Question 1:

-*Question*: If y = arccos(2x / √(1 + 4x^2)), where x > 0, find dy/dx. Simplify your answer.

-Option A: -2 / (1 + 4x^2)

-Option B: -2 / √(1 + 4x^2)

-Option C: 2 / (1 + 4x^2)

-Option D: 2 / √(1 + 4x^2)

**-Correct Answer: B

**-Metadata:

-Cognitive Level: Analysis

-Difficulty Level: Hard

-Topic: Calculus -Subtopic: Derivatives of Inverse Trigonometric Functions

-Grade Level: College Freshman

-Expected Solution Time: 6 minutes

Question 2:

-*Question*: If x^2 + y^2 = e^(xy), find dy/dx at the point (0, 1). Hint: Use implicit differentiation.

-Option A: -1/2

-Option B: 0

-Option C: 1/2

-Option D: 1

**-Correct Answer: C

**-Metadata:

-Cognitive Level: Application

-Difficulty Level: Medium

-Topic: Calculus -Subtopic: Implicit Differentiation

-Grade Level: Grade 12

-Expected Solution Time: 4 minutes

Question 3:

-*Question*: Evaluate using L'Hôpital's rule: lim(x → 0) [e^(sin x) - e^x] / x^3

-Option A: -1/6

-Option B: -1/3

-Option C: 1/6

-Option D: The limit does not exist

**-Correct Answer: A

**-Metadata:

-Cognitive Level: Analysis

-Difficulty Level: Hard

-Topic: Calculus -Subtopic: Limits and L'Hôpital's Rule

-Grade Level: College Freshman

-Expected Solution Time: 7 minutes

Question 4:

-*Question*: For the function f(x) = x^4 - 4x^3 + 4x^2 - 1 on the interval [0, 3], determine: a) The number of critical points b) The nature of each critical point (local maximum, local minimum, or inflection point)

-Option A: 2 critical points; local minimum, local maximum

-Option B: 2 critical points; local maximum, local minimum

-Option C: 3 critical points; local minimum, inflection point, local maximum

-Option D: 3 critical points; local maximum, inflection point, local minimum

**-Correct Answer: B

**-Metadata:

-Cognitive Level: Analysis

-Difficulty Level: Medium

-Topic: Calculus -Subtopic: Function Analysis and Critical Points

-Grade Level: Grade 12

-Expected Solution Time: 6 minutes

Question 5:

-*Question*: Assume f(x) is a continuous function. If f'(x) > 0 for x < 2 and f'(x) < 0 for x > 2, which statement must be true?

-Option A: f(x) has a local minimum at x = 2

-Option B: f(x) has a local maximum at x = 2

-Option C: f(x) has an inflection point at x = 2

-Option D: Not enough information to determine

**-Correct Answer: B

**-Metadata:

-Cognitive Level: Evaluation

-Difficulty Level: Medium

-Topic: Calculus -Subtopic: Relationship between Function and its Derivative

-Grade Level: Grade 12

-Expected Solution Time: 3 minutes

Additional Question:

-*Question*: A manufacturer determines that the profit P (in thousands of dollars) from producing and selling x units of a product is given by P(x) = -0.01x^2 + 4x - 100. How many units should be produced to maximize profit?

-Option A: 100

-Option B: 150

-Option C: 200

-Option D: 250

**-Correct Answer: C

**-Metadata:

-Cognitive Level: Application

-Difficulty Level: Medium

-Topic: Calculus -Subtopic: Optimization

-Grade Level: Grade 12

-Expected Solution Time: 5 minutes