

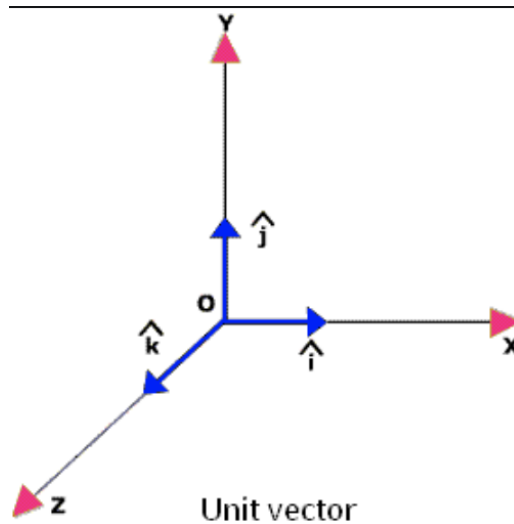
### Vector Activity

#### Introduction

A Euclidean vector (sometimes called a geometric vector or a spatial vector) is a geometric object that has both a magnitude and a direction. A Euclidean vector is frequently represented by a line segment with a definite direction, or graphically as an arrow, connecting an initial point A with a terminal point B.

A vector is what is needed to “carry” point A to point B. The Latin word *vector* means carrier. The magnitude of the vector is the distance between the two points and the direction refers to the direction of the displacement from A to B.

The standard vector is often denoted by



In which the hat symbol typically denotes a unit vector. A unit vector is a vector with a magnitude of 1 with no units. Its only purpose is to point - to describe a direction in space. The unit vector  $\hat{i}$  is called “i hat” and represents the x-direction; the unit vector  $\hat{j}$  is called “j hat” and represents the y-direction. Think of these as “units.”

In this case, the scalar and vector components may be represented by:

$$A = A_x + A_y + A_z = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

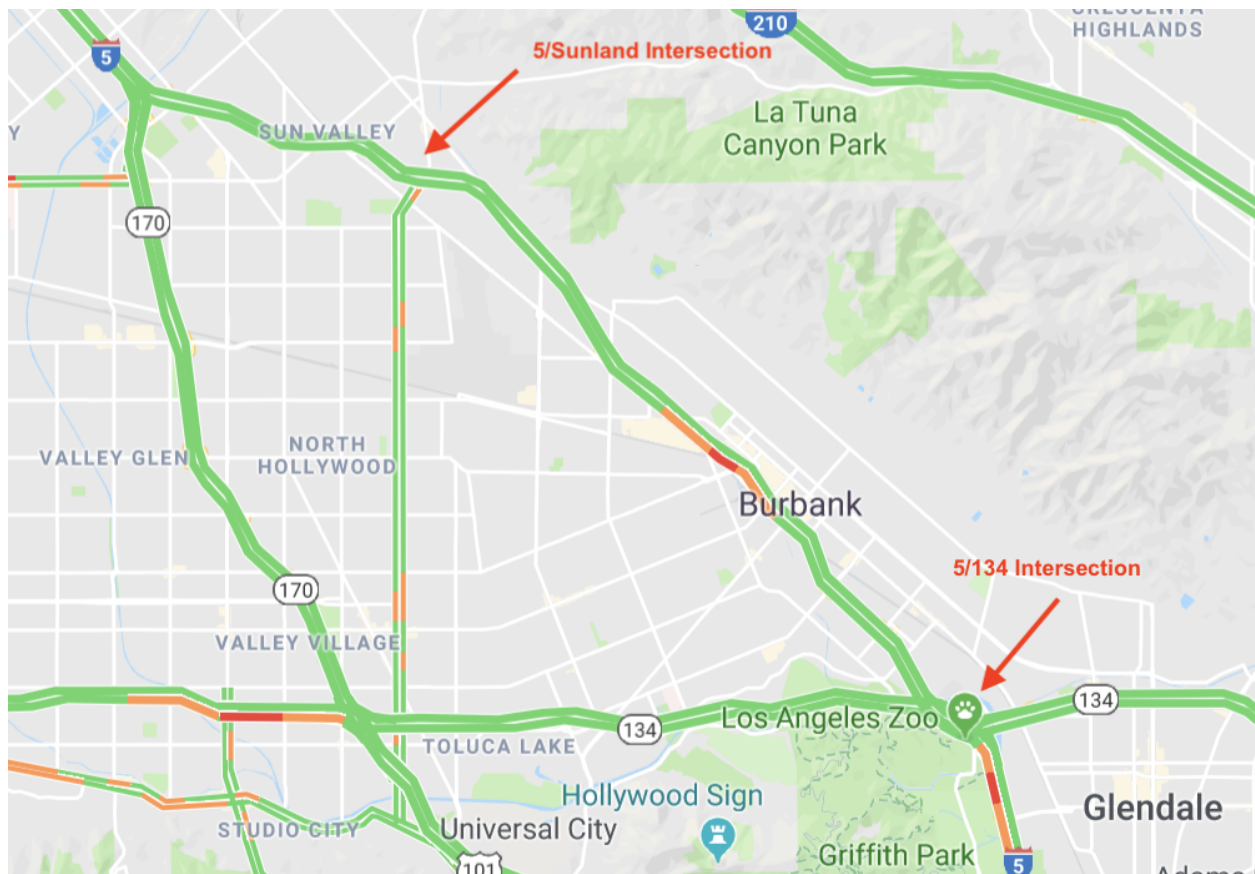
For example, a vector that points 2 m in the x-direction and 3 m in the y-direction would be represented as:

$$\mathbf{r} = (2 \text{ m})\mathbf{i} + (3 \text{ m})\mathbf{j}$$

In this activity, you will use Google Maps to develop your understanding of vectors and unit vector notation.

### Directions

Will and I drive from the intersection of the 5 Freeway and the 134 Freeway (near the Los Angeles Zoo) to the intersection of the 5 Freeway and Sunland Boulevard, as shown below.



1. Open Google Maps.
2. Measure the distance (approximate it as a straight line) between the 5/134 Intersection and the 5/Sunland Blvd intersection.

Record your distance **in meters:** m

3. Now measure the straight-line distance from the 5/134 Intersection and 134/Vineland Avenue intersection.

Record your distance **in meters:** m

4. Now measure the straight-line distance between the 134/Vineland intersection and the 5/Sunland Blvd intersection.

Record your distance **in meters:** m

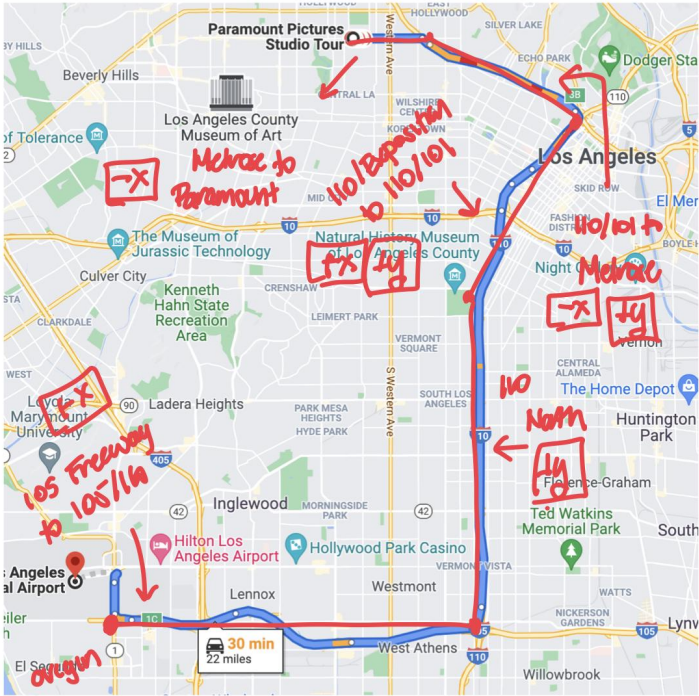
5. This approximates a right triangle. Use the Pythagorean theorem to determine the magnitude of the hypotenuse of this triangle as well as the magnitude of the vertex angle.

6. Determine your percent error between your direct distance measurement and your hypotenuse calculation.

7. Write your vector in unit vector notation.

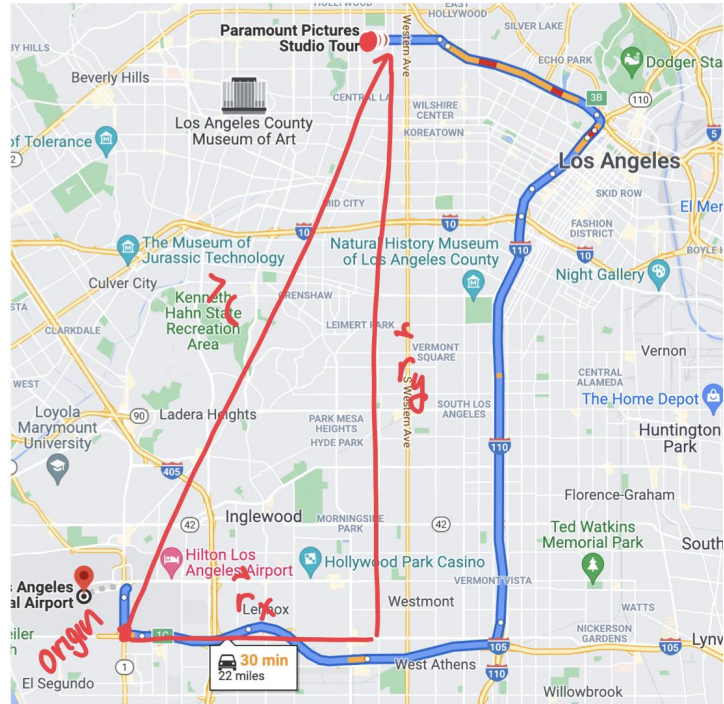
## **Part 2 - Vector Addition**

On another trip, Will and I traveled from LAX to Paramount Studios, located at 3333 Melrose Avenue.



We drive east along the 105, then north along the 110 and then northwest along the 101.

Each segment is represented with a vector. The vector  $\mathbf{r}$  represents the net displacement vector.



2. Determine the displacement vector for each leg of the trip. You may assume that each east/west leg or each north/south leg goes along the x- or y-axis.

Segment	Displacement Vector (in unit vector notation)
105 Freeway East (from Sepulveda) to the 105/110 Intersection	
110 Freeway North to Exposition Boulevard	
110 Freeway/Exposition Blvd to 110/101 Intersection*	
110/101 Freeway Intersection to Melrose Exit*	
Melrose Exit to Paramount	
Vector Sum	
Magnitude of displacement vector (use Pythagorean theorem)	
Actual displacement from LAX to Paramount studios (measured on map)	

\* indicates vector is in x- and y-direction.

3. Add the individual displacement vectors to determine the overall displacement vector in unit vector notation.
4. Use the Pythagorean theorem to determine the magnitude of the displacement vector.
5. Calculate your percent error between the magnitude of the displacement vector and the actual displacement.