

12.2: Vectors

Friday, January 29

Warmup

1. $\lim_{x \rightarrow 0} \frac{\sin x}{x} =$

2. $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x} =$

3. $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2} =$

4. If $y(t) = t^2$ and $x(t) = 1 - \cos t$, what is the slope when $t = 0$?
5. Alice and Bob find a treasure map, which gives the following instructions:

Go 2 miles north. Go 3 miles east. Go 4 miles west. Go 1 mile south. Go 1 mile west.

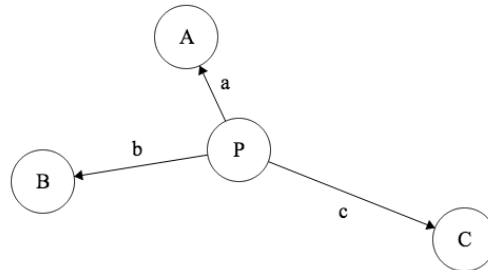
- (a) How far away from their starting point will they end up?
- (b) If they start at the right spot but accidentally follow the instructions in reverse order, how far from the treasure will they end up?

Vectors!

1. Plot the vector $v = \langle 2, 2\sqrt{3} \rangle$. What angle does it make with the positive x-axis? **Note: these numbers are different from the ones presented in class, but the procedure for solving the problems is largely the same.**
2. Find a unit vector u that is perpendicular to v , and plot u , $u + v$, and $3u - 2v$ relative to the origin.
3. Find $|v|$, $|u + v|$, and $|3u - 2v|$. How is the Pythagorean Theorem relevant?
4. Plot the vectors $w = \langle 1, 3 \rangle$ and $z = \langle 5, 2 \rangle$. Plot the vectors $tw + (1 - t)z$ for $t = -1, 0, 1/2, 3/2$. Make observations.

More Vectors!

1. A box is neither moving nor accelerating (relative to the table it sits on). What is the net force on the box?
2. The three forces a , b , and c are acting on the object at P , and the net force is zero.



Treating $P = \vec{OP}$, $A = \vec{OA}$, $B = \vec{OB}$, and $C = \vec{OC}$ as vectors starting from the origin (not pictured), express a , b , c in terms of P, A, B, C .

3. Given that the net force is zero, express P in terms of A, B , and C .

4. A boatman wants to cross a canal that is 2km wide and wants to land on a point 4km upstream from his starting point. The current in the canal flows at 2km/h and the speed of his boat is 13km/h. **Note: These numbers have been changed to make the answer nicer.**
 - (a) In what direction should he steer?
 - (b) How long will the trip take?