

magnitude and direction together, added tip to tail

A vector, defined

notation, magnitude $a, |a|$

position vector of a point (x,y,z) $r = x\hat{i} + y\hat{j} + z\hat{k}$

its magnitude $|r| = \sqrt{x^2+y^2+z^2}$

unit vector along a , from a itself $\hat{a} = \frac{a}{|a|}$

a scalar is a number alone. A vector needs both a magnitude and a direction to be fully described

Types of vectors

Zero vector

magnitude 0, direction not defined

Unit vector

magnitude exactly 1, direction can be anything

Collinear vectors

parallel to the same line, whatever their magnitude or direction along it

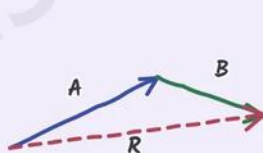
Equal vectors

same magnitude AND same direction, positions can differ

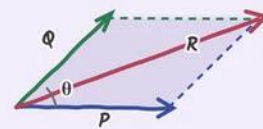
collinear only needs the same line of action. Equal needs magnitude and direction to match exactly

Adding two vectors, two pictures of the same sum

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triangle law: place the tail of B at the tip of A, and the resultant R closes the triangle back to the start



parallelogram law: P and Q drawn from a common point, the diagonal R through that point is their sum $P+Q$

same two vectors, same resultant, either way it's drawn

Addition, laws it obeys *

commutative

$$a+b = b+a$$

associative

$$(a+b)+c = a+(b+c)$$

additive identity

$$a+0 = a$$

additive inverse

$$a+(-a) = 0$$

scalar multiplication scales the magnitude by $|k|$ and flips the direction when k is negative, leaving it unchanged when k is positive

the resultant is the diagonal in the parallelogram picture, and the closing side of the triangle in the other: two drawings, one vector