1. (6 points each) Use known Taylor series to find Taylor series for the following functions.
   
   (a) $e^{2x/3}$

   (b) $2x \sin(\pi x)$

   (c) $\ln(1 - x)$, $|x| < 1$
2. (8 points) A projectile is fired with a velocity of 500 m/s from a gun 1.5 m above the ground at an angle of 30° above horizontal. How far from the gun will the projectile land?
3. (6 points each) Consider the function \( f(x) = \frac{1}{x} \).

(a) Find the Taylor polynomial of order 3 centered at \( c = 1 \) for \( f(x) \).

(b) What is the maximum error in using a Taylor polynomial of order 3 centered at \( c = 1 \) to estimate \( 1/1.2 \)?

(c) Find the Taylor series centered at \( c = 1 \) for \( f(x) \).
4. (6 points each) An object is traveling along the path described parametrically by

\[ x = \cos^3 t \]
\[ y = \sin^3 t \]

for \(0 \leq t \leq \pi\).

(a) Graph the path of the object and label its orientation.

(b) What is the object’s speed when \(t = 1\)?
(c) Find the distance that the object travels.

5. (6 points each) Consider the power series \( \sum_{k=0}^{\infty} \frac{-3}{\sqrt{k}} \left( \frac{x}{2} \right)^k \).

   (a) Find the radius of convergence of the series.

   (b) Find the interval of convergence of the series.
6. (5 points each) Determine of the following infinite series converge absolutely, converge conditionally, or diverge. You must justify your answers using a convergence or divergence test.

(a) \[ \sum_{k=1}^{\infty} \frac{(-1)^k k}{k^3 + 1} \]

(b) \[ \sum_{k=1}^{\infty} \frac{\sin k}{k^{3/2}} \]

(c) \[ \sum_{k=2}^{\infty} \frac{7}{k \ln k} \]
(d) \[ \sum_{k=1}^{\infty} \frac{k^2 + 4}{k^3 + 2k + 3} \]