Show ALL your work, along with JUSTIFICATION for the steps you take.

1. \( \int 9xe^{5-3x^2} \, dx = -\frac{9}{6}e^{5-3x^2} + c \)

2. \( \int \sqrt{7x - 3} \, dx = \frac{2}{21}(7x - 3)^{3/2} + c \)

3. \( \int (7 - 3x)e^{6x} \, dx = \frac{7-3x}{6}e^{6x} + \frac{1}{12}e^{6x} + c \)

4. \( \lim_{x \to 4} \frac{x^2 - 7x + 12}{x - 4} = 1 \)

5. \( \lim_{x \to 3} f(x) = 14 \) where \( f(x) = \begin{cases} x^2 + 5 & x \neq 3 \\ 7 & x = 3 \end{cases} \)

6. \( \lim_{x \to 5} \frac{3x - 15}{\sqrt{x^2 - 10x + 25}} \) does not exist

7. \( \frac{d}{dx} \left[ \frac{3 + \sqrt{x}}{x^3 - 9x^2 + 14} \right] = \frac{1}{x}x^{-2/3}(x^3 - 9x^2 + 14) - (3x^{1/3})(3x^2 - 18x) \)

8. \( \frac{d}{dx} (3x + 5\sqrt{x}) \left( 7x^2 - 9\sqrt{x^7} \right) = \left(3 + \frac{5}{2}x^{-1/2}\right)(7x^2 - 9x^{7/4}) + (3x + 5\sqrt{x}) \left(14x - \frac{63}{4}x^{3/4}\right) \)

9. \( \int_{-\infty}^{\infty} \frac{1}{2\beta} e^{tx} e^{-|x-\alpha|/\beta} \, dx \) where \(-\infty < \alpha < \infty, \beta > 0, |t| < \frac{1}{\beta} \)

   Ans: \( \frac{1}{2\beta} e^{-\alpha/\beta} \left( \frac{e^{(t+\frac{1}{\beta})\alpha}}{t+\frac{1}{\beta}} - \frac{1}{2\beta} e^{\alpha/\beta} \cdot \frac{(t - \frac{1}{\beta})\alpha}{t - \frac{1}{\beta}} \right) = \frac{e^{\alpha t}}{1 - \beta^2 t^2} \)

10. \( \int_{x+y \geq 1} f(x, y) \, dx \, dy \) where \( f(x, y) = e^{-y} \) for \( 0 < x < y < \infty \)

    Ans: \( \int_{0}^{1/2} \int_{1-x}^{\infty} e^{-y} \, dy \, dx + \int_{1/2}^{\infty} \int_{x}^{\infty} e^{-y} \, dy \, dx = 2e^{-1/2} - e^{-1} \)