

1. If  $f'(x) = \frac{1}{x} + x^2$  and  $f(1) = \frac{2}{3}$

a. Find  $f(x)$ .

b. Evaluate:  $\int_1^e \frac{\ln(x)}{x} dx$

2. Let  $y = 2x + 5$  with  $0 \leq x \leq 4$ .

Use a Riemann mid sum with 2 rectangles to approximate the area in the first quadrant of this region.

3. Evaluate:

a.  $\int_0^0 (x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)(7x^6 + 6x^5 + 5x^4 + 4x^3 + 3x^2 + 2x + 1) dx$

b. Use Human Intervention to find:  $\int_0^2 x\sqrt{1+x^2} dx$ . Show your work for credit.

4. Consider the region defined by the functions  $y = f(x) = x^2$  and  $y = g(x) = x + 6$ .

a. Find the area of the region bounded by these functions.

b. Set up the integral to find the volume when the region is rotated about the x-axis.

5. Rotate the region defined in problem #4 about the line  $y = -1$  and find its volume.

6. a. How much work is done if a 2.2 pound brick is raised 5 feet?

b. How much work is done if a 1 kg brick is raised 1.521 meters?

c. If 1 kg = 2.2 pounds and 1.521 meters = 5 feet, how many joules are in a foot-pound?

7. A swimming pool is built in the shape of a rectangular tank, 10 ft deep, 15 ft wide and 20 ft long.

a. If the pool is filled to 1 ft below the top, how much work is required to pump all of the water into a drain at the top edge of the pool?

b. A one-horsepower motor can do 550 ft-lbs of work per second. What size motor is required to empty the pool in one hour?

8. If the average value of the depth of a bay were 12 feet, could you navigate your ship, with a 7-foot draft, up the bay? Please explain in a paragraph of lucid English prose.