

## Thermal Physics, Autumn 2016 CMI

Problem set 6

Due by 5pm Friday, Oct 7, 2016

Entropy and its properties

1. ⟨8⟩ Suppose we choose the conjugate variables  $T$  and  $S$  as independent thermodynamic variables instead of  $P$  and  $V$ . (a) Draw a diagram of a Carnot cycle on a  $TS$  diagram indicating the axes, direction of process, adiabats, temperatures, isotherms. (b) Geometrically interpret the heats absorbed/expelled by the engine, net heat absorbed, the net work done and the efficiency of the engine.
2. ⟨8⟩ Show that the infinitesimal heat reversibly added to a gas (not necessarily ideal) can be expressed as (Hint: use results we have derived!)

$$TdS = c_V dT + \frac{\alpha T}{\kappa_T} dV. \quad (1)$$