1. Tie rod d = 12 mm carrying P = 25 kN: normal stress (one decimal, MPa)?

   _____ MPa

2. Solid shaft d = 30 mm, T = 300 N · m: surface shear (one decimal, MPa)?

   _____ MPa

3. Simply supported 3 m span, central P = 6 kN: maximum moment (one decimal, kN · m)?

   _____ kN · m

4. Rectangle 40 x 80 mm, V = 3 kN: maximum transverse shear (two decimals, MPa)?

   _____ MPa

5. Simply supported 3 m, central P = 6 kN, EI = 341.3 N · m^2 x 10^6: mid-span deflection (two decimals, mm)?

   _____ mm

6. Below the transition slenderness, the column stress comes from:

   ☐ the yield stress directly

   ☐ the eccentricity formula

   ☐ the Johnson parabola

   ☐ Euler with a safety factor

7. An unrestrained steel rod heated by 40 K carries:

   ☐ strain but no stress

   ☐ neither

   ☐ stress but no strain

   ☐ both stress and strain

8. Shear stress in a solid circular shaft under torsion is:

   ☐ maximum at the axis

   ☐ zero at the axis and maximum at the surface

   ☐ uniform across the section

   ☐ zero at the surface

9. Under a central point load on a simply supported span, the moment diagram is:

   ☐ zero at mid-span

   ☐ a triangle peaking at mid-span

   ☐ a rectangle

10. With both principal stresses positive, the absolute-maximum shear is:

    ☐ the in-plane radius R

    ☐ sigma_1 - sigma_2

    ☐ zero

    ☐ sigma_1 / 2

1. **221.0 MPa**

   P over pi r squared.

2. **56.6 MPa**

   16T over pi d cubed.

3. **4.5 kN · m**

   PL/4.

4. **1.41 MPa**

   1.5 V over A.

5. **9.89 mm**

   PL^3/48EI.

6. **the Johnson parabola**

   Euler would exceed yield there; Johnson meets it at sigma_y/2.

7. **strain but no stress**

   Free expansion produces deformation only; constraint produces stress.

8. **zero at the axis and maximum at the surface**

   tau = T rho / J grows linearly with radius.

9. **a triangle peaking at mid-span**

   Linear ramps to PL/4 at the load point.

10. **sigma_1 / 2**

    The out-of-plane plane carries sigma_1/2 when both share a sign.