

sci.math: Re: What is a basis for vector space of  $\{(a_1, a_2, \dots)\}$   $a_i$  real?

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Ron Jones wrote:

- > *I'd be very grateful if anyone could answer the following.*
- > *If  $V$  is the set of all countable-tuples  $(a_1, a_2, a_3, \dots)$*
- > *where  $a_i$  are rational or real, then under usual pointwise*
- > *addition and scalar multiplication it is a vector space.*
- > *Every vector space has a basis – what then is a basis of  $V$ ?*
- > *Also any book that deals with infinite-dimensional spaces–...*

The standard basis is:

$$e_1 = (1, 0, 0, \dots),$$

$$e_2 = (0, 1, 0, \dots),$$

$$e_3 = (0, 0, 1, \dots), \dots$$

Then a vector  $(a_1, a_2, a_3, \dots) = (a_1)e_1 + (a_2)e_2 + \dots$

This space is isomorphic to the space of polynomials, however you want to choose the coefficients (either only rationals or real coefficients). The standard basis for this space is  $\{1, x, x^2, x^3, \dots\}$ .