An Introduction to Elementology (A)

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1. Theorem Environment

Let's create a theorem environment that is similar to the one in the book "The Art of Computer Programming" by Donald Knuth. The theorem environment will have a title, a number, and a body. The number will be automatically generated and will be in the format "Theorem 1.1".

Theorem 1.1. Generalized Fubini Theorem

Let Ω be a Jordan measurable set in $\mathbb{R}^n$, and f be continuous on Ω. Then

$$\int_{X \times Y} f(x_1, \ldots, x_m; y_1, \ldots, y_n) \, \mathrm{d}x_1 \ldots \mathrm{d}x_m \, \mathrm{d}y_1 \ldots \mathrm{d}y_n$$
$$= \int_X \left(\int_Y f(x_1, \ldots, x_m; y_1, \ldots, y_n) \, \mathrm{d}y_1 \ldots \mathrm{d}y_n \right) \mathrm{d}x_1 \ldots \mathrm{d}x_m .$$

Proof of Theorem 2. wow this is a proof

Merge the complex eigenspaces into

$$W = \ker(A^2 - 2bA + (b^2 + c^2)I).$$

Try to find $v, w \in W$ s.t. $A(v, w) = (v, w)\begin{pmatrix} b & c \\ -c & b \end{pmatrix}$.

$$Av = bv - cw \Rightarrow \boldsymbol{w} = -c^{-1}(A - bI)\boldsymbol{v}$$
$$\Rightarrow Aw = cv + bw. (\text{Note: } A^2 v = 2bAv - (b^2 + c^2)v)$$

By the above restriction, find

$$1. w \perp v$$
$$2. \operatorname{span}(v, w)^{\perp} \text{ is } A \text{ -invariant.}$$

Then the result follows from simple induction. □

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$$= \int_X \left(\int_Y f(x_1, \ldots, x_m; y_1, \ldots, y_n) \, \mathrm{d}y_1 \ldots \mathrm{d}y_n \right) \mathrm{d}x_1 \ldots \mathrm{d}x_m .$$

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