Please answer the following questions. Your answers will be evaluated on their correctness, completeness, and use of mathematical concepts we have covered. Please show all work and write out your work neatly. Answers without supporting work will receive no credit. The point values of the problems are listed in parentheses.

1. (10 points each) Determine whether each of the following infinite series is absolutely convergent, conditionally convergent, or divergent. You must justify your answers to receive credit.

   (a) \( \sum_{k=1}^{\infty} (-1)^{k-1} \frac{k^{-1/3}}{k} \)

   (b) \( \sum_{k=0}^{\infty} \frac{(-1)^k (k + 1) 3^k}{2^{2k+1}} \)
(e) \[ \sum_{k=2}^{\infty} \frac{(-1)^k \sqrt{k}}{\ln k} \]
2. (10 points) A projectile is fired from ground level at an angle of 30° above horizontal at a speed of 400 m/s. Assuming the only force on the projectile after launch is gravitational attraction, how far from its launching point will the projectile land?
3. (10 points) Find the sum of the series

\[ \sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{k^5} \]

correct to five decimal places.
4. (10 points) Find the area enclosed by the graph of the set of parametric equations

\[
\begin{align*}
x(t) &= 3 \cos t \\
y(t) &= 2 \sin t.
\end{align*}
\]
5. (10 points) Find the radius and interval of convergence of the power series

\[ \sum_{k=1}^{\infty} \frac{(x - 2)^k}{k 3^k} \]
6. (10 points) Find the slope of the tangent line to the graph of the following set of parametric equations at \( t = 1 \).

\[
\begin{align*}
x(t) &= e^{\sqrt{t}} \\
y(t) &= t - \ln(t^2)
\end{align*}
\]
7. (10 points) Find a Maclaurin series for \( f(x) = \frac{x^2}{1-x} \). You may find the Maclaurin series directly or by using a known series for a similar function.
8. (10 points) Find the values of $t$ (if any) for which the tangent lines to the graph of the following parametric equations are vertical.

$$
x(t) = t^3 - 3t^2
$$

$$
y(t) = t^3 - 3t
$$