Department of Mathematics and Natural Sciences

MAT 120: Integral Calculus & Differential Equations

Spring 2024

ASSIGNMENT 2

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1. Evaluate the following integrals by using the proper method. Identify the improper integral, if any, and then comment on the convergency of the improper integral. Use Beta and Gamma functions, if needed. $[1.5 \times 7]$

   (a) $\displaystyle \int \frac{x^4 + 6x^3 + 10x^2 + x}{x^2 + 6x + 10} dx$

   (b) $\displaystyle \int \frac{2x^3 - 4x - 8}{x^4 - x^3 + 4x^2 - 4x} dx$

   (c) $\displaystyle \int_{-\infty}^{0} \frac{e^{\frac{1}{x}}}{x^2} dx$

   (d) $\displaystyle \int_{0}^{\frac{\pi}{6}} \frac{\cos x}{\sqrt{1 - 2\sin x}} dx$

   (e) $\displaystyle \int_{0}^{1} \frac{1}{\sqrt{x \ln\left(\frac{1}{x}\right)}} dx$

   (f) $\displaystyle \int_{0}^{\infty} e^{-x^2} dx$

   (g) $\displaystyle \int_{-3}^{1} \frac{1}{w^2 + 2w} dw$

2. If $\mathcal{R}$ is the region bounded above by the graph of the function $f(x) = 9 - \left(\frac{x}{2}\right)^2$ and below by the graph of the function $g(x) = 6 - x$, find the area of the region $\mathcal{R}$. $[1.5]$

3. Find the exact length of the curve given by $y = (8x + 3)^{\frac{3}{2}}$ over the interval $11^{\frac{3}{2}} \le y \le 27^{\frac{3}{2}}$ with respect to y-axis. $[2]$

4. Find the exact length of the curve given by $24xy = y^4 + 48$ over the interval $2 \le y \le 4$ with respect to y-axis. $[2]$

5. Determine the area of the region bounded by $y = 2x^2 + 10$, $y = 4x + 16$, $x = -2$ and $x = 5$. . $[2]$

6. Find the surface area generated by the curve $y = \frac{1}{4}\sqrt{6x + 2}$ over the interval $\frac{\sqrt{2}}{2} \le y \le \frac{\sqrt{5}}{2}$ with respect to x-axis. $[2]$