

# MATH327: StatMech and Thermo, Spring 2025

## Extra practice — $ST$ diagrams

We have extensively used pressure–volume ( $PV$ ) diagrams as a way to visualize and analyse thermodynamic processes and cycles, taking advantage of the fact that these two quantities suffice to describe the complete thermodynamic macro-state of an ideal gas. It is also possible to draw diagrams using different pairs of quantities, which in some cases can be more revealing. After  $PV$  diagrams, entropy–temperature ( $ST$ ) diagrams are the next-most-common choice, with entropy on the horizontal axis and temperature on the vertical axis.

- (a) Draw an isotherm and an adiabat on an  $ST$  diagram.
- (b) The area underneath a process on a  $PV$  diagram is the (negative) work done on the gas through that process. What does the area under a process on an  $ST$  diagram correspond to?
- (c) Draw the  $ST$  diagram for the Carnot cycle.
- (d) Draw  $ST$  diagrams for the Otto and Diesel cycles.