

Section 6.2: Setting up integrals: Volume, Density, Average Value

During the BP oil spill, when there was some question about exactly how much oil was spewing out of the well-head, I heard an industry spokesperson say something like this:

“The pipe’s only six inches in diameter! How could we possibly get 20,000 barrels of oil out of it per day?!”

So we want to consider this questions. Some things you’ll need:

- A barrel of oil contains 42 US-gallons.
- 231 cubic inches per gallon

Suppose that the oil is coming out at a steady rate. Here’s what you need to do:

1. Imagine a column of oil, six inches in diameter, produced over a 24 hour day. Draw it as a right circular cylinder along the x -axis.

2. Consider the problem as an integral, $V = \int dV$. Now insert a tiny (but non-vanishing) “ ΔV ” into your picture above. What are the appropriate limits of integration?

3. In this case we know that the total volume is purportedly 20,000 barrels of gallon per day. If " ΔV " represented one second's oil leaking, how much oil would be leaking in gallons per second?

4. Does this seem like a plausible leak rate?

5. How much oil would be leaking in cubic inches per second?

6. Do we really need integrals to solve this?