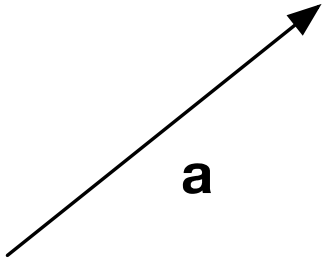
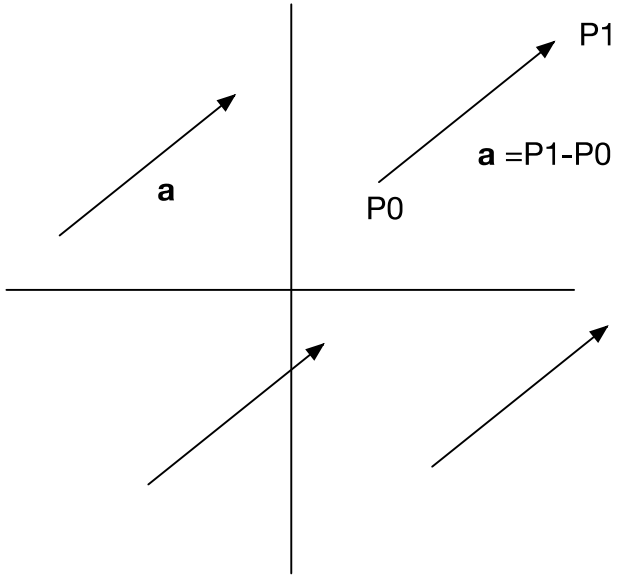
CMSC427 Geometry and Vectors: Affine Geometry

Vectors

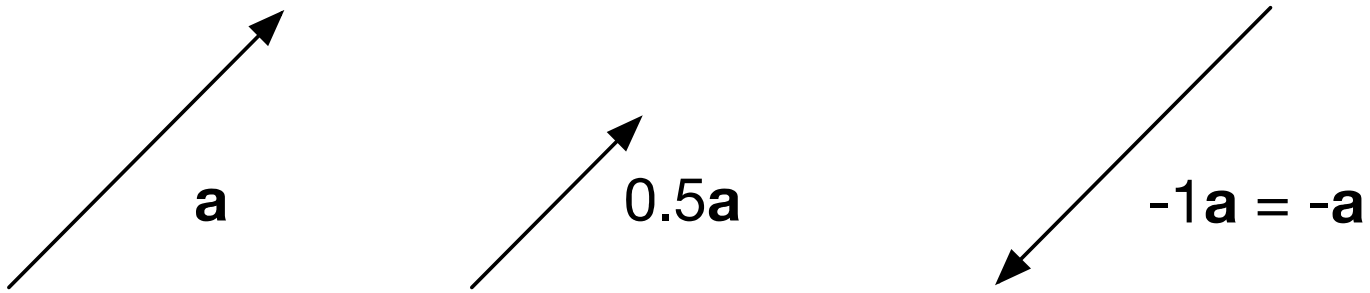
- Direction and distance
- Describes
  - Difference between points
  - Speed, translation, axes
- Notation
  - In bold **a**
  - Angle brackets **a** = <x,y>
  - (Points in parens (x,y))
- Free vectors
  - No anchor point
  - Displacement, not location

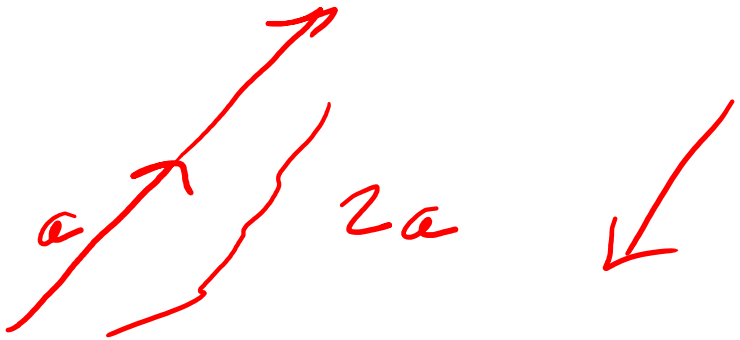




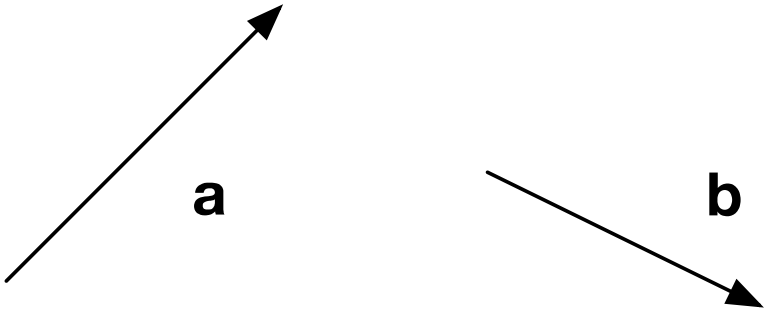
Vector scaling

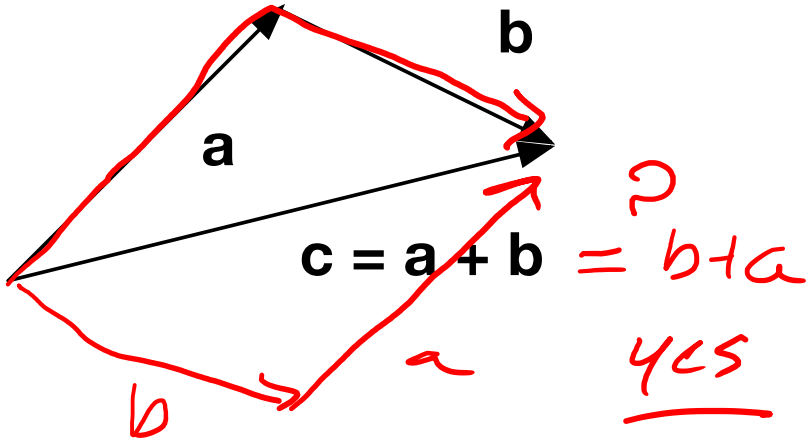
Multiplication by scalar $s\mathbf{a}$





Vector addition and subtraction

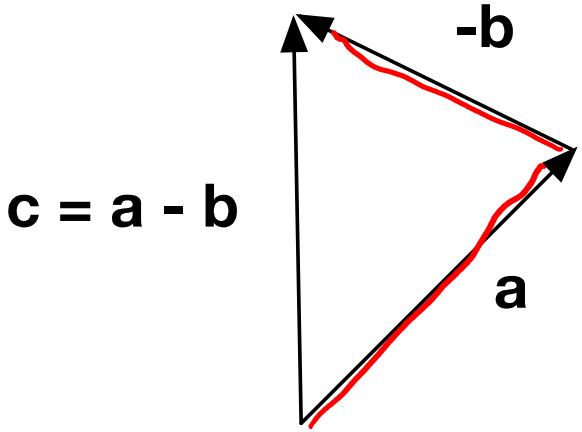




?

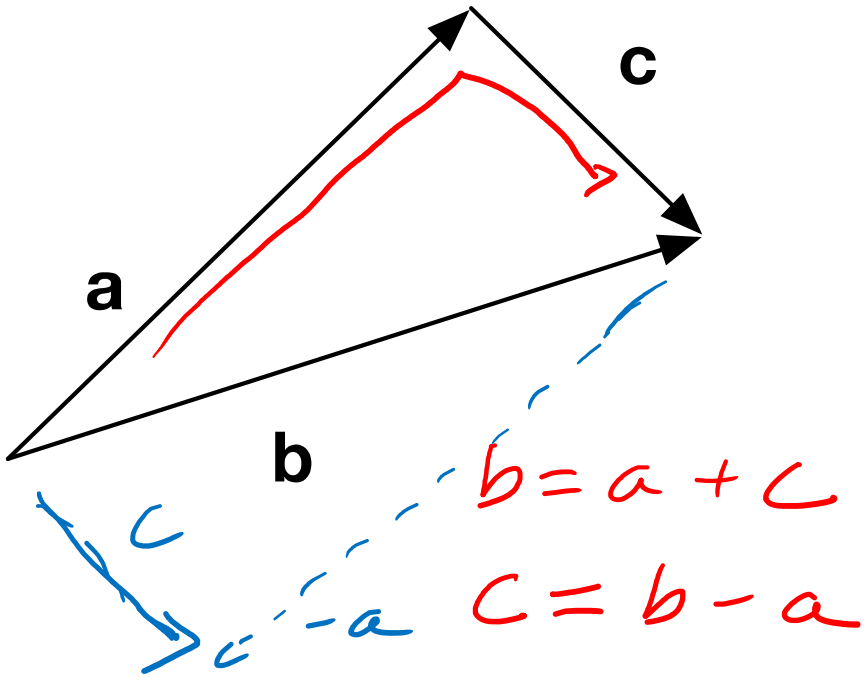
b+a

yes



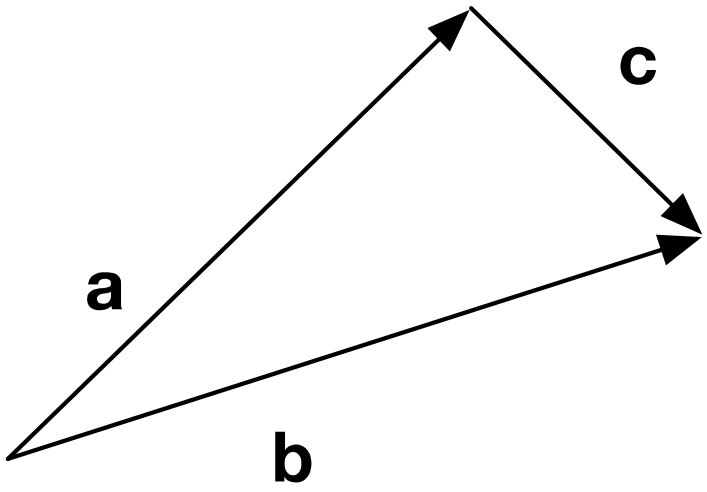
Vector addition and subtraction

What is **c** in terms of **a** and **b**?



Vector addition and subtraction

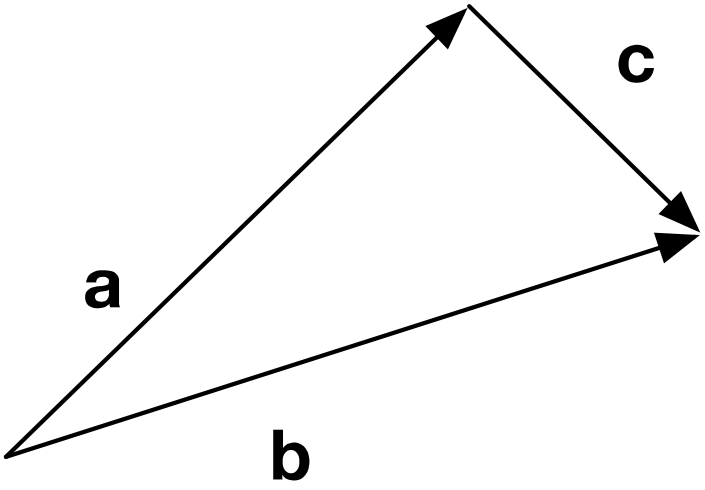
What is **c** in terms of **a** and **b**?



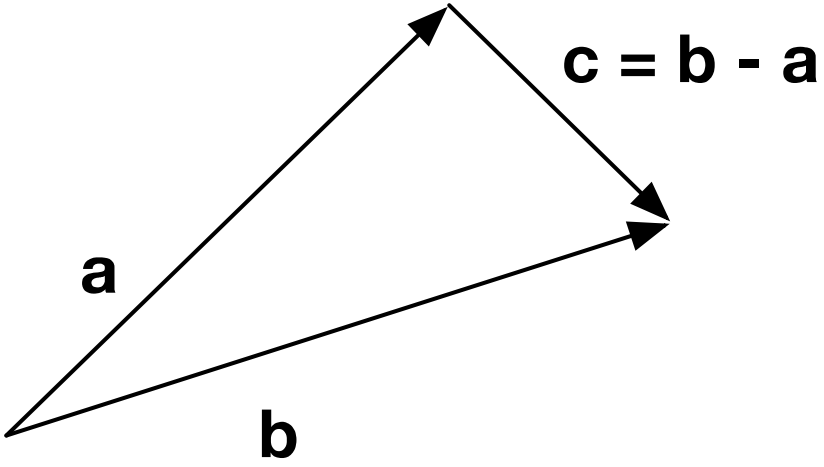
a + c = b

Vector addition and subtraction

What is **c** in terms of **a** and **b**?



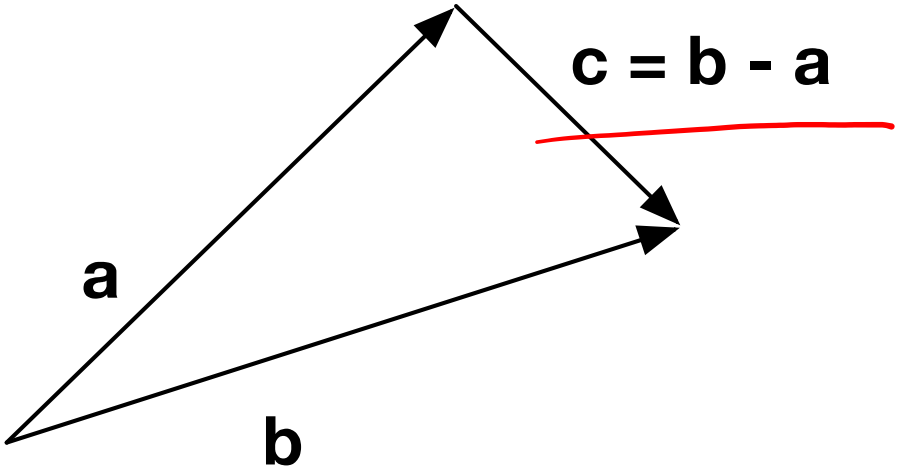
a + c = b



Coordinate vs. coordinate-free representation

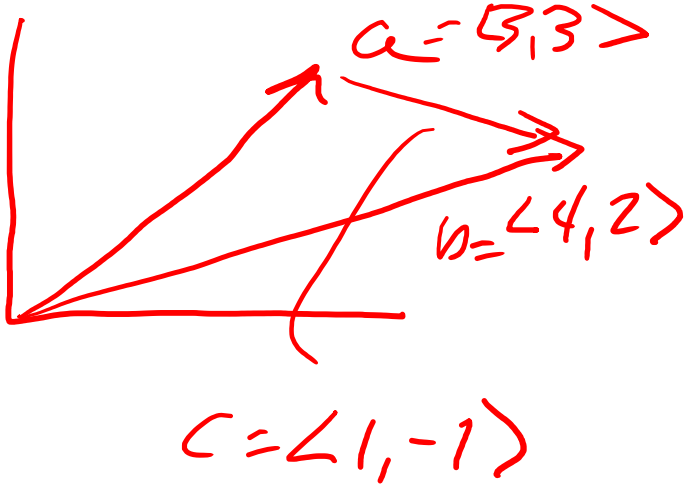
Coordinate-free equation
Valid for 2D and 3D

Prefer when possible

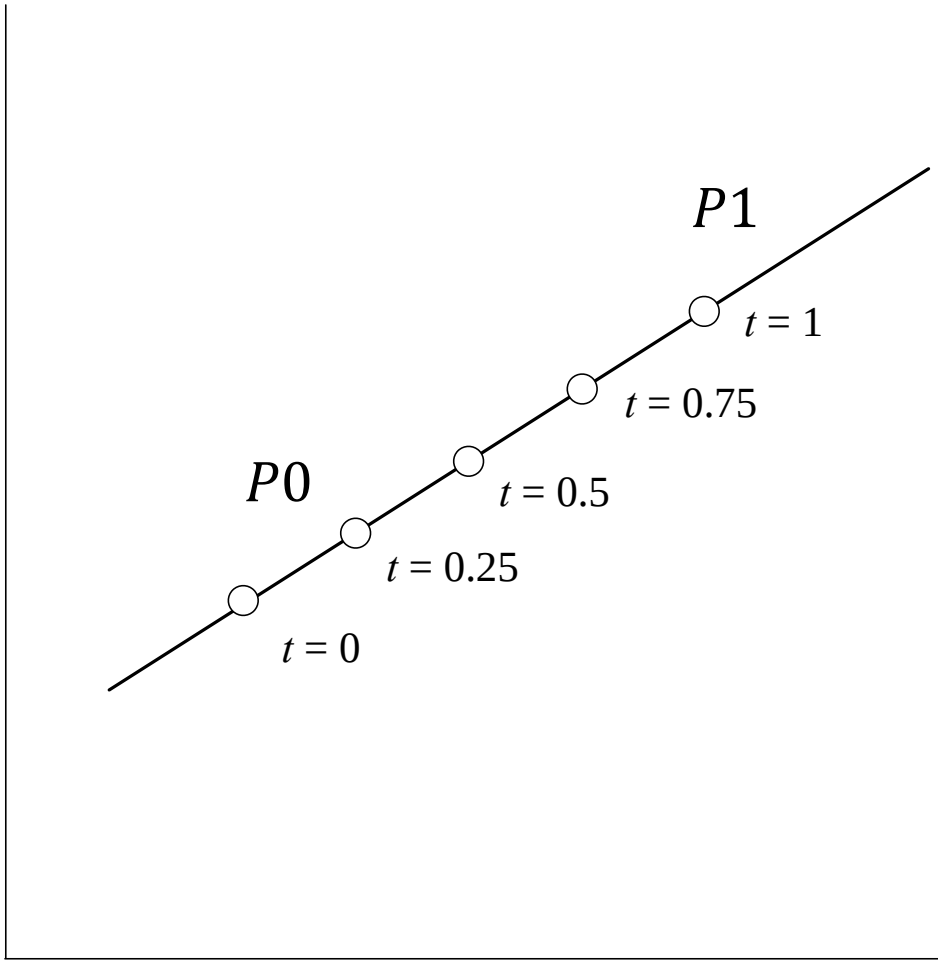


Coordinate equation
a = <3,3>
b = <4,2>

c = b - a = <4,2> - <3,3> = <1,-1>



Parametric line in coordinate-free vector format



$$x = t\,dx + px$$
$$y = t\,dy + py$$

Set

$$\boldsymbol{V} = P1 - P0$$
$$= < dx, dy >$$

Then

$$P(t) = t\,\boldsymbol{V} + P0$$

Good in 2D and 3D

What you should know

1. Notation for vectors <x,y> and pts (x,y)
2. Vector math: scaling, addition, subtraction
3. Coordinate vs coordinate-free formulas

linear combinations of vector