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Dr. Franke

Name \_\_\_\_\_

Show all work. You may not use a calculator.

1. (20%) For each integral, decide if it converges or diverges.

(a)  $\int_1^9 \frac{1}{(x-9)^3} dx$

(b)  $\int_2^\infty \frac{1+\cos^2 x}{2+x^4} dx$

2. (36%) Draw the bounded region between  $y = 4 - 2x$  and  $y = 4 - x^2$ .

(a) Find the area of the bounded region.

(b) A solid of revolution is formed by revolving the bounded region around the line  $x = -1$ . Set up the integrals that would give the volume of this solid using:

1. cylindrical shells. Do not integrate. Draw the picture.

2. slicing. Do not integrate. Draw the picture.

3. (10%) Find the length of the arc given by  $x = t^3 + 1, y = 2t^{9/2} - 4$  from  $(1, -4)$  to  $(2, -2)$ .

4. (10%) Find the average value of  $f(x) = x \sin(x)$  on  $[0, \pi]$ .

5. (24%) The tank shown is full of water.

(a) How much work would it take to pump the water out of the outlet? Set up the integral. Do not carry out the integration.

(b) How much force is the water exerting against one of the ends? Set up the integral. Do not carry out the integration.