

$$\Rightarrow \frac{u_t + uu_x}{D} = 2$$

$$= \frac{N^2 p q e^{qt} \sin(\pi x) + MN (p \pi e^{qt} \cos(\pi x) - r q e^{qt} \cos(\pi x)) + M^2 r \pi e^{qt} \sin(\pi x)}{D}$$

$$= \frac{-N^2 p \pi^2 e^{qt} \sin(\pi x) + MN (r \pi^2 e^{qt} \cos(\pi x) + \frac{p \pi}{D} e^{qt} \cos(\pi x)) + M^2 \frac{r \pi}{D} e^{qt} \sin(\pi x)}{D}$$

$$= N^2 M_{xx} - MN N_{xx} + \frac{MN}{D} M_x - \frac{M^2}{D} N_x$$

$$= N^2 M_{xx} - MN N_{xx} - 2NM_x N_x + 2MN_x^2 = u_{xx}.$$

$$\Rightarrow u_t + uu_x = D u_{xx}$$

