

## 5.1 - Modelling Periodic Behaviour

### Periodic Functions

- A function is periodic if it has a pattern of y-values that repeat at regular intervals
- One complete pattern is called a cycle.
- The horizontal length of one cycle is called the period:
- Half the vertical length of one cycle is called the amplitude  
 $\text{amplitude} = (\text{max value} - \text{min value}) \div 2$

Ex 1 - For the graph, determine:

a) # complete cycles = 3

b) period = 6 units

c) max value = 5

d) min value = -5

e) amplitude  $\frac{\text{max} - \text{min}}{2} = \frac{5 - (-5)}{2}$

f) domain = 5

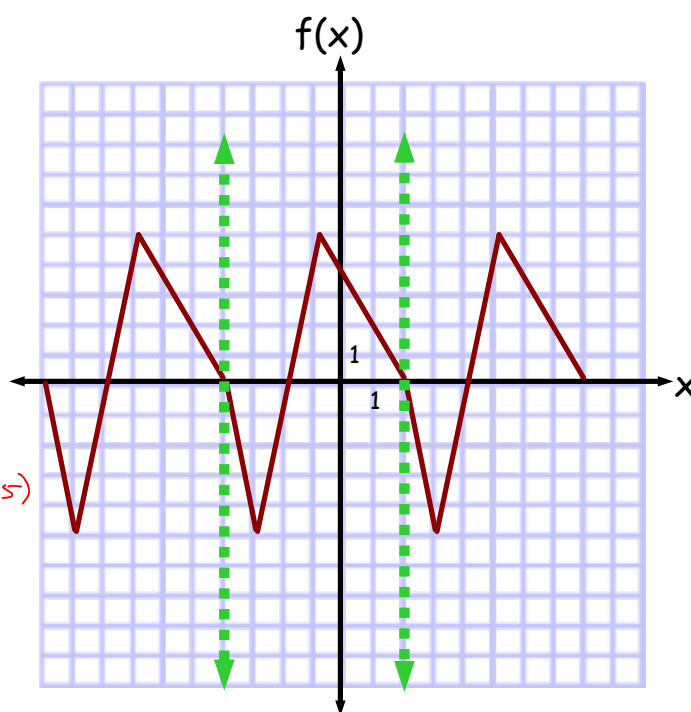
g) range  $\{x \in \mathbb{R} \mid -10 \leq x \leq 8\}$

$\{y \in \mathbb{R} \mid -5 \leq y \leq 5\}$

h)  $f(2) = 0$

$f(-4) = 0$

$f(-1) = 5$



Ex 2 - For the graph, determine:

a) period = 9 units

b) max value = 7

c) min value = -3

d) amplitude  $\frac{\text{max} - \text{min}}{2}$   
= 5

e) domain  $\{x \in \mathbb{R}\}$

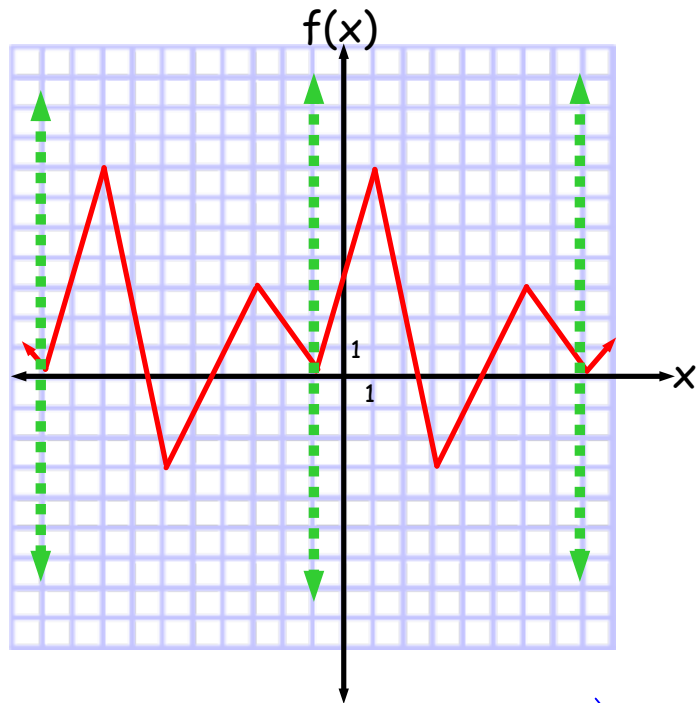
f) range  $\{y \in \mathbb{R} \mid -3 \leq y \leq 7\}$

g)  $f(-3) = 3$

$$\begin{aligned} f(24) &= f(24 - 9) = 3 \\ &= f(15) \\ &= f(6) \\ &= f(-3) \end{aligned} \quad \left\{ \begin{array}{l} f(24 - 3 \cdot 9) \\ = f(-3) \end{array} \right.$$

$$\begin{aligned} f(-1) &= 0 \end{aligned}$$

$$\begin{aligned} f(-19) &= f(-19 + 2 \cdot 9) \\ &= f(-1) \\ &= 0 \end{aligned}$$



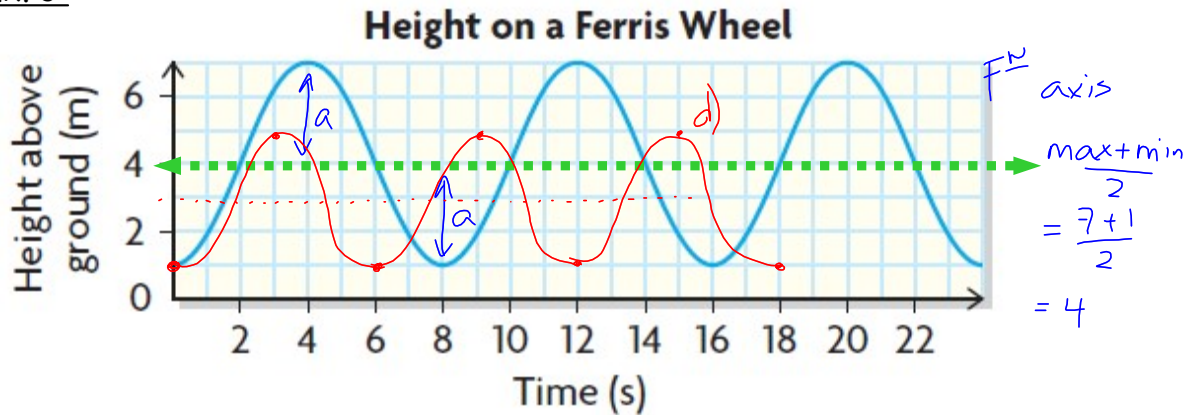
$$\begin{aligned} \text{i) } f(360) &= f(360 - 40 \cdot 9) \\ &= f(0) \\ &= 3.5 \end{aligned}$$

$$\begin{aligned} f(341) &= f(341 - 38 \cdot 9) \\ &= f(-1) \\ &= 0 \end{aligned}$$

OR

$$\begin{aligned} f(341) &= f(341 - 37 \cdot 9) \\ &= f(8) \\ &= 0 \end{aligned}$$

Ex. 3




- a) Determine the period of the function. 8s  
 What does the period represent in the context of the question?

One revolution around the ferris wheel

- b) Determine the amplitude of the function.  
 What does the amplitude represent in the context of the question?

Max = 7      $A = \frac{7-1}{2} = 3$      Radius of the ferris wheel  
 Min = 1

- c) Determine the speed of the Ferris Wheel. Hint 
- $$s = \frac{d}{t}$$
- $$= \frac{1 \text{ circumference}}{1 \text{ period}} = 2.4 \text{ m/s}$$
- $$= \frac{6\pi}{8}$$
- $$= \frac{3\pi}{4}$$
- Circ =  $2\pi r$   
 $= 2\pi(3)$   
 $= 6\pi$

- d) On the grid above sketch the height over time of another Ferris Wheel, for 3 full cycles, that boards at the same height, has a radius of of 2 and completes one full rotation in 6 seconds.

Period 6  
 Amplitude 2  
 Min = 1  
 Max = 5

Homework - p. 352 # 1-4, 7, 8, 11

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Many things in daily life repeat with a predictable pattern, such as weather, tides, and hours of daylight.



This periodic graph represents a normal heartbeat.