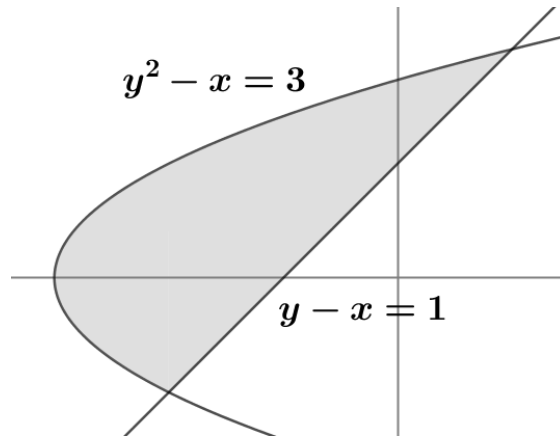


Do the problems below in a neat, clear and complete manner on the paper provided to you. If I am unable to follow your solutions, if enough detail is not provided, you will lose points.

1. Set up and evaluate a definite integral to find the shaded area between the graphs of  $y^2 - x = 3$  and  $y - x = 1$  shown below. Hint: The answer is between 3 and 5 square units.



2. The temperature  $T$  (in degrees Celsius) of a cup of coffee  $t$  minutes after it is poured is given by the function

$$T(t) = 20 + 75e^{-0.02t}$$

Set up and evaluate a definite integral to find the average temperature of the coffee over the first half-hour (30 minutes) after it is poured. Give your answer to the nearest degree. Hint: The answer is between 60 and 80 degrees Celsius.

3. The region of the  $xy$ -plane bounded by the  $x$ -axis, the line  $x = 2$  and the curve  $y = \sqrt{x}$  is rotated about the line  $x = -1$  to create a solid of revolution. Set up, but *do not evaluate* definite integrals to find the volume of the solid using:
- (a) Cylindrical shells
  - (b) Rings (washers)
4. The region described in the previous problem is the base of a solid. Cross sections perpendicular to the base and  $x$ -axis are squares. Set up and evaluate a definite integral to find the volume of the solid. Hint: The answer is between 5 and 11 cubic units.
5. A 30 foot cable hangs over the edge of a 50 foot tall building. Its “weight density” (pounds per foot) is given by  $\delta(y) = 5 - 0.1y$ , where  $y$  is the distance from the bottom of the cable; A small segment of cable of length  $dy$  at location  $y$  from the bottom of the cable weighs  $\delta(y) dy$  pounds.

Set up and evaluate a definite integral to find the work done in pulling the cable up to the top of the building. Hint: The answer is between 1500 and 2000 ft-lbs.