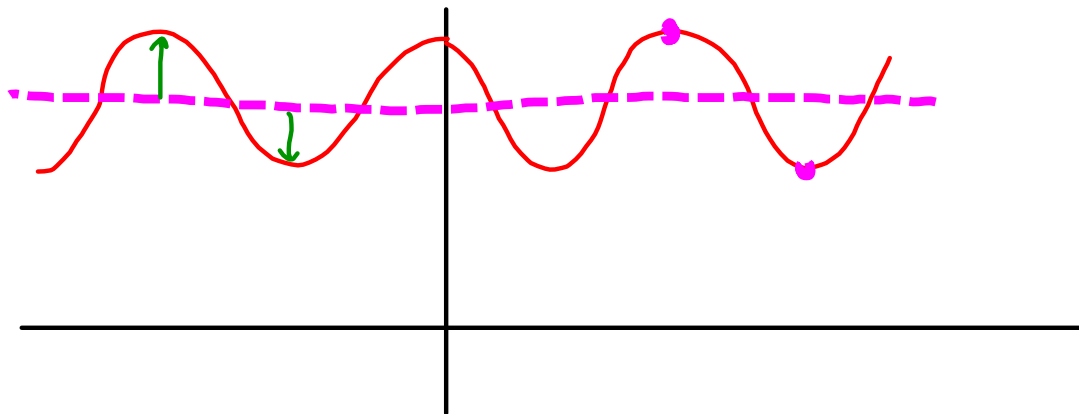
Cycle smallest complete repeating pattern of a graph

Period the length of one complete cycle



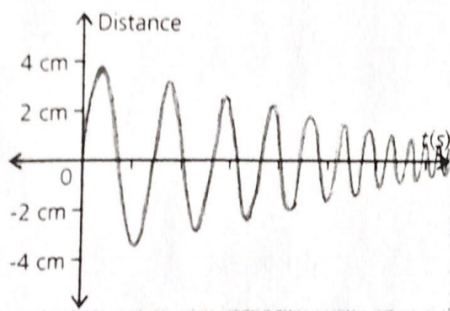
Axis of Curve - horizontal line that is half way between maximum and minimum value

Amplitude - the distance from the axis of the curve to either the max or min value



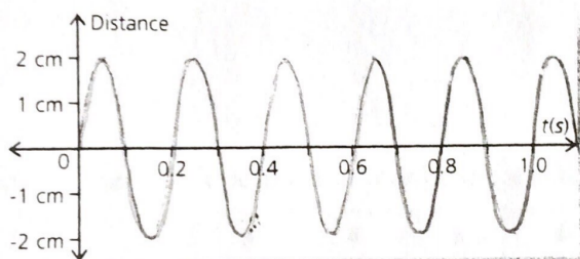
Are the graphs periodic?

(a) tip of vibrating meter stick



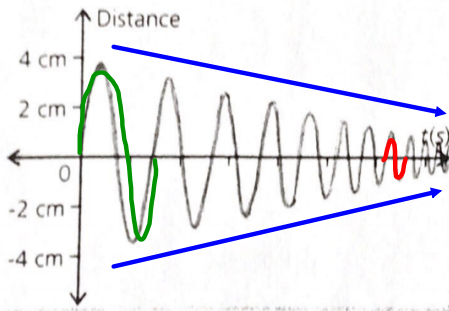
Try on your own

(b) movement of a piston in a combustion engine



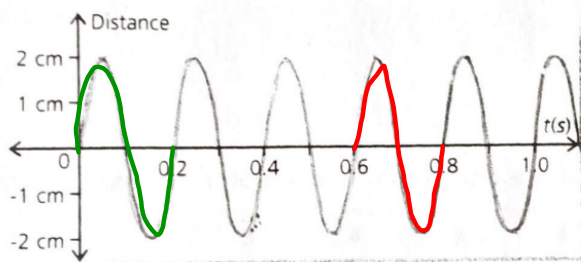
Are the graphs periodic?

(a) tip of vibrating meter stick



No, because the amplitude is getting smaller each time

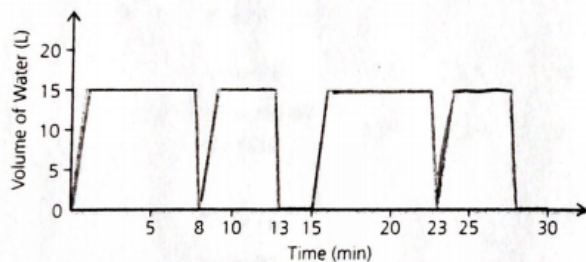
(b) movement of a piston in a combustion engine



Yes

Example 2

The automatic dishwasher in a school cafeteria runs constantly through lunch. The graph shows the amount of water used as a function of time.

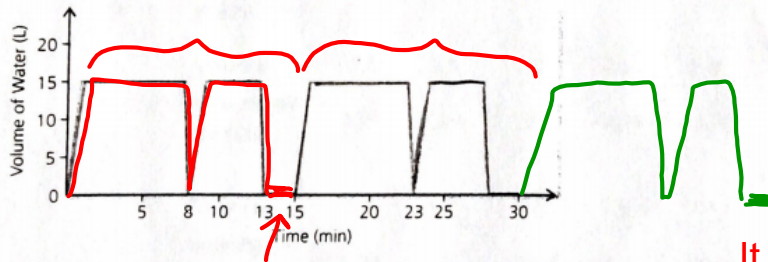


Try on your own

- Explain why the operation of the dishwasher is an example of a periodic function.
- What is the length of the period? What does one complete cycle mean in the context of the question?
- Extend the graph for one more complete cycle.
- How much water is used if the dishwasher runs through eight complete cycles?

Example 2

The automatic dishwasher in a school cafeteria runs constantly through lunch. The graph shows the amount of water used as a function of time.



It repeats 2 times

- (a) Explain why the operation of the dishwasher is an example of a periodic function.
- (b) What is the length of the period? What does one complete cycle mean in the context of the question?

Wash and rinse

- (c) Extend the graph for one more complete cycle.
- (d) How much water is used if the dishwasher runs through eight complete cycles?

1 cycle -- wash 15 L, rinse 15 L

8 cycles -- wash 120 L, rinse 120 L

Try on your own

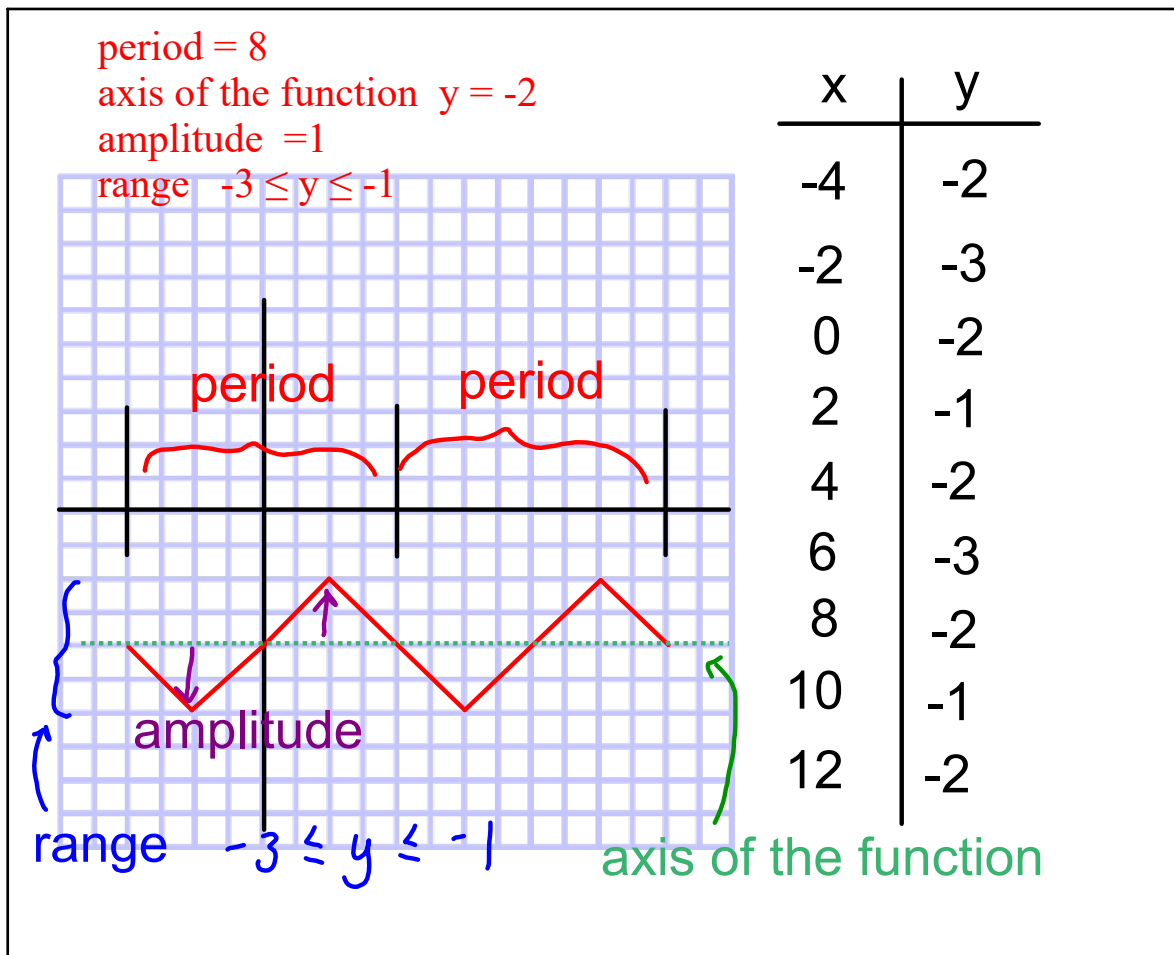
Example

Sketch

Find

- period
- axis of the function
- amplitude
- range

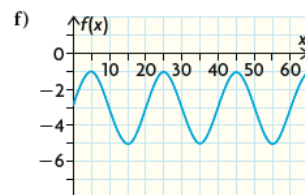
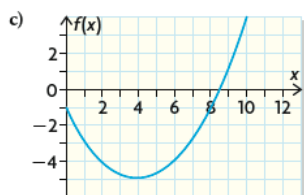
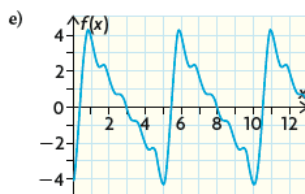
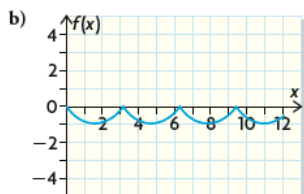
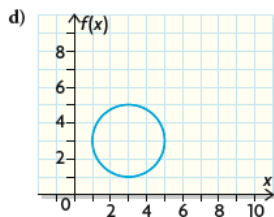
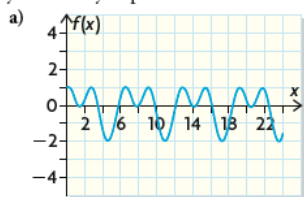
x	y
-4	-2
-2	-3
0	-2
2	-1
4	-2
6	-3
8	-2
10	-1
12	-2



Try On Your Own

Text Book Pg 352 # 4, 6-10

4. Identify which graphs are periodic. Estimate the period of the functions that you identify as periodic.



6. Which of the tables of values might represent periodic functions? Justify.

a)

x	y
-5	9
-4	4
-3	1
-2	0
-1	1
0	4
1	9
2	16

b)

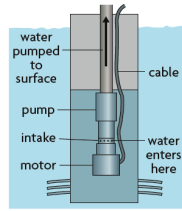
x	y
0.7	5
0.9	6
1.1	7
1.3	5
1.5	6
1.7	7
1.9	5
2.1	6

c)

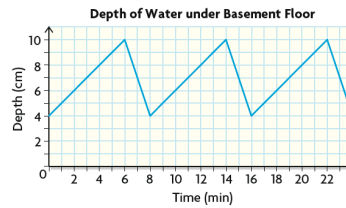
x	y
23	-6
26	-6.5
29	-7
32	-7.5
35	-8
38	-8.5
41	-9
44	-9.5

d)

x	y
1	5
2	6
4	5
7	6
11	5
16	6
22	5
29	6

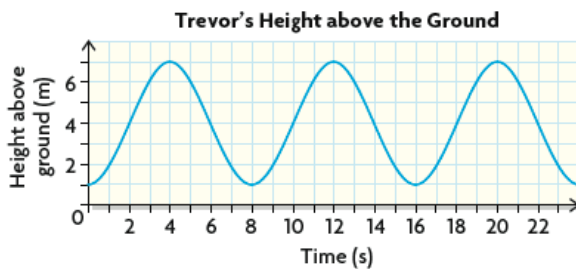


7. Chantelle has a submersible pump in her basement. During a heavy rain, the pump turned off and on to drain water collecting under her house's foundation. The graph models the depth of the water below her basement floor in terms of time. The depth of the water decreased when the pump was on and increased when the pump was off.



- Is the function periodic?
- At what depth does the pump turn on?
- How long does the pump remain on?
- What is the period of the function? Include the units of measure.
- What is the range of the function?
- What will the depth of the water be at 3 min?
- When will the depth of the water be 10 cm?
- What will the depth of the water be at 62 min?

8. While riding on a Ferris wheel, Trevor's height above the ground in terms of time can be represented by the graph shown.



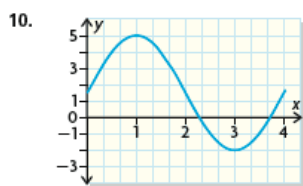
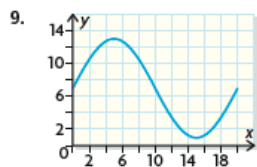
- What is the period of this function, and what does it represent?
- What is the equation of the axis?
- What is the amplitude?
- What is the range of the function?
- After 24 s, when will Trevor be at the lowest height again?
- At what times is Trevor at the top of the wheel?
- When will his height be 4 m between 24 s and 30 s?

9. Sketch the graph of a periodic function with a period of 20, an amplitude of 6, and whose equation of the axis is $y = 7$.

10. Sketch the graph of a periodic function whose period is 4 and whose range is $\{y \in \mathbf{R} \mid -2 \leq y \leq 5\}$.

Answers

- house appliance.
4. a) period: 6 c) not periodic e) period: 5.5
 b) period: 2 d) not periodic f) period: 20
 5. (a), (b), and (f)
 6. (b) repeating cycle
 7. a) yes e) range: $\{d \in \mathbf{R} \mid 4 \leq d \leq 10\}$
 b) 10 cm f) 7 cm
 c) 2 min g) At $t = 6$ min and every 8 min from that time
 d) 8 min h) 10 cm
 8. a) 8 s; one rotation of Ferris wheel e) 32 s
 b) $b = 4$ f) 4 s, 12 s, 20 s, 28 s
 c) 3 m g) at $t = 26$ s and $t = 30$ s
 d) $\{b \in \mathbf{R} \mid 1 \leq b \leq 7\}$



Attachments



<https://www.youtube.com/watch?v=FJBPNJR2QJU>