Ay190 – Worksheet 14
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1 Advection Equation

We will consider the advection equation.

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = 0$$

We use it to advect a Gaussian

$$\Psi_0 = \Psi(x, t = 0) = \frac{1}{8}\sin(2\pi x/L)$$

. Where $L = 100$ a $[0, 100]$ domain.

1.1 Shock Develops

As you can see in myadvect.py I have implemented the upsind scheme.

We notice that the section of the sin wave with $u > 0$ moves to the right, positive x. While the section of the sin wave with $u < 0$ moves to the left, negative x. This results in the shock at $x = 0$ at around $t \approx 140$

You can see the shock develop in figure 1 at $t = 121$, devolop defined features by $t = 145$ reffig:2 and be completely formed in figure 3 at $t = 200$

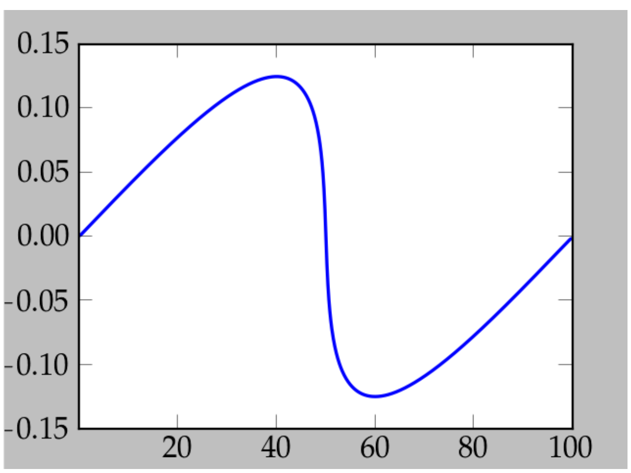

Figure 1: Begining of shock development from upwind scheme evolution of Burger's equation at $t = 121$.

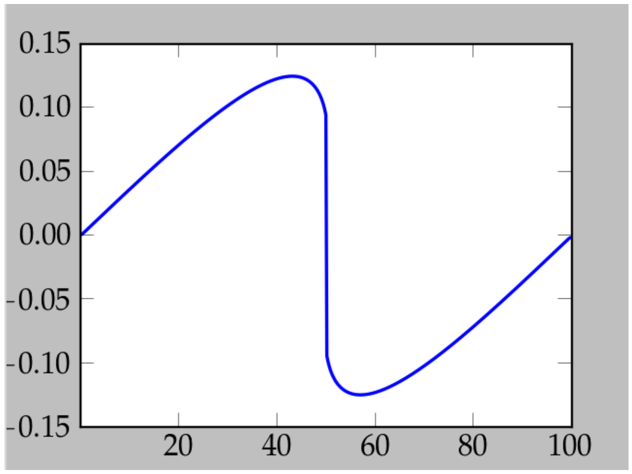

Figure 2: Strong shock development from upwind scheme evolution of Burger's equation at $t = 145$.

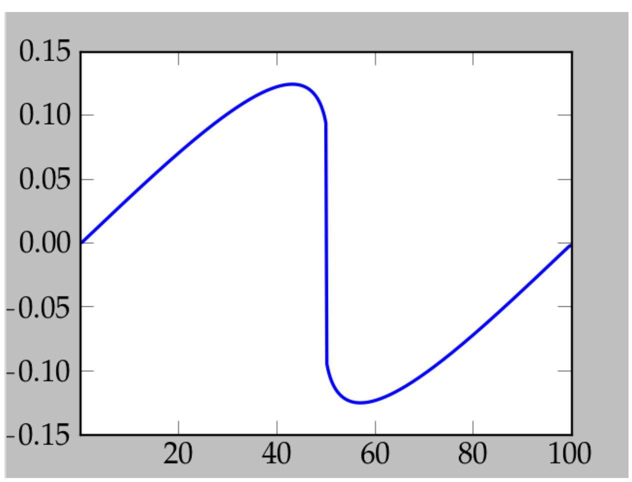

Figure 3: Complete shock development from upwind scheme evolution of Burger's equation at $t = 200$.