

**Worksheet 11, Tuesday, April 29, 2025**

**Exponential Growth and Decay** Answer the following. Justify. Simplify, and give full final answers. You can use Calculators on the final answers or leave them as solved.

**For each problem, state the General Solution formula**

1. A bacteria culture starts with 1000 bacteria. After two hours the population is 2500. Assume the culture grows at a rate proportional to its size.
  - Find the population after 6 hours.
  - When will the population equal 9000?
2. The Half-Life of Carbon-14 is 5730 years, meaning that after that many years, half of the original Carbon-14 material remains in the organic sample. Suppose there was originally 100 grams of Carbon-14, how much remains after 200 years?

**Volumes of Revolution** For all problems, make sure to Sketch both the bounded 2-D region and the 3-D solid. Also, Sketch one Approximating Rectangle on the 2-D sketch and then one Approximating Disk or Washer on the 3-D sketch.

Please write all Formulas clearly before substituting.

3. Consider the region bounded by  $y = 1 - x^2$  and  $y = 0$ . Rotate this region about the  $x$ -axis. Compute the resulting Volume. Sketch.
4. Consider the region bounded by  $y = x^2 + 3$  and  $y = 0$  and then between  $x = -1$  and  $x = 1$ . Rotate this region about the  $x$ -axis. Compute the resulting Volume. Sketch.
5. Consider the region bounded by  $y = e^x$  and  $y = x$  and between  $x = 0$  and  $x = 2$ . Rotate this region about the horizontal line  $y = -1$ . **Set-Up but DO NOT COMPUTE** the integral that represents the resulting Volume. Sketch.
6. Consider the region bounded by  $y = e^x + 1$  and  $y = 3$  and the  $y$ -axis. Rotate this region about the horizontal line  $y = -2$ . **Set-Up but DO NOT COMPUTE** the integral that represents the resulting Volume. Sketch.

**Turn in your own solutions into Gradescope before 11:59 pm today, Tuesday April 29**

**Finish all problems through number 5**