Name: _____   _____ / 25

25 points possible. No aids (book, calculator, etc.) are permitted. You need not simplify unless asked, but show all work and use proper notation for full credit.

1. **[5 points]** Oil leaked out from a tanker at a rate of $r(t)$ liters per hour (L/h). Every two hours, the rate of flow out of the tanker was measured as shown in the table. Estimate the total amount of oil that leaked from the tanker over the 8 hours. Include units in your answer.

t (in hours)	0	2	4	6	8
$r(t)$ (in liters/hour)	0	10	15	25	25

2. **[6 points]**

   Given $f(x) = \frac{1}{1+x}$, approximate the area (shaded in gray) bounded between the curve and the x-axis and the lines $x = 1$ and $x = 3$ using $\boxed{\text{three LEFT-HAND rectangles}}$. **Draw and shade in the rectangles you are using on the graph.** Show your computation clearly. You do not need to simplify your answer.
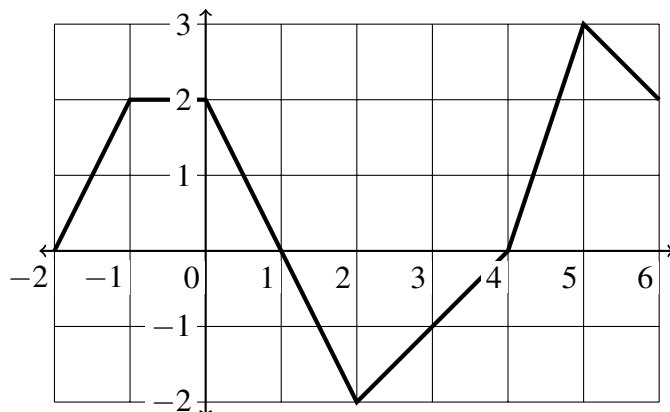
   (a) Width of each rectangle = _____
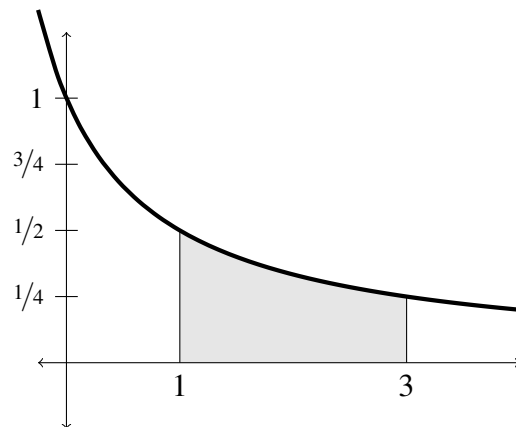
   (b) Is your answer an overestimate or an underestimate for the actual area, and why?

3. **[3 points]** [Fill in the blank] Using the graph of $f(x)$ shown to the right and geometry, calculate exactly each of the following quantities.

a. $\int_{-2}^{1} f(x)\, dx = $ _____

b. $\int_{0}^{2} f(x)\, dx = $ _____

c. $\int_{2}^{6} f(x)\, dx = $ _____

4. **[8 points]** [Fill in the blank] If $\int_{1}^{5} f(x)\, dx = 3$, $\int_{1}^{8} f(x)\, dx = 10$ and $\int_{1}^{5} g(x)\, dx = -4$, compute the following quantities:

a. $\int_{1}^{5} 3f(x)\, dx = $

b. $\int_{1}^{5} 2f(x) - 6\, dx = $

c. $\int_{3}^{3} g(x)\, dx = $

d. $\int_{1}^{5} f(x) - 2g(x)\, dx = $

e. $\int_{5}^{1} f(x)\, dx = $

f. $\int_{5}^{8} f(x)\, dx = $

5. **[3 points]** Use geometry to determine $\int_{-2}^{0} \sqrt{4 - x^2}\, dx$. Justify your answer with a few words or a sketch.