Problem 1 (10 points)

\[\int_0^\infty \frac{1}{(9x^2 + 4)^{3/2}} \, dx.\]
Problem 2 (10 points) Estimate

$$|(1.2)^{2/3} - T_3(1.2)|$$

for the Taylor approximation based at $a = 1$. 
Problem 3 (10 points total) Determine whether the series converges (5 points) and determine its exact value (5 points).

\[ \sum_{n=2}^{\infty} \frac{n(n - 1)}{4^n} \]
Problem 4 (10 points) Find the radius of convergence of the power series.

\[ F(x) = \sum_{n=1}^{\infty} \frac{3^nx^n}{2^n n!} x^n \]
Problem 5 (10 points total) Find

$$\lim_{x \to \infty} x^2 (\pi/2 - \arctan(x^2))$$

(5 points). Determine whether

$$\sum_{n=0}^{\infty} (\pi/2 - \arctan(n^2))$$

converges or diverges (5 points).
Problem 6 (10 points) Find the power series expansion of

\[ \int_{0}^{\infty} \frac{t}{1 + 9t^4} \, dt \]

(5 points) and determine its interval of convergence (5 points).
Problem 7 (10 points) Determine whether the sequence diverges, converges conditionally, or converges absolutely.

\[ \sum_{n=2}^{\infty} \frac{(-1)^n}{n \ln(n^3)} \]
Problem 8 (10 points)
\[ \int \frac{\arctan(x)}{(1 + x)^2} \, dx \]