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
  amplitude = (max value - min value) ÷ 2

Ex 1 - For the graph, determine:

a) # complete cycles = 3

b) period = 6

c) max value = 5

d) min value = -5

e) amplitude $a = \frac{max-min}{2}$

$= \frac{5-(-5)}{2}$

$= 5$

f) domain

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

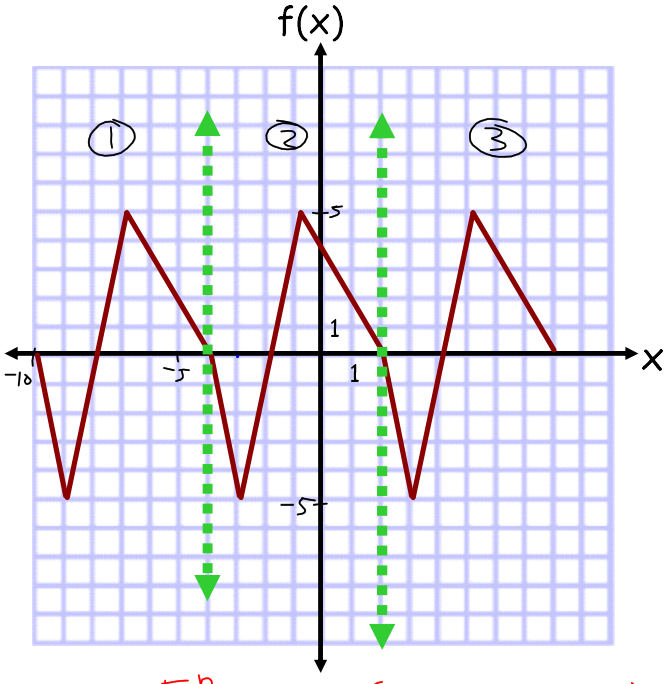
g) range

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

h) f(2)= 0

f(-4)=0

f(-1)=5



NOTE: F^n axis (imaginary middle)

$\frac{max+min}{2} = \frac{5+(-5)}{2}$

$= 0$ $\therefore y = 0$

Ex 2 - For the graph, determine:

a) period = 9

b) max value = 7

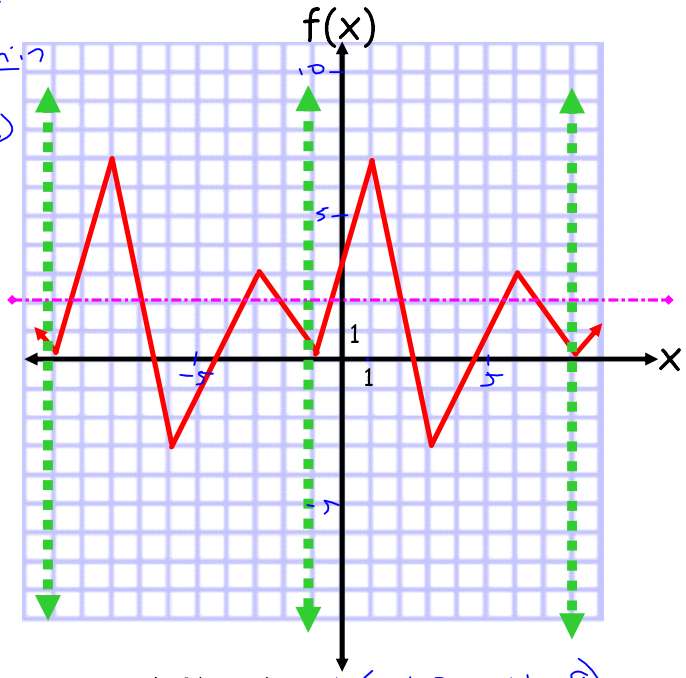
c) min value = -3

d) amplitude $= \frac{\text{max} - \text{min}}{2} = \frac{7-(-3)}{2} = 5$

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

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

F of Axis: $y = \frac{\text{max}+\text{min}}{2} = \frac{7+(-3)}{2} = 2$



g) f(-3) = 3

How many periods?

f(24) $= f(24 - 2 \cdot 9)$
$= f(24 - 18)$
$= f(6)$
$= 3$

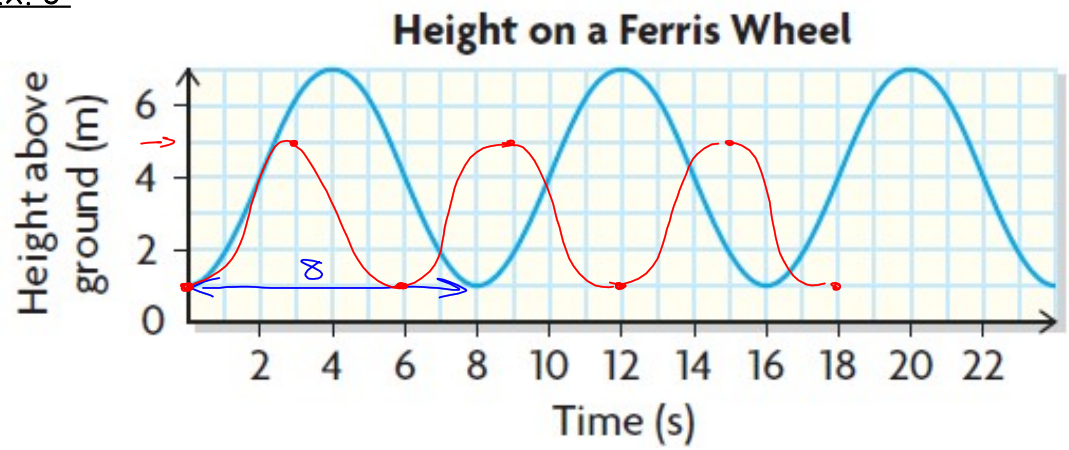
f(-1) = 0

f(-19) $= f(-19 + 2 \cdot 9)$
$= f(-1)$
$= 0$

i) f(360)= $f(360 - 40 \cdot 9)$
$= f(0)$
$= 3$

f(341)= $f(341 - 37 \cdot 9)$
$= f(8)$
$= 0$

Ex. 3



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

8s The time it takes for one complete rotation of the ferris wheel.

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

Max = 7
Min = 1

$a = \frac{\text{max} - \text{min}}{2}$

$= \frac{7-1}{2}$

$= 3$

The radius of the ferris wheel

c) Determine the speed of the Ferris Wheel. Hint

$s = \frac{d}{t}$

$= \frac{1 \text{ circumference}}{8s}$

$= \frac{6\pi}{8s}$

$= 2.4 \text{ m/s}$

Circ $= 2\pi r$

$= 2\pi(3)$

$= 6\pi$

∴ The speed is 2.4 m/s

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. 290 #1-3, 6, 8-11, 14, 22

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.