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# Today in Physics 217: vector analysis

Vectors:

- have direction
- have magnitude

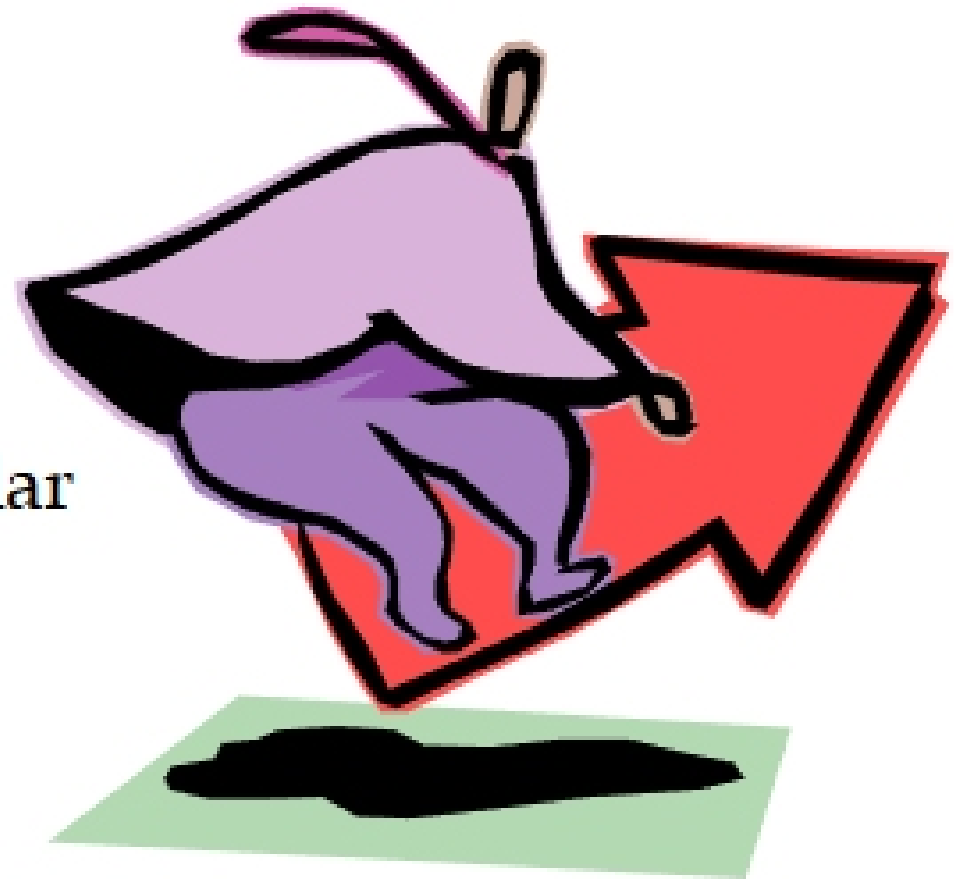
Vector operations include

- vector addition
- vector multiplication by a scalar
- the dot product
- the cross product

Vector components

Vector transformation

Second-rank tensors



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# Vector operations

Vector addition:

- Adding two vectors produces a third vector:

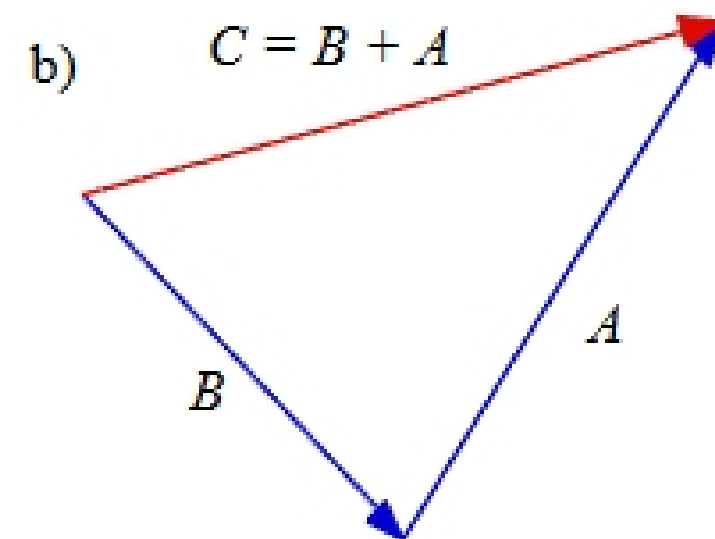
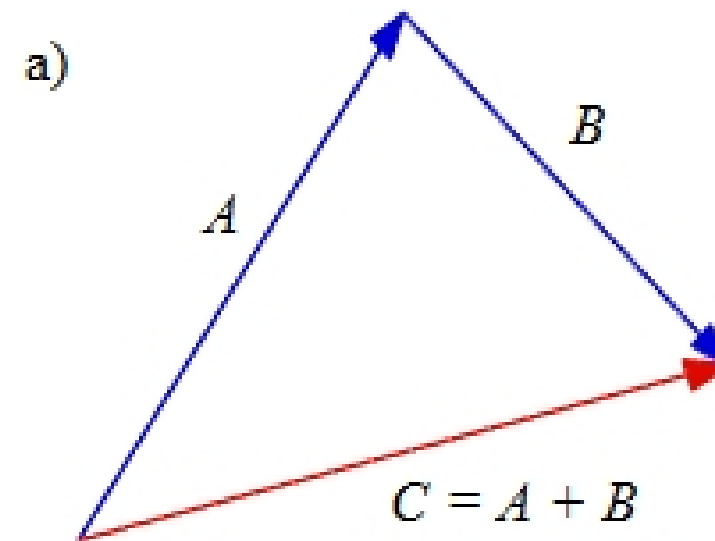
$$A + B = C$$

- Vector addition is commutative:

$$A + B = C = B + A$$

- Vector subtraction is equivalent to adding the opposite of a vector:

$$A - B = A + (-B)$$



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## Vector operations (continued)

Vector multiplication by a scalar:

- ❑ The result of vector multiplication by a scalar is a vector.
- ❑ The magnitude of the resulting vector is the product of the magnitude of the scalar and the magnitude of the vector.
- ❑ The direction of the resulting vector is the same as the direction of the original vector if  $a > 0$  and opposite to the direction of the original vector if  $a < 0$ .
- ❑ Vector multiplication is distributive:  $a(A + B) = aA + aB$

