Midterm 3 Review Problems **Math 142**

These are suggested review problems similar to what might be on Midterm 3. Included with each problem is a link to a video where you can see how the problem is solved. I didn't make the videos, they are all available online.

1. Find the volume of the region between the curve $y = x^3$, line $y = 8$, and the y-axis when it is revolved around the y-axis.

https://youtu.be/M85_r3pZ5YA

2. Find the arc length of the parametric curve with coordinates $x = 2 + 6t^2$ and $y = 5 + 4t^3$ for $0 \leq t \leq \sqrt{8}$.

https://youtu.be/X8N21DrWmjU

3. A circular swimming pool is 24 ft. in diameter, the sides are 5 feet high, and the depth of the water is 4 ft. How much work is required to pump all of the water out over the sides (recall that the weight density of water is 62.4 lbs. per cubic foot).

https://youtu.be/dHw-_5kXaNA

4. Re-write the series $3e + e^2 + \dfrac{e^3}{3} + \dfrac{e^4}{9} + \dfrac{e^5}{27} + \ldots$ in summation notation, then find the sum.

https://youtu.be/jxRqRLMliPc?t=879

5. Find the sum of the geometric series $\displaystyle\sum_{n=1}^{\infty}(2^{3n} \cdot 5^{1-2n})$.

https://youtu.be/jxRqRLMliPc?t=640

6. Evaluate $\displaystyle\int \frac{e^{x^2}}{x}\,dx$ as an infinite series.

https://youtu.be/jupmIcf1ypQ

7. Use the comparison test to determine whether the series $\displaystyle\sum_{n=1}^{\infty} \frac{1}{2^n + n}$ converges or diverges.

https://youtu.be/XoBlfbrdBpQ

8. Find the volume of the region under the curve $y = 2x^2 - x^3$ from $x = 0$ to $x = 2$ when it is revolved around the y-axis.

https://youtu.be/M85_r3pZ5YA

9. Consider the infinite series $\displaystyle\sum_{k=1}^{\infty} \frac{(-1)^k}{k!}$. The 5th partial sum is

$$S_5 = \sum_{k=1}^{5} \frac{(-1)^k}{k!} = -1 + \frac{1}{2} - \frac{1}{6} + \frac{1}{24} - \frac{1}{120} = -\frac{19}{30}.$$

Estimate the worst case error for how far $S_5 = -\frac{19}{30}$ might be from the true value of the infinite sum.

https://youtu.be/mhqA3TX8unQ