

CALCULUSII

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Question Bank.Second Semester 2023-2024

1. Find the points of discontinuity of the function $f(x) = \begin{cases} 0 & \text{if } x < -2 \\ -x & \text{if } -2 \leq x < 0 \\ x^2 - 1 & \text{if } x \geq 0 \end{cases}$.

2. Find the points of discontinuity of the function $f(x) = \begin{cases} \frac{x^2-9}{x-3} & , \quad x \neq 3 \\ 4 & , \quad x = 3 \end{cases}$.

3. Find the value of the constant k so that the function f defined below is continuous at $x = 0$

$$f(x) = \begin{cases} \frac{1 - \cos(4x)}{8x^2} & x \neq 0 \\ k & x = 0 \end{cases}$$

4. Use the definition of the derivative to compute $f'(x)$, for $f(x) = \frac{1}{2}x - \frac{3}{5}$.

5. Find $\frac{dy}{dx}$, for $y = \pi^x \tan x$.

6. Prove that $\cosh^2 x - \sinh^2 x = 1$.

7. Find the following limits:

1- $\lim_{x \rightarrow \infty} \frac{\ln(\ln x)}{x}$.

2- $\lim_{x \rightarrow \frac{\pi}{4}} [(1 - \tan x) \sec 2x]$.

3- $\lim_{x \rightarrow 0} (1 + \sin 2x)^{\frac{1}{x}}$

8. Find the following limits:

1- $\lim_{x \rightarrow 1} \frac{\ln x}{x-1}$.

2- $\lim_{x \rightarrow \infty} x e^{-x}$.

9. By using parts to find the following integral $\int \ln x \, dx$.

10. By using partial Fractions to find the following integral $\int \frac{x-12}{x^3+4x^2} \, dx$.

11. By using parts to find the following integral $\int x \cos x \, dx$.

12. By using partial Fractions to find the following integral $\int \frac{3x-17}{x^2-2x-3} dx$.

13. By using substitution to find the following integral $\int \frac{\sin\theta}{\sqrt{1-\cos^2\theta}} d\theta$.

Exercise 1: Assume that y is a function of x .

(1) Find y' for $\sin(x^2y^2) = x$. (2) Find y' for $x = \frac{1}{\sin y}$.

(3) Find y' for $e^{xy} = e^{4x} - e^{5y}$.

Exercise 2: Compute (1) $\lim_{x \rightarrow 0} \left(\frac{1}{x^2} - \frac{1}{x^4} \right)$. (2) $\lim_{x \rightarrow 0} \left(\csc x - \frac{1}{x} \right)$
(3) $\lim_{x \rightarrow \infty} (x - \ln(x^2 + 1))$ (4) $\lim_{x \rightarrow \frac{\pi}{2}} \cos x \csc(\cos x)$

Exercise 3: Find the following limits:

1- $\lim_{x \rightarrow \infty} \frac{\ln(\ln x)}{x}$.

2- $\lim_{x \rightarrow \frac{\pi}{4}} [(1 - \tan x) \sec 2x]$.

3- $\lim_{x \rightarrow 0} (1 + \sin 2x)^{\frac{1}{x}}$

Exercise 4: Find the following limits:

1. $\lim_{x \rightarrow \infty} \frac{2^x}{3^x}$

2. $\lim_{x \rightarrow 0^+} \tan^{-1}(\ln x)$

3. $\lim_{x \rightarrow \infty} \frac{5^x}{3^{x+2}}$

Exercise 5: By using parts to find the following integral $\int (\ln x)^2 dx$.

Exercise 6: By using partial Fractions to find the following integral

$$\int \frac{3x^2 + x + 1}{(x-1)(x^2 + 4)} dx$$

Exercise 7: By using parts to find the following integral $\int x^4 e^x dx$.

Exercise 8: By using partial Fractions to find the following integral

$$\int \frac{-x^2 + 3x + 4}{x(x+2)^2} dx$$