Vector fun homework

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1 Vector Basics

(a) A point is given in a coordinate system: B = (7, 8). What is the vector going from (0, 0) to B?

$\vec{A} = [7, 8]$

A vector between two points can be found by subtracting one point from the other. E.g. the vector going from Copenhagen (C) to Kolding (K) would be found by K to C.

(b) Two points, A and B, in a coordinate system are given by A = (4,3), B = (7,8). The vector $\vec{A}$ goes from A to B. What is $\vec{A}$?

$\vec{A} = [3, 4]$

(c) Given vector $\vec{A} = [3, 5]$, what is its magnitude $\vec{A}$ (its length)?

$\sqrt{3^2 + 5^2} = 5,83$

Two guys are pulling a boat on a river, each on their side, as seen on Figure 1. The pulls from our heroes are given as $\vec{A}$ and $\vec{A}$ respectively.

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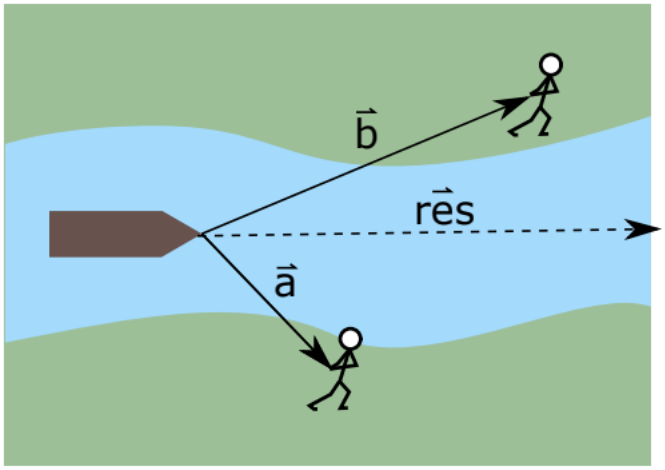


Figure 1: Two bachelor students pulling a boat

$$\vec{a} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}, \vec{b} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$$

(d) What is the resulting vector of their combined pull $r\vec{e}s$?

$r\vec{e}s = [7, 0]$

Given three vectors, $\vec{A} = [3, 2]$ $\vec{B} = [5, 1]$ $\vec{c} = [-2, 6]$ calculate

$\vec{a} + \vec{b}$

$r\vec{e}s = [8, 3]$

$\vec{b} + \vec{c}$

$r\vec{e}s = [3, 7]$

$(\vec{a} + \vec{b}) + \vec{b}$

$r\vec{e}s = [6, 9]$

$\vec{a} + (\vec{b} + \vec{b})$

$r\vec{e}s = [6, 9]$

$\vec{b} + \vec{a}$

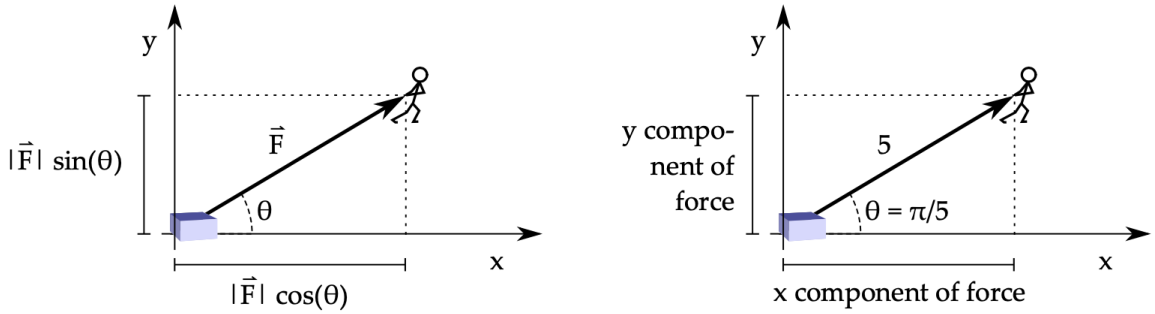
$r\vec{e}s = [8, 3]$

2 Vector Decomposition

(f) In Figure 3, what is the x-component of the force applied? What is the y-component?

(g) In Figure 3, what is the vector of the force $\vec{f}$?

(h) Having found the x-component (let's call it Fx) and the y-component (let's call it Fy), find $\sqrt{f_x^2 + f_y^2}$



3 Multiplication of a Vector with a Scalar

When multiplying with a scalar, each component is multiplied with the scalar.

(i) Given $\vec{a} = [-4, 5]$ and $\vec{b} = \vec{a} * 5$,what is b?

$\vec{b} = [-20, 25]$

(j) What is the length of ?

$\sqrt{-4^2 + 5^2} = 6,40$

(k) What is the length of ?

$\sqrt{-20^2 + 25^2} = 32,01$

(l) What is the result of [1,0] · 4?

$r\vec{e}s = [4, 0]$

(m) What is the result of [1,3] · 0,5?

$r\vec{e}s = [0.5, 1.5]$

4 unit vectors

Unit vectors have a magnitude of 1. The unit vector of a vector a is denoted aˆ, and points exactly in the same direction as a – it just has the magnitude of 1.

(n) Given any vector, how can you find it's unit vector?

(o) What is the unit vector ofa= 2 ?

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5 Dot Product / Scalar Product

The product (multiplication) of two vectors is called the dot product or the scalar product (confusing – I know! We will stick to the term "dot product"). The dot product of two vectors a and b is given by

6 python

Using Python and numpy, implement a mag(vec) function to return the magnitude (length) of a 2-dimensional vector (as a numpy array).

```
def mag(vec):
    return np.linalg.norm(vec)
```