

Math 171 Written Homework 7
 Sections 5.1 to 5.3
 April 19, 2018

Name _____

Credit given for work shown.

Problem 1. Solve the initial value problem.

$$\frac{dz}{dt} = t^{-3/2}, \quad z(4) = -4$$

$$\int z'(t) dt = \int t^{-3/2} dt$$

$$z(t) = -2t^{-1/2} + C$$

Since $z(4) = -4$, we can find the constant of integration.

$$z(4) = -2 \cdot 4^{-1/2} + C = -4$$

$$-1 + C = -4$$

$$C = -3$$

Putting them together,

$$z(t) = -2t^{-1/2} - 3$$

Problem 2. Find the following indefinite integral: $\int \text{[REDACTED]} dx$

Unfortunately we cannot make out the original problem. However, we know that Veronica's answer was $\sin^2 x + C$, Chris's answer was $-\cos^2 x + C$, and Matt's answer was $\cos^2 x + C$. Two of the students got the correct answer, the other one got it wrong. The wrong answer was given by _____ and the original question was compute $\int f(x)dx$ for $f(x) = \underline{\hspace{4cm}}$.

$$\text{Veronica: } \frac{d}{dx} [\sin^2(x) + C] = 2 \sin(x) \cos(x)$$

$$\text{Chris: } \frac{d}{dx} [-\cos^2(x) + C] = -2 \cos(x)(-\sin(x))$$

$$\text{Matt: } \frac{d}{dx} [\cos^2(x) + C] = 2 \cos(x)(-\sin(x))$$

Since Chris's and Veronica's match, Matt must be wrong.

The integrand should be $f(x) = 2 \sin(x) \cos(x)$.

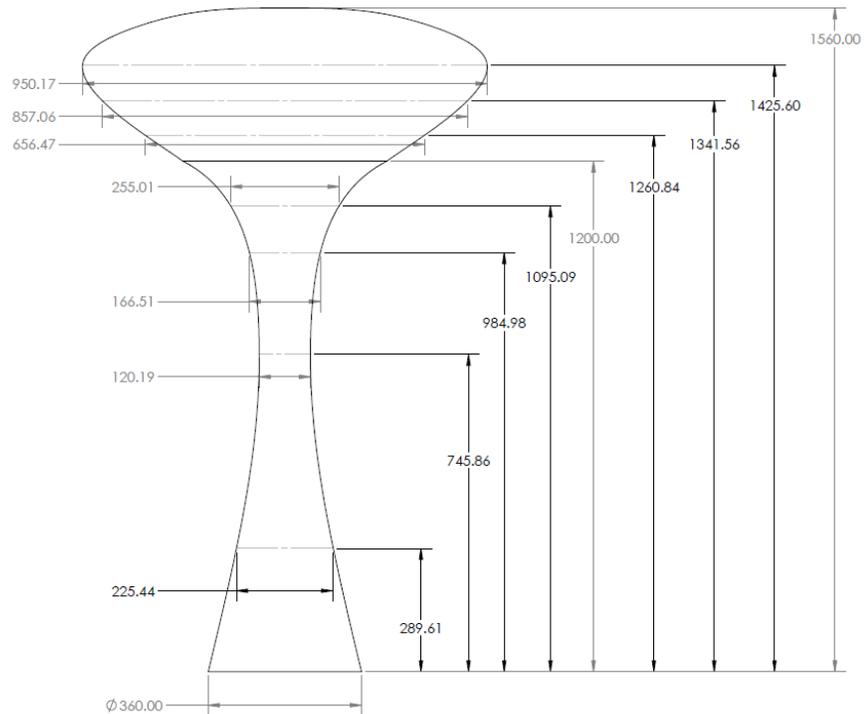
Problem 3. We want to approximate the volume of the water tower shown below. This water tower was chosen because it can be considered as a solid of revolution. You will learn techniques to compute volumes of solids of revolution in M172.



Slicing the tower parallel to its bottom, we see that the cross sections are circular. Thus, we can approximate the volume using a section method. The idea is to break the object up into pieces that we can compute the volume of.

Each cross section is a circle and the dimensions of the widths of the tower are given at various heights. Use this information to estimate the volume of this water tower.

Answers will vary.



- a) Find an overestimation of the true volume of the tower.

$$\text{Volume} \approx \pi(180)^2(289.61) + \pi(112.72)^2(745.86 - 289.61) + \pi(83.255)^2(984.98 - 745.86) + \pi(127.055)^2(1095.09 - 984.98) + \pi(328.235)^2(1260.84 - 1095.09) + \pi(429.53)^2(1341.56 - 1260.84) + \pi(475.085)^2(1425.6 - 1341.56) + \pi(475.085)^2(1560 - 1425.6) = 100,668,616,046.9\pi \approx 316,260,000,000 \text{ cubic inches}$$

- b) Find an underestimation of the true volume.

$$\text{Volume} \approx \pi(112.72)^2(289.61) + \pi(60.095)^2(745.86 - 289.61) + \pi(60.095)^2(984.98 - 745.86) + \pi(83.255)^2(1095.09 - 984.98) + \pi(127.055)^2(1260.84 - 1095.09) + \pi(328.235)^2(1341.56 - 1260.84) + \pi(429.53)^2(1425.6 - 1341.56) + \pi(0)^2(1560 - 1425.6) = 33,831,579,782.8\pi \approx 106,285,000,000 \text{ cubic inches}$$