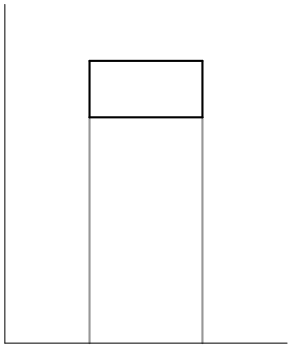
Recorder: _____

Task Master: _____ **Cynic:** _____ **Other:** _____

THE GRID

Working in small groups (3 or 4 people), solve as many of the problems below as possible. Try to resolve questions within the group before asking for help. The Recorder is responsible for writing up the group's results and turning it in. Show your work! Full credit will only be given if your answer is supported by calculations and/or explanations as appropriate.

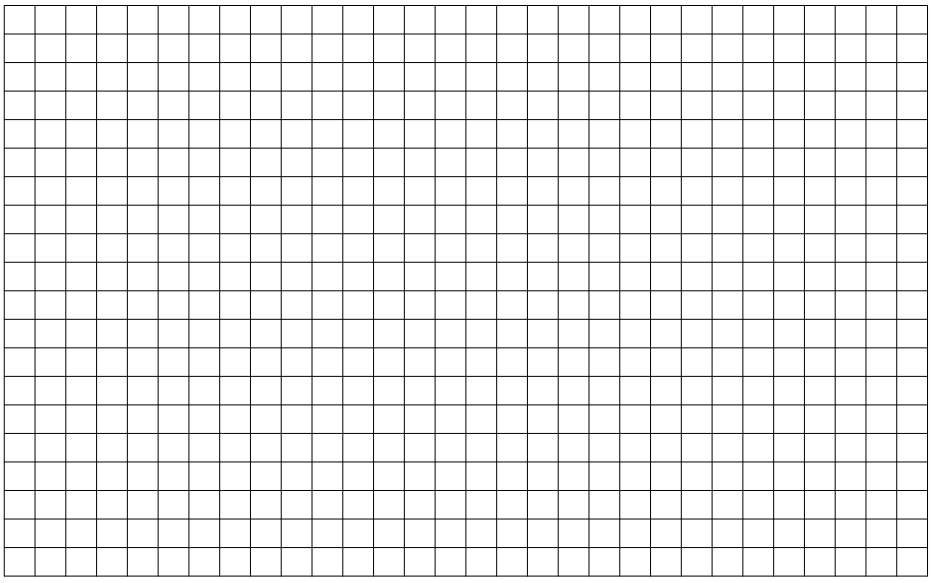
1. Consider the rectangle in the first quadrant of the xy-plane, which is drawn at the right with thick black lines. Label the bottom horizontal edge of the rectangle $y = c$. Label the sides of the rectangle Δx and Δy.



(a) What is the area of the rectangle?

(b) There are also 2 rectangles whose base is the x-axis, the larger of which contains both the smaller and the original rectangle. Express the area of the original rectangle as the difference between the areas of these 2 rectangles.

2. On the grid below, draw any simple, closed, piecewise smooth curve C, all of whose segments C_i are parallel either to the x-axis or to the y-axis. Your curve should **not** be a rectangle. Pick an origin and label it, and assume that each square is a unit square.



(a) Compute the area of the region D inside C by counting the number of squares inside C.

(b) Evaluate the line integral $\oint_C (y\,\hat{\boldsymbol{\imath}}) \cdot d\vec{\boldsymbol{r}}$ by noticing that along each segment either x or y is constant, so that the integral is equal to $\sum_{C_i} y\,\Delta x$. *Can you relate this to Problem 1?*

(c) Are your answers to the preceding two calculations the same?

(d) Would any of your answers change if you replaced $y\,\hat{\boldsymbol{\imath}}$ by $x\hat{\boldsymbol{\jmath}}$ in part (b)?