

## 442 Tutorial Sheet 1<sup>1</sup>

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1. (1) Show that  $T^{ab}S_b$  is a tensor, where  $T$  and  $S$  are tensors.
2. (1) Show that  $T^{(ab)}V_{[a|c|b]}$  vanishes, where  $T$  and  $V$  are tensors.
3. (1) Show that  $T^a{}_e = T^{abc}{}_{de}\delta_c^d$  is a tensor.
4. (1) Show that  $T^{ab} = -T^{ba}$  in one coördinate system implies that  $T^{a'b'} = -T^{b'a'}$  in another coördinate system.
5. (2) Write  $\Delta f$  in polar coordinates.
6. (3) Show that torsion is a tensor.
7. (3) Find the transformation law for  $\det g_{ab}$ .
8. (2) Show that  $D_a g^{bc} = 0$  for a torsion free metric connection.

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<sup>1</sup>Conor Houghton, [houghton@maths.tcd.ie](mailto:houghton@maths.tcd.ie), see also <http://www.maths.tcd.ie/~houghton/442.html>