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(1) Determine if the following integral converges or diverges. If it converges, find its value.

\[
\int_{5}^{8} \frac{1}{\sqrt{x^2 - 10x + 25}} \, dx
\]
(2) Consider the following integral

\[ \int_4^\infty \frac{3t^2}{\sqrt{2t^7 + 5}} dt \]

Does this integral converge or diverge? For full credit, you must justify your claim. \textbf{You need not calculate this integral.}
(3) Consider the region bounded by the curves \( y = -x^2 + 3 \) and \( y = x^2 - 5 \).

a) Sketch this region.

b) Find an integral that represent the area of this region using \( x \)-axis integration. **You do not have to calculate the integral.**

c) Find an integral (or integrals) that represent the area of this region using \( y \)-axis integration. **You do not have to evaluate the integral(s).**
(4) Consider the region bounded by \( y = 2e^{-3x}, \ y = 2, \) and \( x = 4. \)

a) Sketch this region.

Set up an integral (or integrals) which determines the volume of the solid obtained by revolving this region about the:

b) \( x \)-axis

c) \( y \)-axis

d) line \( y = -2 \)

e) line \( x = 7 \)
At ground level, pollution emanates circularly from a factory with a density \( f(r) = 0.237e^{-3.2r^2} \frac{\text{kg}}{\text{mi}^2} \) with \( r \) the distance from the factory in miles.

a) Write a Riemann sum which approximates the total mass of the pollution within a 10 mile radius of the factory. To receive any partial credit, draw a sketch illustrating your calculation and label your variable.

b) Write a definite integral which corresponds to the Riemann sum found in part a) above. Find the exact value of this integral and then approximate it’s value with 2 decimal-place accuracy.
(6) A cylindrical tank half-filled with oil is standing vertically with its top 15 feet under ground. The tank has a radius of 6 feet and is 24 feet tall. The density of the oil is $35 \text{ lb/ft}^3$.

a) Find an integral which describes the work done in pumping the oil to the top of the tank. **You need not evaluate the integral. To receive any partial credit, draw a sketch illustrating your calculation, indicate where your variable is zero, and write out the corresponding Riemann sum.**

b) Find an integral which describes the work done in pumping the oil to ground level. **You need not evaluate the integral. To receive any partial credit, draw a sketch illustrating your calculation, indicate where your variable is zero, and write out the corresponding Riemann sum.**