Name: _____

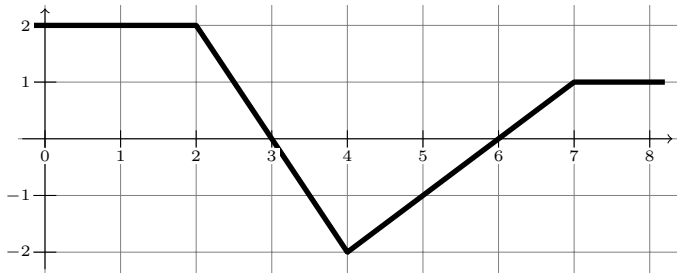
Directions: Show all work. No credit for answers without work.

1. [**2 parts, 2 points each**] A definite integral.

   (a) Using $n = 4$, find the left hand sum approximation to $\int_1^9 \ln(x)\, dx$.

   (b) Illustrate your solution to part (a) graphically. Your figure should include a graph of the integrand and the graphical representation of the left hand sum.

2. [**2 points**] Using the graph of the function $f(x)$ below, find $\int_2^7 f(x)\,dx$ exactly.



3. [**2 points**] At time $t = 0$, a large block of ice is removed from a freezer and begins to melt. At time t (in hours), the ice melts at a rate of $2t + 1$ kg per hour. Express the mass of ice that melts during the first 3 hours as a definite integral. (Your answer must be a definite integral; do not solve the integral.)

4. [**2 parts, 1 point each**] The FTC.

   (a) State the Fundamental Theorem of Calculus.

   (b) Describe what is represented by each of the two sides of the equation in the Fundamental Theorem of Calculus.