1. Find the integral:

\[ \int x^2 \cos 2x \, dx \]

2. Find the integral:

\[ \int_0^{\pi/2} \sin^2 x \cos^5 x \, dx \]
3. Find the integral:
\[ \int \frac{1}{(x^2 + 1)^2} \, dx \]

4. Find the integral:
\[ \int \frac{dx}{x - \sqrt{x + 2}} \]

5. Find the integral:
\[ \int \frac{dx}{\sqrt{2x - x^2}} \]

6. Write the form of the partial fraction expansion, but do not find the values of the constants:
\[ \frac{x^6 + x^4 + x - 1}{x^5 + x^3} \]

7. Some values of a function \( f \) are given in the table below. In each part of this problem, use the indicated rule with the indicated value of \( n \) to approximate \( \int_0^8 f(x) \, dx \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

(a) Simpson’s Rule with \( n = 4 \).
(b) The Midpoint Rule with \( n = 2 \).

8. The error ET in approximating an integral \( \int_a^b f(x) \, dx \) using the Trapezoid Rule with \( n \) subintervals satisfies the inequality
\[ |ET| \leq \frac{K(b - a)^3}{12n^2}, \]
where \( K \) is any constant such that
\[ |f''(x)| \leq K \quad \text{for} \quad a \leq x \leq b. \]

Using this error estimate, find the smallest value of \( n \) required to guarantee that the error in approximating
\[ \int_0^2 \sin 2x \, dx \]
using the Trapezoid Rule has absolute value less than 0.1 (\( \approx \frac{1}{10} \)). Note: do not evaluate the integral itself, or make any substitution.