**Class XII Mathematics Question Paper: Calculus**

**Instructions:** All questions are compulsory. The question paper consists of 5 sections.

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**Section A: (20 Marks)**

**MCQ1:** What is the derivative of f(x) = x^3 + 3x^2 - 5x + 7?

A) 3x^2 + 6x - 5

B) 3x^2 + 5

C) 3x^2 + 6x + 7

D) 3x^3 + 2x

**Correct Answer:** A

**MCQ2:** Which of the following is the integral of sin(x)?

A) -cos(x) + C

B) cos(x) + C

C) sin(x) + C

D) -sin(x) + C

**Correct Answer:** A

**MCQ3:** If f(x) = e^2x, what is f'(x)?

A) 2e^2x

B) e^2x

C) 2xe^2x

D) 2e^x

**Correct Answer:** A

**MCQ4:** The area under the curve y = x^2 from x = 0 to x = 2 is:

A) 8/3

B) 2

C) 4

D) 4/3

**Correct Answer:** A

**MCQ5:** What is the second derivative of f(x) = 3x^4 - 4x^3 + 2x - 1?

A) 36x^2 - 24x + 2

B) 12x^2 - 12x + 2

C) 12x^3 - 12

D) 36x^3 - 24x + 2

**Correct Answer:** A

**MCQ6:** The integral ∫ (3x^2 + 2x + 1) dx evaluates to:

A) x^3 + x^2 + x + C

B) x^3 + x^2 + C

C) x^3 + x^2 + x + 1

D) 3x^3 + x^2 + C

**Correct Answer:** A

**MCQ7:** If f(x) = ln(x^2 + 1), what is f'(1)?

A) 0

B) 1/2

C) 1

D) 1/3

**Correct Answer:** B

**MCQ8:** The fundamental theorem of calculus connects which two concepts?

A) Derivatives and limits

B) Integration and differentiation

C) Algebra and geometry

D) Functions and sequences

**Correct Answer:** B

**MCQ9:** The derivative of f(x) = tan(x) is:

A) ^2(x)

B) cos^2(x)

C) sin^2(x)

D) (x)

**Correct Answer:** A

**MCQ10:** The integral ∫\_0^1 x^3 dx equals:

A) 1/4

B) 1/5

C) 1/3

D) 1/6

**Correct Answer:** B

**MCQ11:** The derivative of f(x) = √(x) is:

A) 1/2√(x)

B) 1/√(x)

C) 1/2x^-1/2

D) Both A and C

**Correct Answer:** D

**MCQ12:** The integral ∫ e^2x dx results in:

A) 1/2e^2x + C

B) 2e^2x + C

C) e^2x + C

D) e^x^2 + C

**Correct Answer:** A

**MCQ13:** If f(x) = x^4 - 8x^2 + 16, find f'(2).

A) 0

B) -16

C) 16

D) 8

**Correct Answer:** A

**MCQ14:** The integral ∫\_1^3 (3x^2 - 4) dx evaluates to:

A) 8

B) 10

C) 6

D) 4

**Correct Answer:** A

**MCQ15:** If f(x) = 5x^3 + 2x^2 - 3x + 1, what is f”(x)?

A) 30x + 4

B) 15x^2 + 4

C) 15x^2 - 3

D) 30x^2 + 2

**Correct Answer:** A

**MCQ16:** The limit lim\_x → 0sin(x)/x is:

A) 0

B) 1

C) ∞

D) -1

**Correct Answer:** B

**MCQ17:** The derivative of f(x) = ln(x) + ln(x+1) is:

A) 1/x + 1/x+1

B) 1/x - 1/x+1

C) 1/x^2 + 1/(x+1)^2

D) 1/x^2 - 1/(x+1)^2

**Correct Answer:** A

**MCQ18:** Which of the following represents the integral ∫\_0^1 (2x + 1) dx?

A) 1

B) 3/2

C) 2

D) 1/2

**Correct Answer:** B

**Assertion-Reason Questions:**

**AR1:** Assertion: The derivative of a constant function is zero.

Reason: A constant function does not change with respect to its variable.

**Correct Answer:** True

**AR2:** Assertion: The integral of a function gives its area under the curve.

Reason: The area under the curve can be negative.

**Correct Answer:** False

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**Section B: (10 Marks)**

**B1:** Find the value of ∫\_0^1 x^2 dx. (2 marks)

**B2:** Differentiate f(x) = cos(3x) + 5. (2 marks)

**B3:** Evaluate d/dx (x^5 - 3x^3 + 2x). (2 marks)

**B4:** Find ∫ (4x^3 - 2x^2 + 3) dx. (2 marks)

**B5:** What is the derivative of f(x) = 1/x? (2 marks)

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**Section C: (18 Marks)**

**C1:** Evaluate ∫ (3x^2 + 2) dx and find the constant of integration if f(0) = 1. (3 marks)

**C2:** If f(x) = x^2 sin(x), find f'(x) using the product rule. (3 marks)

**C3:** Prove that d/dx (e^ax) = ae^ax for any constant a. (3 marks)

**C4:** Calculate the area under the curve y = x^2 from x = 1 to x = 3. (3 marks)

**C5:** Find the maximum value of f(x) = -x^2 + 4x using differentiation. (3 marks)

**C6:** Evaluate ∫\_1^2 (6x - 4) dx. (3 marks)

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**Section D: (20 Marks)**

**D1:** Find the value of ∫ (2x^3 - 3x^2 + 4x - 5) dx and evaluate it from x = 1 to x = 3. (5 marks)

**D2:** Prove that if f(x) = x^2 cos(x), then f'(x) = 2x cos(x) - x^2 sin(x). (5 marks)

**D3:** Using the first principle of derivatives, find f'(x) for f(x) = x^2 + 5x. (5 marks)

**D4:** Evaluate ∫\_0^1 (2x^2 - 3x + 1) dx and interpret the result geometrically. (5 marks)

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**Section E: (12 Marks)**

**E1:** Consider the function f(x) = x^3 - 3x + 1.

a) Find f'(x). (1 mark)

b) Determine the critical points of f(x). (1 mark)

c) Find the intervals of increase and decrease. (1 mark)

d) What are the local maxima and minima? (1 mark)

**E2:** A company’s profit P(x) in thousands of dollars is given by P(x) = -2x^2 + 12x - 10, where x is the number of units sold in thousands.

a) Find P'(x). (1 mark)

b) Determine the number of units that maximizes the profit. (1 mark)

c) Calculate the maximum profit. (1 mark)

d) What is the profit when 2 units are sold? (1 mark)

**E3:** The velocity of a particle is given by v(t) = 6t - 4 m/s.

a) Find the acceleration of the particle. (1 mark)

b) Determine the time when the particle comes to rest. (1 mark)

c) Calculate the displacement of the particle from t = 0 to t = 2. (1 mark)

d) What is the total distance traveled during this time? (1 mark)

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**End of Question Paper**