1. Evaluate \( \int_0^1 x^5 e^{x^3} \, dx \)

A. 1  B. e  C. \( \frac{1}{3} \)  D. \( \frac{2}{3}e \)  E. \( \frac{2}{3}e - \frac{1}{3} \)

2. Graph the curves on the same plane. At how many distinct points do the curves intersect?

\( r_1 = 2\cos \theta \)  \( r_2 = 2\cos(2\theta) \)

A. 0  B. 1  C. 2  D. 3  E. 4

3. Evaluate \( \int_0^1 \frac{x}{x^2 + 2x + 1} \, dx = \)

A. \( \ln(2) + 1 \)  B. \( \ln(2) \)  C. \( \ln(2) + \frac{1}{2} \)  D. \( \ln(2) - 1 \)  E. \( \ln(2) - \frac{1}{2} \)

4. Let \( C(t) = (2t - t^2, 3t - t^3) \). Which of the following is true?

A. \( C(t) \) is increasing and concave up at \( t = 3 \)
B. \( C(t) \) is decreasing and concave up at \( t = 3 \)
C. \( C(t) \) is increasing and concave down at \( t = 3 \)
D. \( C(t) \) is decreasing and concave down at \( t = 3 \)
5. Let \( C(t) = (2t - t^2, 3t - t^3) \)
which of the following is true?

A. \( C(t) \) has 1 horizontal tangent line and no vertical tangent lines
B. \( C(t) \) has 1 horizontal tangent line and 1 vertical tangent line.
C. \( C(t) \) has 2 horizontal tangent lines and no vertical tangent lines
D. \( C(t) \) has 2 horizontal tangent lines and 1 vertical tangent line.

6. Find the volume \( V \) of the described solid \( S. \)
The base of \( S \) is triangular, with vertices \((0,0), (0,6), \) and \((6,0)\)
Cross-Sections are \( \perp \) to the y-axis and are semi-circles.

A. \( 3\pi \) B. \( 45\pi \) C. \( 9\pi \) D. \( \frac{9\pi}{2} \)

7. Find \( T_2 \), the Taylor polynomial of degree 2, centered at 2 for \( f(x) = \frac{1}{x} \)

7. Find \( T_2 \), the Taylor Polynomial of degree 2, centered at 3, for \( f(x) = \frac{1}{x^2} \). Use \( T_2 \) to approximate \( \frac{1}{(3.1)^2} \).

a. \( \frac{1}{(3.1)^2} \approx \frac{1}{9} - \frac{2}{270} + \frac{1}{1350} \)

b. \( \frac{1}{(3.1)^2} \approx \frac{1}{9} + \frac{2}{270} - \frac{1}{1350} \)

c. \( \frac{1}{(3.1)^2} \approx \frac{1}{9} - \frac{2}{270} - \frac{1}{2700} \)

d. \( \frac{1}{(3.1)^2} \approx \frac{1}{9} - \frac{2}{270} - \frac{1}{3500} \)

e. \( \frac{1}{(3.1)^2} \approx \frac{1}{9} - \frac{2}{270} + \frac{1}{2700} \)
8. Determine the values of $k$ for which the integral
\[ \int_{1}^{\infty} \frac{x^{k/2}}{3x^k + 10x} \, dx \] will converge.

A. $\left[ \frac{4}{2}, \infty \right)$

B. $\left( \frac{3}{2}, \infty \right)$

C. $\left( \frac{4}{2}, \frac{3}{2} \right)$

D. $(5, \infty)$

E. $(\frac{9}{2}, \infty)$
1. C. \( \frac{1}{3} \)

2. B. 1

3. E. \( \ln(2) - \frac{1}{2} \)

4. C. Increasing and Concave down

5. A. \( C(t) \) has 1 HTL and NO VTL

6. C. \( 9\pi \)

7. E. \( \frac{1}{(3,1)^2} \approx \frac{1}{9} - \frac{1}{270} + \frac{1}{32700} \)

8. E. \( (\frac{9}{2}, \infty) \)