Math 152 – Python Lab 2

Directions: Use Python to solve each problem, unless the question states otherwise. (Template link)

1. Sticky Chins' Ice Cream shop uses an ice cream cone that with a maximum radius of 1 inch and a height of 4 inches.

   (a) Given the cone is completely full and the ice cream above the cone creates a hemisphere, find the volume of the ice cream using an integral, rotating around the vertical center of the cone.

   (b) Suppose Sticky Chins' wants to design a cone with the same height as their current cone but in such a way that one cup (14.5 cubic inches) of ice cream is served. Find the radius needed for such a cone. Give your answer as a decimal approximation using **evalf()**.

2. Given $f(x) = 2x^2$ and $g(x) = |x^2 - 9|$:

   (a) Plot the two functions on the same axes with x-interval $[-5, 5]$.

   (b) Find the points of intersection (approximate if necessary).

   (c) Find the area of the region enclosed by the two curves (approximate if necessary).

3. The birth rate in the US in 2017 was given by $b(t) = 3.941109e^{0.01199t}$, while the death rate was $d(t) = 2.744248e^{0.009t}$, where t is in years and the population in millions.

   (a) Find the area between these curves for $0 \leq t \leq 5$. What does this area represent?

   (b) The US population in January 2017 was 325.1 million people. In January 2022, the US population was 332.4 million people. Compare these values to your results in part (a).

4. Evaluate the following integrals.

   (a) $\int \tan^2(x)dx$

   (b) $\int x\tan^2(x^2)dx$

   (c) What strategy could you use to integrate (a) by hand?
   What additional strategy could you use to integrate (c) by hand?