

Class Exercise 2

(1)

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Determine whether the following integrals converges or diverges

$$(a) \int_1^{\infty} \frac{1}{(x+2)^2} dx$$

$$(b) \int_1^{\infty} \frac{1}{(x-2)^2} dx$$

If the integral converges, Find its value

$$(a) \int_1^{\infty} \frac{1}{(x+2)^2} dx = \int_1^{\infty} (x+2)^{-2} dx = \frac{(x+2)^{-1}}{-1} = \left[ -\frac{1}{(x+2)} \right]_1^{\infty}$$

$$= \left[ \left( -\frac{1}{\infty+2} \right) - \left( -\frac{1}{1+2} \right) \right] = 0 + \frac{1}{3} = \frac{1}{3}$$

$$\int_1^{\infty} \frac{1}{(x+2)^2} dx = \frac{1}{3} \quad \text{The integral converges to } \frac{1}{3}$$

$$(b) \int_1^{\infty} \frac{1}{(x-2)^2} dx = \underbrace{\int_1^2 \frac{1}{(x-2)^2} dx}_{I_1} + \underbrace{\int_2^{\infty} \frac{1}{(x-2)^2} dx}_{I_2}$$

$$I_1 = \left[ -\frac{1}{(x-2)} \right]_1^2 = \left[ \left( -\frac{1}{2-2} \right) - \left( -\frac{1}{1-2} \right) \right] = \text{und.} - 1$$

$$I_2 = \left[ -\frac{1}{(x-2)} \right]_2^{\infty} = \left[ \left( -\frac{1}{\infty-2} \right) - \left( -\frac{1}{2-2} \right) \right] = 0 + \text{und.}$$

$$\int_1^{\infty} \frac{1}{(x-2)^2} dx = \text{diverges}$$

