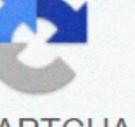


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What is the definition of the word zero product property

For the product of zero factors, see empty product. In algebra, the zero-product property determines that the product of two non-zero elements is nonzero. In other words, this is the following assertion: If $a \cdot b = 0$, then $a = 0$ or $b = 0$. The zero-product property is also known as arranging zero product, the zero factor law, the multiplication property of zero, the non-existence of non-void zero divisors, or one of the two zero-factor properties. [1] All the number of systems studied in elementary math — the integers \mathbb{Z} , the rational numbers \mathbb{Q} , the actual numbers \mathbb{R} , and the complex numbers \mathbb{C} — satisfy the null product property. In general, a ring that conforms to the zero-product property is called a domain. Algebraic context AssumeS A is an algebraic structure. We can ask, does A have the null product property? In order to have this question meaning, A must have both additive structure and multiplying structure. [2] Usually one assumes that a is a ring, even if it can be something else, e.g. $\{0, 1, 2, \dots\}$ with plain addition and multiplication, which is only a (commutative) semiring. Note that if A meets the null product property, and if B is a subset of A, then B also meets the null product property: if $a, b \in B$ are such that $a \cdot b = 0$, then either $a = 0$ or $b = 0$ because a and b also as elements of A showstyle A. Examples A ring in which the null product property holds up is called a domain. A commutative domain with a multiplying identity element is called an integral domain. Any field is an integral domain; in fact, any subring of a field is an integral domain (as long as it contains 1). Similarly, any subring of a skewed field is a domain. Thus, the zero-product property holds for any subring of a skewed field. If p is a prime number, then the ring of integer modulo p has the null product property (in fact, it's a field). The Gaussian integers are an integral domain because they are a subring of the complex numbers. In the strictly skewed field of mercury, the zero-product property holds. This ring is not an integral domain, because the multiplication is not commutable. The set of nongative integer $\{0, 1, 2, \dots\}$ is not a ring (to be a semiring instead), but it does the zero-product property. Non-examples Let Z a assign the ring of integer modulo n. Then Z 6 does not meet the zero product property: 2 and 3 are nonzero elements, but $2 \cdot 3 \equiv 0 \pmod{6}$. In general, if n is a composite number, Z n does not meet the null product property. Namely, if $n = q m$ where $0 < q, m < n$, then m and q is nonzero modulo n but $q m \equiv 0 \pmod{n}$. The ring $Z^{2 \times 2}$ of 2 through 2 matrices with integer entries do not meet the null product property : if $M = \begin{pmatrix} 1 & 1 & 0 & 0 \end{pmatrix}$ and $N = \begin{pmatrix} 0 & 1 & 0 & 1 \end{pmatrix}$, then $M N = \begin{pmatrix} 1 & 1 & 0 & 0 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 & 0 \end{pmatrix} = 0$, but neither M nor N is null. The ring of all functions $f : [0, 1] \rightarrow \mathbb{R}$, from the unit interval to the actual numbers, has non-adverse zero divers: there are pairs of features that are not identical to zero yet whose product is the zero function. In fact, it's not hard to construct, for any $n \geq 2$, features f_1, \dots, f_n , none of which are identically zero, so that $f_i f_j$ is identically zero when $i \neq j$ ie The same is true, even if we consider only continuous features, or even infinitely smooth features. Application to find roots of polynom assuming P and Q are univariate polynom with actual coefficients, and x is a true number allowing $P(x) Q(x) = 0$. (Actually, we can allow the coefficients and x to come from any integral domain.) By the zero-product property, it follows that either $P(x) = 0$ or $Q(x) = 0$. In other words, the roots of P Q are exactly the roots of P along with the roots of Q . So one can use factory to find the roots of a polynom. For example, the polnom $x^3 - 2x^2 - 5x + 6$ factory as $(x - 3)(x - 1)(x + 2)$; thus, its roots are exactly 3, 1, and -2. In general, suppose R is an integral domain and f is a monical univariate polynom of grade $d \geq 1$ with coefficients in R . Also suppose that f d has separate roots $r_1, \dots, r_d \in R$. This follows (but we don't prove here) that f factors as $f(x) = (x - r_1) \cdots (x - r_d)$. Through the zero-product property, it follows that r_1, \dots, r_d are the only roots of f : any root of f should be a root of $(x - r_i)$ for some i for some i In particular, f came at most d separate roots. However, if R is not an integral domain, the conclusion does not have to hold down. For example, the cubic polnom $x^3 + 3x^2 + 2x$ has six roots in \mathbb{Z}_6 (though it has just three roots in \mathbb{Z}) Also see Fundamental statement from algebra Integral domain and domain Prime ideal Zero dededer Notes ^ The other is a $\cdot 0 = 0 \cdot a = 0$. Mustafa A. Munem and David J. Foulis, Algebra and Trigonometry with Applications (New York: Worth Publishers, 1982), p. 4. ^ There should be an idea of zero (the additive identity) and an idea of products, that is, multiplication. References David S. Dummit and Richard M. Foote, Abstract Algebra (3d ed.), Wiley, 2003, ISBN 0-471-43334-9. External links PlanetMath: Zero rule of product retrieved from

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