

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

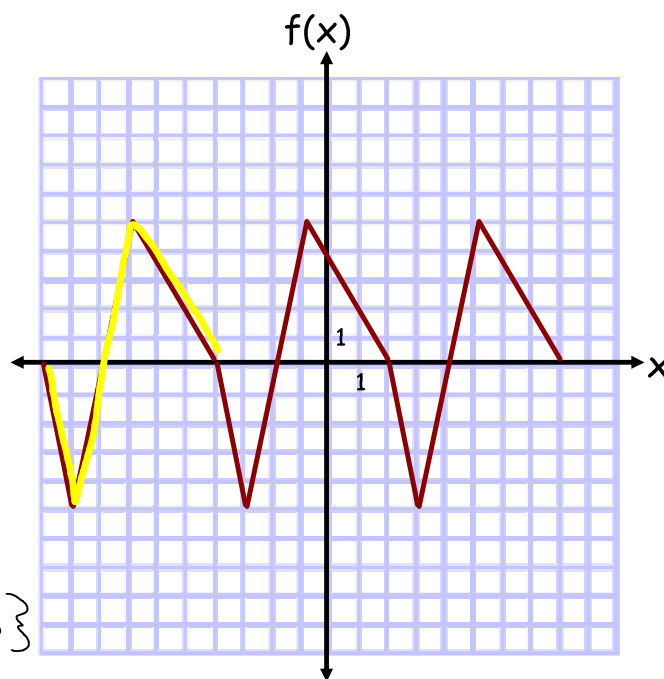
f) domain  $D = \{x \in \mathbb{R} \mid -10 \leq x \leq 8\}$

g) range  $R = \{y \in \mathbb{R} \mid -5 \leq y \leq 5\}$

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  $\frac{7 - (-3)}{2} = 5$

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

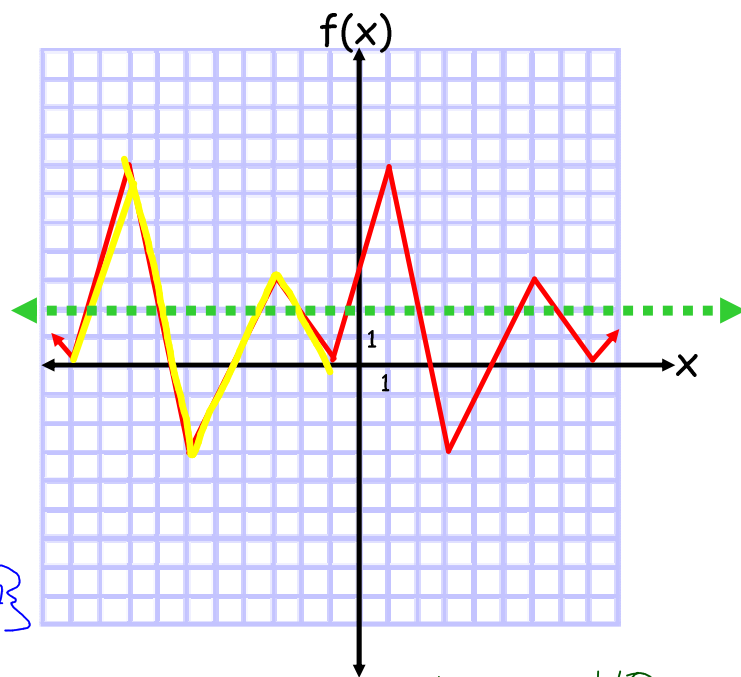
f) range  $R = \{y \in \mathbb{R} \mid -3 \leq y \leq 7\}$

g)  $f(-3) = 3$

$f(24) = f(15)$   
 $= f(6) = 3$   
 $= f(-3)$   
*Cycle repeats every 9 units*

$f(-1) = 0$

$f(-19) = f(-10)$   
 $= f(-1) = 0$



i)  $f(360) =$  Subtract 40  
 $= f(0)$  "9" unit cycles  
 $= 3.5$

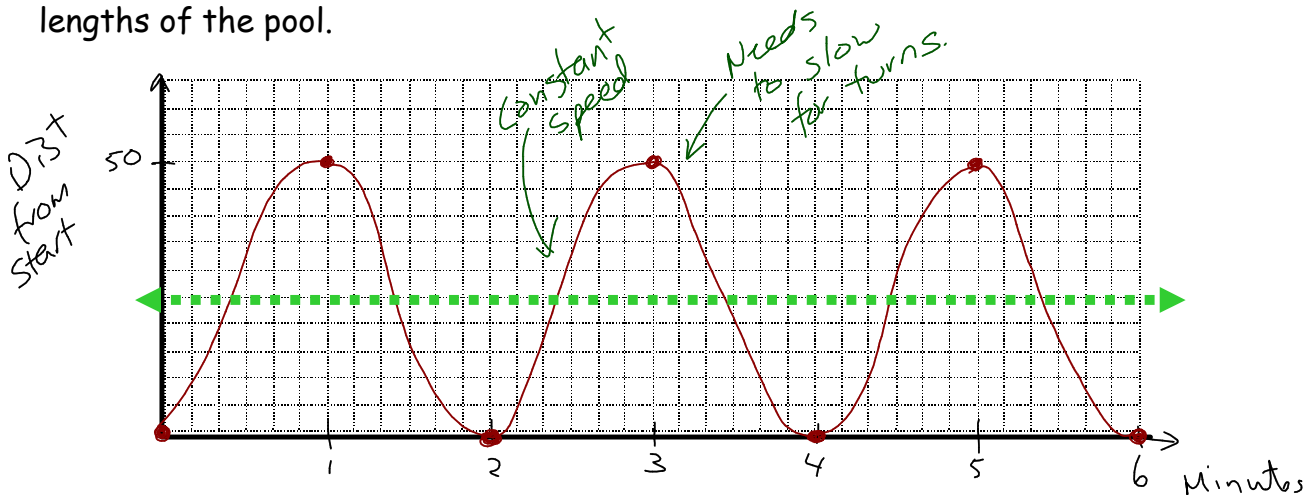
$f(341) =$

$f(341) = f(341 - 333)$   
 $= f(8)$   
 $= 0$

$341 \div 9 = 37.8\dots$   
 Subtract 37 "9 unit cycles"  
 $37 \times 9 = 333$

**Ex. 3** Jennifer is training for a triathlon by swimming lengths of a 50m pool at a constant speed. She swims one length every minute.

a) Graph her distance,  $m$ , from her starting point versus time, in minutes, for 6 lengths of the pool.



b) Determine the period and amplitude of the function.

Period  $2$  minutes      Amplitude  $\frac{50-0}{2} = 25$  m

c) State the domain and range.

$$D = \{x \in \mathbb{R} \mid 0 \leq x \leq 6\}$$

$$R = \{y \in \mathbb{R} \mid 0 \leq y \leq 50\}$$

d) After a month of training, Jennifer increases her speed by 10%. If she swims another 6 lengths of the pool...how will be amplitude and period compare with b)?

Amplitude the same

Period gets smaller

Homework - p. 360 #1-5, 6, 8,10, 13, 14

