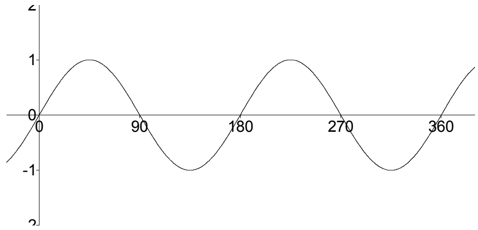
What happens if the *x* part of the function is multiplied by a number? For example, what does the graph of $y = \sin 2x$ look like?

So the graph of $y = \sin(x/2)$ would have a period of 720°

This has the effect of doubling the *frequency* of the curve, making the wave go twice as fast. That is, its *period* (the *x* distance of one complete cycle) halves.




In general, then, the graph of $y = a\sin bx + c$ will:

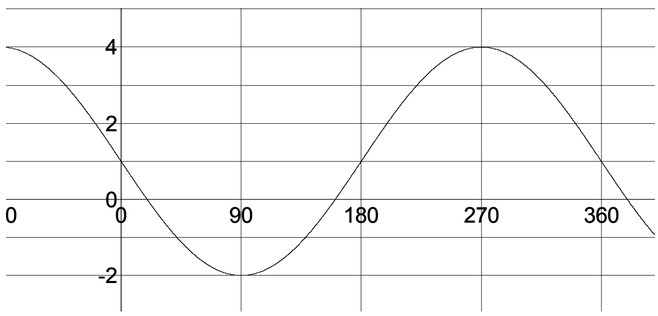
- Oscillate around $y = c$
- Have an amplitude of $a$
- Have a period of $360/b$

Note that a value of $-a$ will turn the graph upside down (ie reflect it in the *x*-axis).

**The diagram below shows the graph of $y = p\sin x + q$. Use the graph to find the values of $p$ and $q$.**

First look for the centre of oscillation – this is the line $y = 1$. Now look to see how far above and below this line the graph goes: up to 4 and down to –2. So the amplitude is 3.

Thus, <u>$p = 3$</u> and <u>$q = 1$</u>

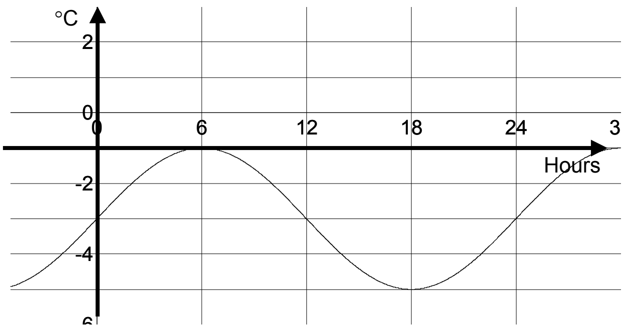



**Applications:** Many naturally occurring phenomena can be modelled using sine and cosine functions. Examples are: the length of the day through the year, the heights of tides through the day, the height of a bicycle pedal above the ground as it turns. If we are given the graph, we can solve problems relating to the real-life situation.

**The temperature during a 24 hour period is illustrated on the graph and is given by the function $f: x \to a + 2\sin bt$, where $t$ is the time in hours.**

**a) From the graph estimate the temperature after 9 hours.**
**b) What is the value of *a*?**
**c) What is the value of *b*?**

*Don't be put off by the change of letter from y to t – the function still behaves in exactly the same way.*




*For part (c), look to see how long the period is – the time for one complete cycle. Then work out how many times faster that is compared to the 360° of y = sinx. This will be the value of b.*

**-1.6°, a = -3, b = 15**

**YOU SOLVE**