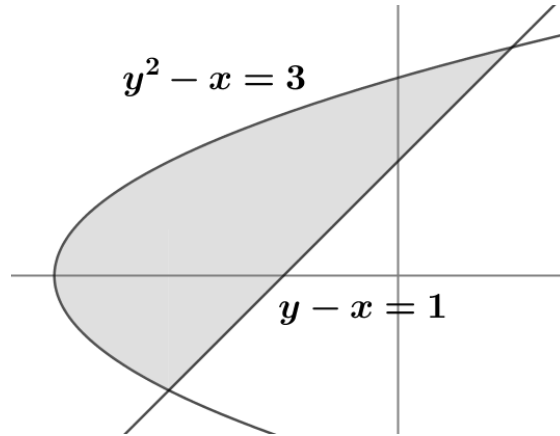


Do the problems below in a neat, clear and complete manner on the paper provided to you. If I am unable to follow your solutions, if enough detail is not provided, you will lose points.

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 30 and 50 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 $x = 4$ 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.