This paper presents the laminar forced convection of Al2O3–water nanofluid in a triangular channel, subjected to a constant and uniform heat flux at the slant walls, using delta-winglet pair (DWP) of vortex generator which is numerically investigated in three dimensions. The governing equations of mass, momentum, and energy are solved using the finite volume method (FVM). The nanofluid properties are estimated as constant and temperature-dependent properties. The nanoparticle concentrations and diameters are in ranges of 1–4% and 25–85 nm, respectively. Different attack angles of vortex generators are examined which are 7 deg, 15 deg, 30 deg, and 45 deg with range of Reynolds number from 100 to 2000. The results show that the heat transfer coefficient is remarkable dependent on the attack angle of vortex generators and the volume fraction of nanoparticles. The heat transfer coefficient increases as the attack angle increases from 7 deg to 30 deg and then diminishes at 45 deg. The heat transfer rate remarkably depends on the nanoparticle concentration and diameter, attack angle of vortex generator and Reynolds number. An increase in the shear stress is found when attack angle, volume fraction, and Reynolds number increase.