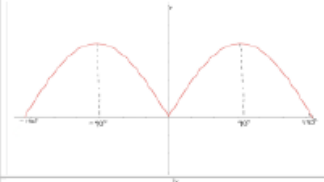
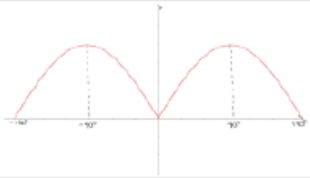
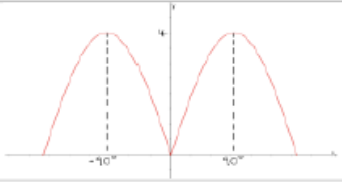
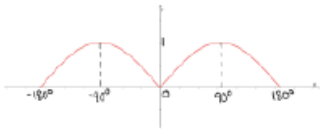
Combining Transformations

You may also be asked to sketch transformations of modulus functions. You can apply the graph transformation techniques you learnt in Chapter 4, Pure Year 1 to these problems. Recall that:

- The transformation $f(x) + a$ is a translation of $f(x)$ by 'a' units in the positive y-direction.
- The transformation $f(x + a)$ is a translation of $f(x)$ by 'a' units in the negative x-direction.
- The transformation $af(x)$ is a stretch of $f(x)$ by scale factor a in the y-direction.
- The transformation $f(ax)$ is a stretch of $f(x)$ by scale factor $\frac{1}{a}$ in the x-direction.
- The transformation $-f(x)$ is a reflection of $y = f(x)$ In the x-axis.
- The transformation $f(-x)$ is a reflection of $y = f(x)$ in the y-axis.

Let's look at how we can apply the above rules to a question involving a modulus function.

Example 4: Given that $f(x) = 2sinx, -180° \leq x \leq 180°$,
sketch the graphs of: (i) $\frac{1}{2}|f(-x)|$, (ii) $2f(|x|) + 4$

(i) $\frac{1}{2}\|f(-x)\|$		(ii) $2f(\|x\|) + 4$	
Step	Corresponding graph	Step	Corresponding graph
We start by sketching $f(x)$		We start by sketching $f(x)$	
Now sketching $f(-x)$ (reflect the graph in the y-axis).		Now we sketch $f(\|x\|)$ by reflecting the graph of $f(x)$ for $x \geq 0$ in the y-axis.	
Applying the modulus function now to sketch $\|f(x)\|$. The portion of the graph below the x-axis is reflected in the x-axis.		Stretching the graph by a scale factor of 2 in the y-direction to achieve $2f(\|x\|)$.	
Stretching our graph by a scale factor of ½ to attain the graph of $\frac{1}{2}\|f(-x)\|$		Finally, we translate our graph up by 4 units giving us the graph of $2f(\|x\|) + 4$.