RELATIVITY – MTH6132

PROBLEM SET 1

1. Derive the escape velocity from the earth (see Tutorial 1)
`https://en.wikipedia.org/wiki/Escape_velocity`

2. Suppose a river flows at a constant rate v and consider the motion of a boat crossing this river with velocity u'. Suppose two observers are monitoring the boat: the first observer is on a raft floating down the river (reference frame F') and the second observer is standing on the river bank (reference frame F). To the observer in the raft, the boat appears to to travel at right angles to the river bank when crossing. On the other hand, to the observer on the bank the boat moves at an angle θ with respect to the bank. Draw a diagram of this scenario and identify any relevant quantities such as angles and velocities. How are the coordinates in the two reference frames related?

Further Exploration. Here are some more challenging and diverse problems to consider when reading the notes:

- Show that the general Galilean transformations appearing in the Appendix of the Week 1 Lecture Notes form a group under composition, giving a physical argument and/or diagrams explaining why this is a 10-parameter group.