For all questions assume σ_y = 250 MPa for steel.

1. Using the Tresca yield criterion, determine the maximum allowable pure torque that can be applied to a 50mm solid circular steel shaft to avoid yield.
   [Ans.: 3068 Nm]

2. Using the von Mises yield criterion, determine the maximum allowable pure torque that can be applied to a 50mm solid circular steel shaft to avoid yield.
   [Ans.: 3534 Nm]

3. Calculate the pressure to cause yielding in a steel cylinder, 80 mm diameter, 1 mm thick using:
   i) the Tresca yield criterion,

   ii) the von Mises yield criterion.

   The cylinder is closed at each end; end effects should be neglected.

   [Ans.: i) 6.25 MPa; ii) 7.22 MPa]

4. Recalculate the pressure values in question 3 if there is an additional constant axial tensile stress of 150 MPa in the cylinder using:
   i) the Tresca yield criterion,

   ii) the von Mises yield criterion.

   [Ans.: i) 5 MPa; ii) 5.77 MPa]

5. What additional torque can be applied about the axis of the cylinder in question 3 if yielding is to occur with an internal pressure of 4.0 MPa using:
   i) the Tresca yield criterion,

   ii) the von Mises yield criterion.

   [Ans.: i) 1146 Nm ii) 1162 Nm]