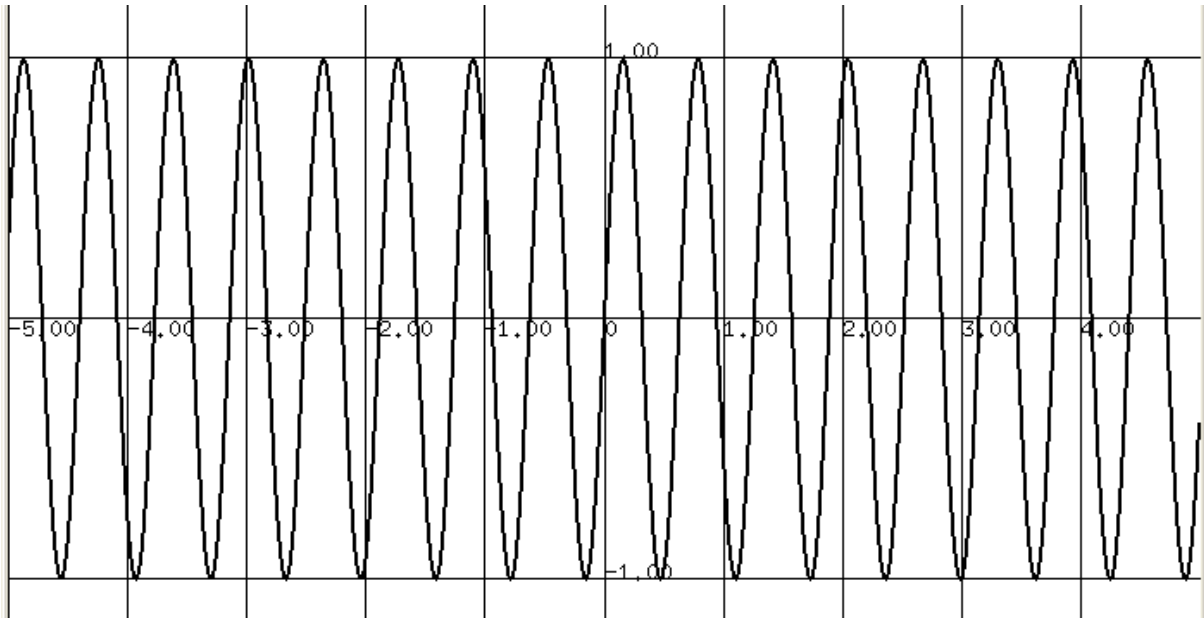
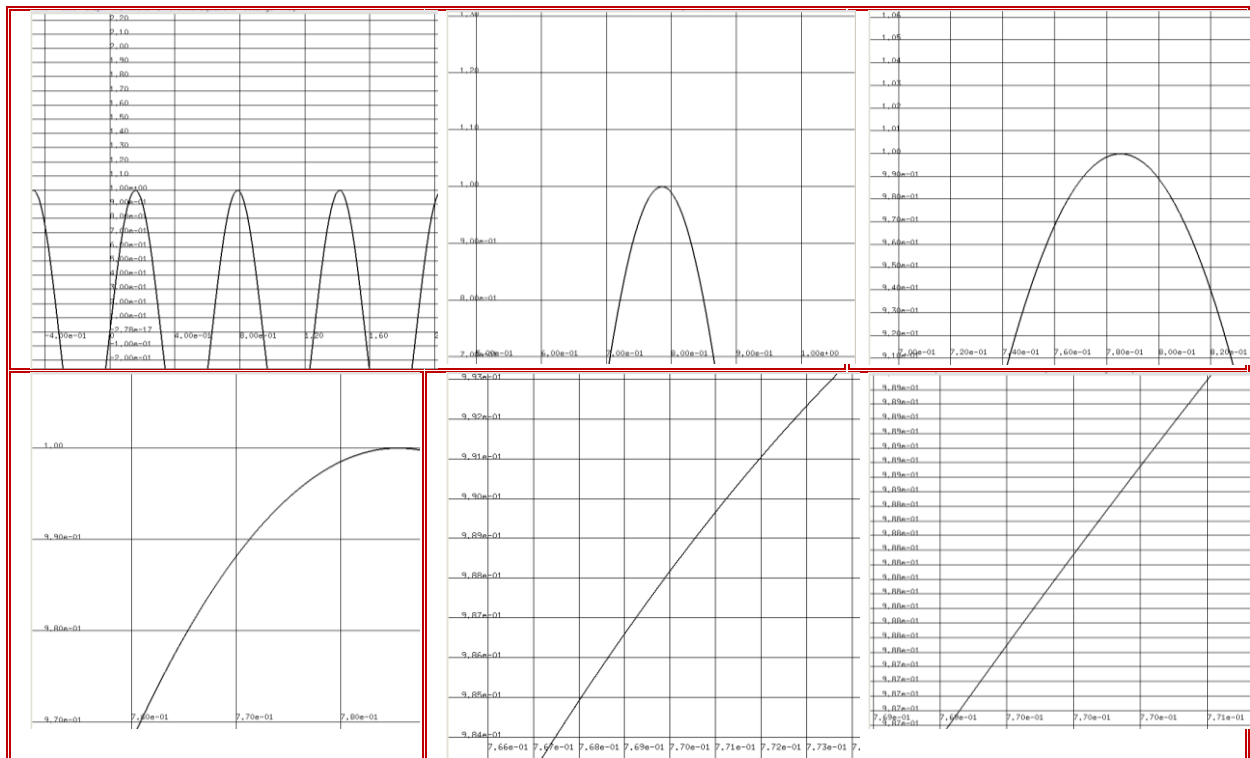


Zooming In

What happens when you zoom in on a graph many times? For example, here is the graph of $y=\sin(10x)$



We will zoom in on the point where $x=0.770$:



So, even though the function initially looks like it has extensive curves, when we zoom in on a point, it starts to look straight. This function is **locally straight** – when we zoom in enough, it looks like a straight line.

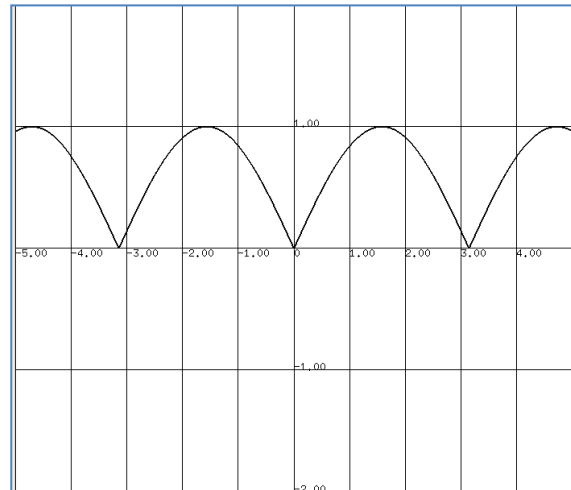
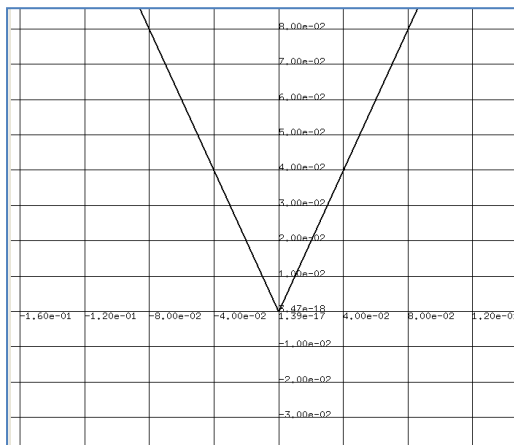
Exercise One

Using suitable software, try this out with a range of functions at different points. Try x^2 , x^3 , $\cos(x^2)$ and e^x and anything else you like. Can you find something which is not **locally straight**?

Not all functions are locally straight

The graph on the right is $|\sin(x)|$. This is the absolute value of $\sin(x)$. If $\sin(x)$ is negative, we take $-\sin(x)$, so we always have a positive value.

If we zoom in on $x=0$, we will see a shape like this:



We get straight lines everywhere, except precisely at $x=0$. At this point, the line has a sharp corner – no matter how closely we zoom in. It is not locally straight at $x=0$.

Exercise Two

At what other points is $|\sin(x)|$ not locally straight?

So..

Many functions are locally straight everywhere. This relates to our generic tangent – if our h is small enough, the **generic tangent will be the function**. Some functions are locally straight everywhere except for some points. Some rather bizarre functions are not locally straight anywhere.