Non-Newtonian stress tensor and thermal conductivity tensor in granular plane shear flow MEHEBOOB ALAM, SAIKAT SAHA, Jawaharlal Nehru Centre for Advanced Scientific Research — The non-Newtonian stress tensor and the heat flux in the plane shear flow of smooth inelastic disks are analysed from the Grad-level moment equations using the anisotropic Gaussian as a reference. Closed-form expressions for shear viscosity, pressure, first normal stress difference ($N_1$) and the dissipation rate are given as functions of (i) the density or the area fraction ($\nu$), (ii) the restitution coefficient ($e$), (iii) the dimensionless shear rate ($R$), (iv) the temperature anisotropy $[\eta, \text{the difference between the principal eigenvalues of the second moment tensor}]$ and (v) the angle ($\phi$) between the principal directions of the shear tensor and the second moment tensor. Particle simulation data for a sheared hard-disk system is compared with theoretical results, with good agreement for $p$, $\mu$ and $N_1$ over a large range of density. In contrast, the predictions from a Navier-Stokes order constitutive model are found to deviate significantly from both the simulation and the moment theory even at moderate values of $e$. We show that the gradient of the deviatoric part of the kinetic stress drives a heat current and the thermal conductivity is characterized by an anisotropic 2nd rank tensor for which explicit expressions are derived.