1. Evaluate
\[ \int \frac{2x^3 - 4x^2 - x - 3}{x^2 - 2x - 3} \, dx \]

2. Solve the equation
\[ \frac{dy}{dx} = (1 + y^2)e^x. \]
Give your answer in the form \( y(x) = \ldots \)

3. Evaluate the limit
\[ \lim_{x \to 0} \frac{x \cos(x) - \arctan(x)}{x^3} \]
using power series.

4. Find the radius and interval of convergence of the series
\[ \sum_{n=1}^{\infty} \frac{(-1)^n (4x - 3)^2}{4^n (n+1)^2}. \]

5. Does the series
\[ \sum_{n=1}^{\infty} \frac{(2n)!}{10^n (n!)^2} \]
converge?

6. Find the Taylor series of \( e^x \) centered at \( a = 2 \). Give your answer in the \( \Sigma \)-notation. (The series suffices, you do not have to prove convergence.)

7. Find the coefficient of \( x^7 \) of the Taylor series expansion of
\[ g(x) = \int_0^x \sin(t^2) \, dt. \]

8. Does the series
\[ \sum_{n=1}^{\infty} (-1)^n \frac{n}{n+1} \]
converge? If so, does it converge conditionally or absolutely?
9. Suppose that \( y(x) \) satisfies the differential equation
\[
x^2 y'' - 2xy' + 3y = 0.
\]
Find the coefficients of \( x^2, x^3, x^4 \) of the Taylor series of \( y(x) \).

10. Evaluate
\[
\int x^2 e^x \, dx
\]