MA3227 Numerical Analysis II

Solution to Tutorial 7

1 Trajectory of a cannonball (continued)

1.
$$f(v) = \begin{pmatrix} -D\sqrt{v_1^2+v_2^2}\,v_1 \\ -D\sqrt{v_1^2+v_2^2}\,v_2 - g \end{pmatrix},$$
$$\nabla f(v) = -D \begin{pmatrix} \frac{v_1^2}{\sqrt{v_1^2+v_2^2}} + \sqrt{v_1^2+v_2^2} & \frac{v_1\,v_2}{\sqrt{v_1^2+v_2^2}} \\ \frac{v_1\,v_2}{\sqrt{v_1^2+v_2^2}} & \frac{v_2^2}{\sqrt{v_1^2+v_2^2}} + \sqrt{v_1^2+v_2^2} \end{pmatrix},$$
$$\nabla f(v_F) = \begin{pmatrix} -\sqrt{gD} & 0 \\ 0 & -2\sqrt{gD} \end{pmatrix}.$$