

## 5.7 Applications of Trigonometric Functions

For any phenomenon in the real world which has a periodically repeating behaviour, Trigonometric Functions can be used to describe and analyze that behaviour. There are a myriad of such phenomena. From the rise and fall of tides to computer gaming habits, Trigonometric Functions have a say.

We will look at a few real world applications of Trigonometric Functions here.



Figure 5.7.1 A periodic rise and fall in online gamers

### Example 5.7.1

From your text: Pg. 345 #9

9. Each person's blood pressure is different, but there is a range of blood pressure values that is considered healthy. The function

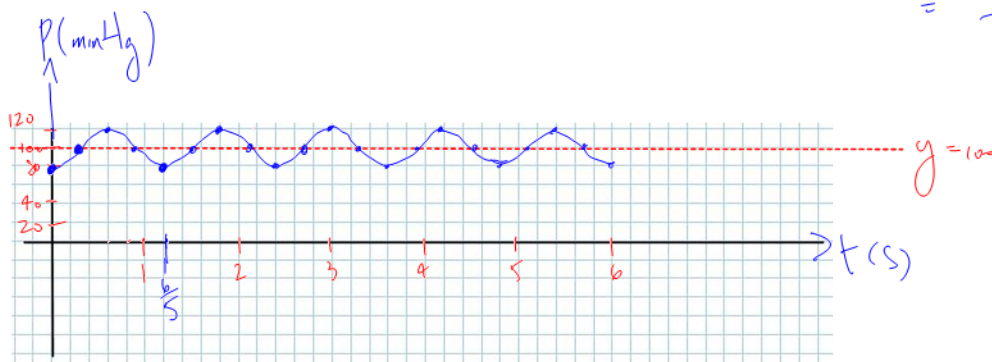
$P(t) = -20 \cos \frac{5\pi}{3}t + 100$  models the blood pressure,  $P$ , in millimetres of mercury, at time  $t$ , in seconds, of a person at rest.

- What is the period of the function? What does the period represent for an individual?
- How many times does this person's heart beat each minute?
- Sketch the graph of  $y = P(t)$  for  $0 \leq t \leq 6$ .
- What is the range of the function? Explain the meaning of the range in terms of a person's blood pressure.

$$\begin{aligned} a) P &= \frac{2\pi}{\frac{5\pi}{3}} = 2\pi \cdot \frac{3}{5\pi} \\ &= \frac{6}{5} \text{ beats/sec} \end{aligned}$$

$$\begin{aligned} b) 60 \text{ sec/min} \cdot \frac{6}{5} \text{ beats/sec} \\ = 72 \text{ beats/min} \end{aligned}$$

c) C.A.  $y = 100$  P.S. none  
 $|a| = 20$  Period  $\frac{6}{5}$



$$d) R_p = \{ P(t) \in \mathbb{R} \mid 80 \leq P(t) \leq 120 \}$$

### Example 5.7.2

From your text Pg. 361 #7

7. A person who was listening to a siren reported that the frequency of the sound fluctuated with time, measured in seconds. The minimum frequency that the person heard was 500 Hz, and the maximum frequency was 1000 Hz. The maximum frequency occurred at  $t = 0$  and  $t = 15$ . The person also reported that, in 15, she heard the maximum frequency 6 times (including the times at  $t = 0$  and  $t = 15$ ). What is the equation of the cosine function that describes the frequency of this siren?

we need to write

$$f(t) = a \cos(k(t-d)) + c$$

$$\begin{aligned} |a| &= \frac{\text{max} - \text{min}}{2} \\ &= \frac{1000 - 500}{2} \\ &= 250 \end{aligned}$$

$$\begin{aligned} k &= \frac{2\pi}{P} \\ &= \frac{2\pi}{3} \end{aligned}$$

$$d = 0$$

$$c = \frac{\text{max} + \text{min}}{2} = \frac{1000 + 500}{2} = 750$$

$$\therefore f(t) = 250 \cos\left(\frac{2\pi}{3}t\right) + 750$$

min 500 Hz  
max 1000 Hz

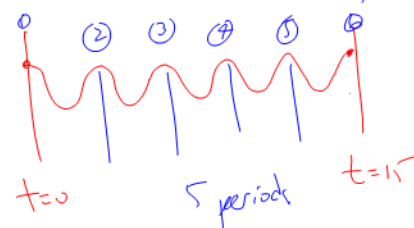
max at  $t = 0_s$  &  $t = 15_s$

max 6 times!



$$P = \frac{15}{5}$$

$$= 3(\text{sec})$$



*Class/Homework for Section 5.7*

*Pg. 360 – 362 #4, 6, 9, 10*