**5.2 – TRANSFORMATIONS OF SINUSOIDAL FUNCTIONS**

$$y=a\sin(\left(b(x-h)\right))+k$$

Examples:

Nothing changed except the centre line which is $y=3$.

Amplitude : $\left|a\right|$

Nothing changed except the amplitude which is now 3.

1. $y=3\cos(x)$



**Note**: If $a$ was negative, there would also be a reflection around the centre line (the graph would “start” at a minimum).
2. $y=\sin(x+3)$



Centre line : $y=k$

1. $y=\cos((3x))$



**Note**: in each cycle, there are 4 easy points to plot (equidistant from one another): 1 max, 1 min and 2 *x*-intercepts. So, by dividing the period by 4, we know how “often” we are going to plot a point. That helps choosing our scale on the *x*-axis. In this example, dividing the period by 4 gives us $\frac{π}{6}$. That’s how often we plotted a point.

Nothing changed except the period which is now $\frac{2π}{3}$.

Period : $\frac{2π}{\left|b\right|}$ or $\frac{360}{\left|b\right|}^{o}$

1. $y=\sin(\left(x-\frac{π}{3}\right))$



Phase Shift : $h$

The graph is shifted $\frac{π}{3}$ units to the right. We call it the **Phase Shift**.

**Note**: We need to choose our scale on the *x*-axis so that the phase shift (starting point from our cycle) is easy to plot. So, we need something in common with the 4 easy points previously considered. In radians a common denominator will be the easiest.
Example: $y=\cos(3\left(x-\frac{π}{4}\right))$

**Combining all the transformations**:

1. $y=-2\cos(\left(x+π\right)-1)$


2. $y=3\sin(\left(2x-\frac{2π}{3}\right)+2)$



**Determining an equation from a graph:**

Example:



You can usually choose between a cos or a sin curve. The easiest is usually to pick the one that doesn’t involve a phase shift…



Your turn



**Hwk: p 250 # 1acef, 2acf, 3, 5 – 7, 9, 13 – 17, 22, 24.**