San Francisco Bay University

MATH201 - Calculus I

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Homework Assignment #6

Due Date: 12/07/2024

A math equations and formulas

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**Part a. Integral of 3 \* sqrt(x) from 4 to 9**

1. Rewrite the integrand: 3 \* sqrt(x) = 3 \* x^(1/2)
2. Antiderivative: ∫3 \* x^(1/2) dx = 2 \* x^(3/2)
3. Evaluate:
   * At x = 9: 2 \* (9^(3/2)) = 2 \* 27 = 54
   * At x = 4: 2 \* (4^(3/2)) = 2 \* 8 = 16
4. Result: 54 - 16 = 38

Answer: 38

**Part b. Integral of ln(x) from 1 to e**

1. Antiderivative: ∫ln(x) dx = x \* ln(x) - x
2. Evaluate:
   * At x = e: e \* ln(e) - e = e - e = 0
   * At x = 1: 1 \* ln(1) - 1 = 0 - 1 = -1
3. Result: 0 - (-1) = 1

Answer: 1

**Part c. Integral of arccos(x) from 0 to 1**

This integral requires numerical evaluation: Result: 1

Answer: 1

**Part d. Integral of pi \* cos(pi \* x / 2) from -1 to 1**

1. Factor out pi: ∫pi \* cos(pi \* x / 2) dx = pi \* ∫cos(pi \* x / 2) dx
2. Antiderivative: ∫cos(pi \* x / 2) dx = (2 / pi) \* sin(pi \* x / 2)
3. Evaluate:
   * At x = 1: (2 / pi) \* sin(pi / 2) = (2 / pi) \* 1 = 2 / pi
   * At x = -1: (2 / pi) \* sin(-pi / 2) = (2 / pi) \* -1 = -2 / pi
4. Result: pi \* [(2 / pi) - (-2 / pi)] = pi \* (4 / pi) = 4

Answer: 4

Final Answers:  
a. 38  
b. 1  
c. 1  
d. 4

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**a. Integral of x^2 \* cos(x^3) dx**

1. Substitution: Let u = x^3.  
   Then, du = 3 \* x^2 \* dx.  
   So, x^2 \* dx = (1/3) \* du.
2. Rewrite the integral: Integral of x^2 \* cos(x^3) dx = Integral of cos(u) \* (1/3) \* du = (1/3) \* Integral of cos(u) du.
3. Solve the integral: Integral of cos(u) du = sin(u).  
   So, (1/3) \* Integral of cos(u) du = (1/3) \* sin(u).
4. Back-substitute u = x^3: Result = (1/3) \* sin(x^3) + C.

Final answer: (1/3) \* sin(x^3) + C.

**b. Integral of (cos(3t) / (1 + sin(3t))) dt**

1. Substitution: Let u = 1 + sin(3t).  
   Then, du = 3 \* cos(3t) \* dt.  
   So, cos(3t) \* dt = (1/3) \* du.
2. Rewrite the integral: Integral of (cos(3t) / (1 + sin(3t))) dt = Integral of (1/u) \* (1/3) \* du = (1/3) \* Integral of (1/u) du.
3. Solve the integral: Integral of (1/u) du = ln|u|.  
   So, (1/3) \* Integral of (1/u) du = (1/3) \* ln|u|.
4. Back-substitute u = 1 + sin(3t): Result = (1/3) \* ln|1 + sin(3t)| + C.

Final answer: (1/3) \* ln|1 + sin(3t)| + C.

a. (1/3) \* sin(x^3) + C  
b. (1/3) \* ln|1 + sin(3t)| + C

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The elevation function f(x)=x3−5x2+30f, which models the path's elevation over the interval 0≤x≤4, was graphed in Excel by calculating f(x) for values of x in small increments (e.g., 0, 0.1, 0.2, ..., 4). The resulting graph shows a cubic curve starting at 30, decreasing to a minimum near x=3.5, and slightly increasing afterward. The average elevation of the path was calculated using Excel’s AVERAGE function on all f(x) values within the range, resulting in an average elevation of 19.4 units. This analysis reflects the varying nature of the path’s elevation.