

Projectile Motion



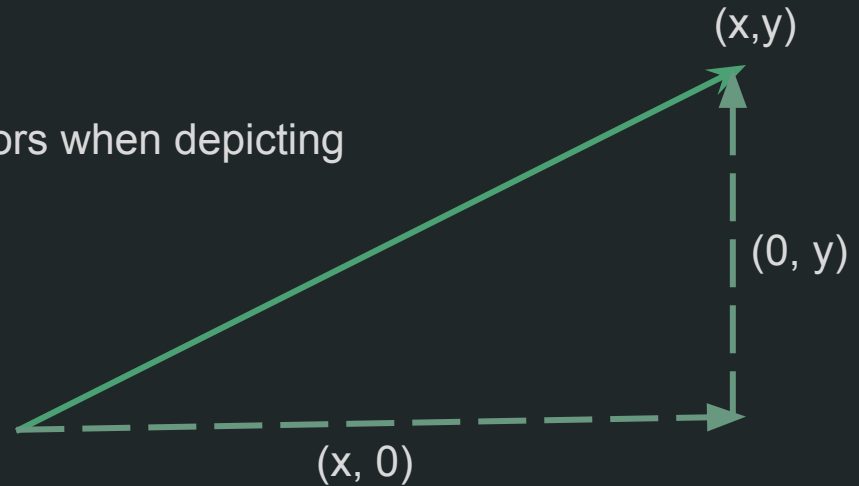
Michael Broberg, Rachael Franklin, Tristan Bambanian, Tigran A.

Vectors and Vector Components

Vectors have both direction and magnitude.

Horizontal and vertical components are **completely independent**
(x and y components)

- ★ It's often helpful to **DRAW OUT** vectors when depicting situations.
- ★ arrows especially
- ★ break your vector down into x and y components



Trigonometry of Projectile Motion

SOH

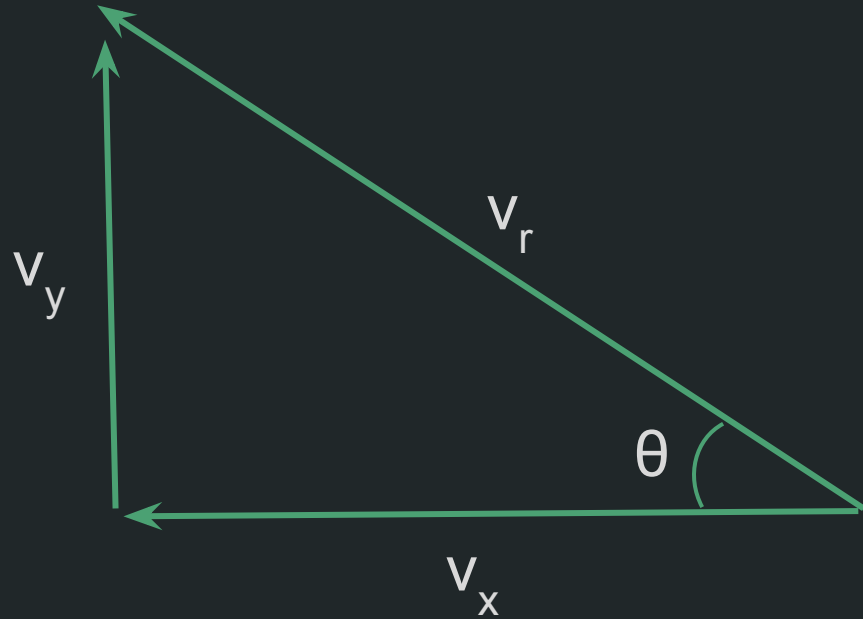
CAH

TOA

☆ $\sin\theta = \frac{v_y}{v_r}$

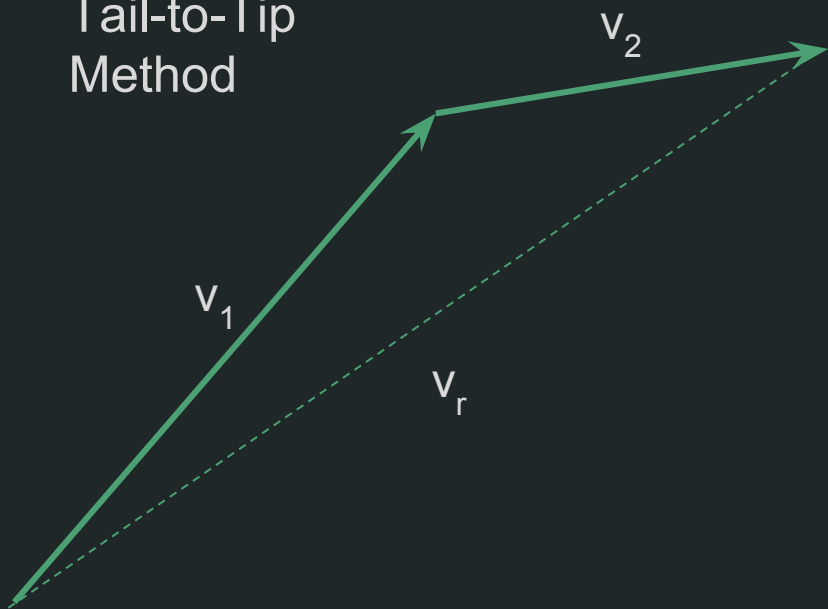
☆ $\cos\theta = \frac{v_x}{v_r}$

☆ $\tan\theta = \frac{v_y}{v_x}$

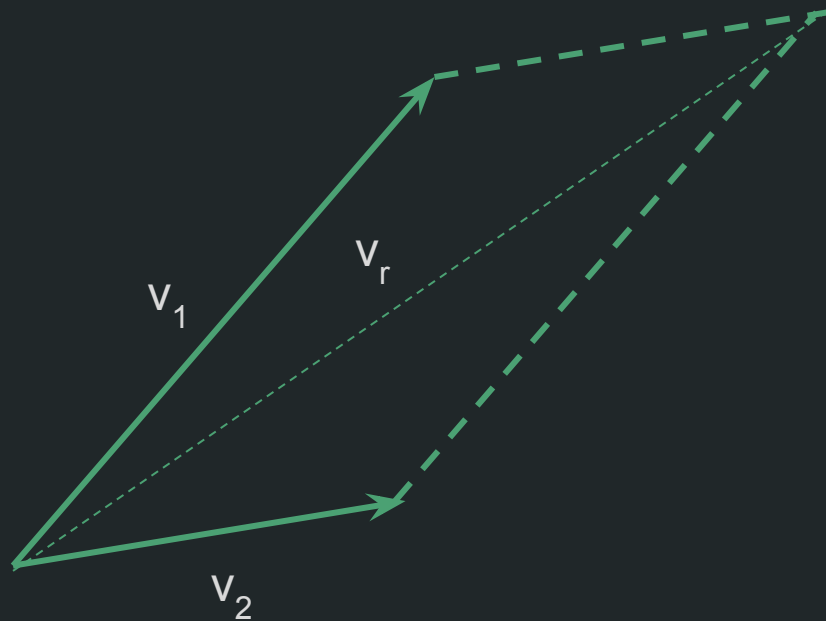


Adding Vectors

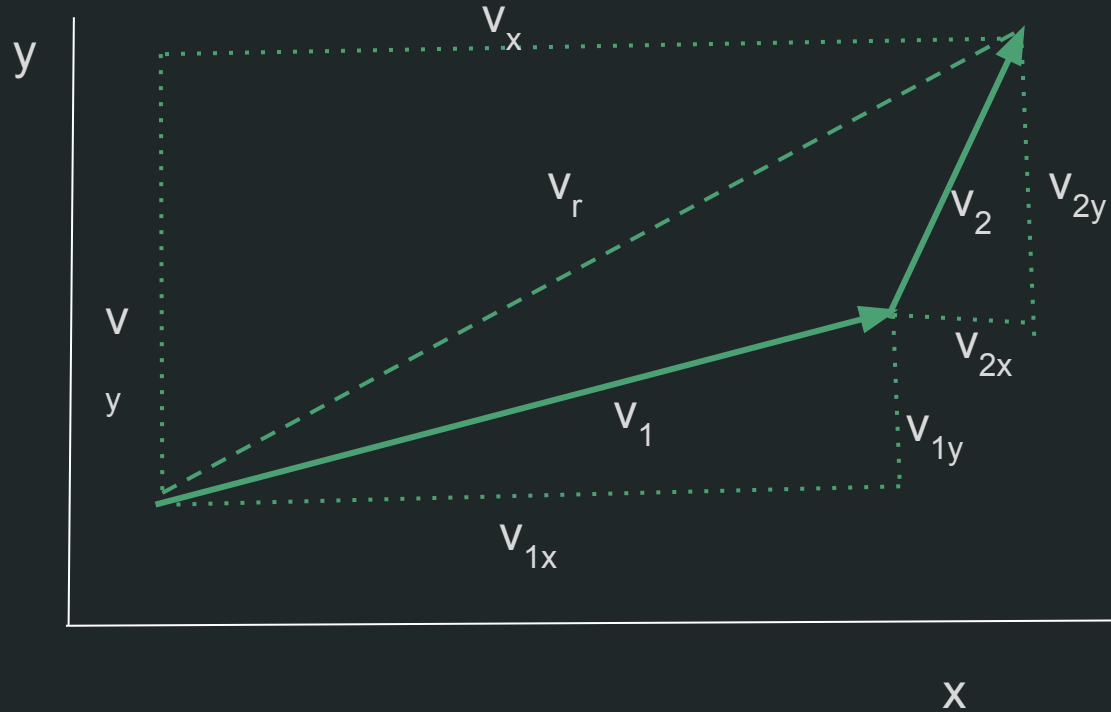
Tail-to-Tip
Method



Parallelogram Method



Vector Decomposition and Resolution



FREE RESPONSE STRATEGIES

-DRAW PICTURE of what you have

-DECOMPOSE Vectors into x and y components

FREE RESPONSE STRATEGIES

- **WRITE OUT** what you have, fill in measurements for all known variables
- **IDENTIFY** what you are looking for and all the unknown variables
- **IDENTIFY AND WRITE** what formula you will be using
- **PLUG** in known variables and solve for missing components

Free Response Example Problem

Tigran kicks a soccer ball with a velocity of 45 m/s at 62 degrees above the horizontal.

- a) Calculate the x and y components of the velocity?
- b) How much time does the ball take to reach its maximum height?
- c) What is its maximum height?
- d) How long before the ball hits the ground?
- e) How far away from him does the ball land?

Free Response Example Problem Answers

Calculate the x and y components of the velocity

$y=39.7 \text{ m/s}$ $x=21.1 \text{ m/s}$

How much time does the ball take to reach its maximum height?

4.04 seconds

What is its maximum height?

79.98 meters

How long before the ball hits the ground?

8.08 sec

How far away from him does the ball land?

170.5 meters

3 Common Misconceptions

1. Horizontal speed affects fall time. NOT TRUE! Horizontal speed has no effect on fall time. A bullet shot horizontally and a bullet dropped will hit the ground at the same time - applying freefall physics.
2. You're texting and driving(don't do it), you look up and see a car stopped in front of you, you throw your phone up in the air to swerve into the other lane, where does the phone land? Answer: back in your lap, because the phone is also moving at the speed of the car. It doesn't land behind you.
3. Simple arithmetic cannot be used to add two vectors if they are not along the same line. To avoid this misconception, make sure the two vectors that are being added together are along the same line.

5 Multiple Choice Questions

TEXT RADGEYSER221 to 22333