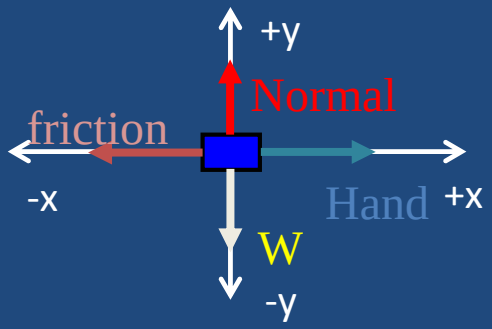
Physics 101: Exam Review!

- **Exam 1 is NEXT MONDAY at 7PM**
- **Check the online gradebook for your room location**
- **Sign up for CONFLICT EXAM on the online gradebook or contact Elaine Schulte**
- **Another exam review SUNDAY NIGHT, 7PM in Loomis 141 (Here!)**

Overview

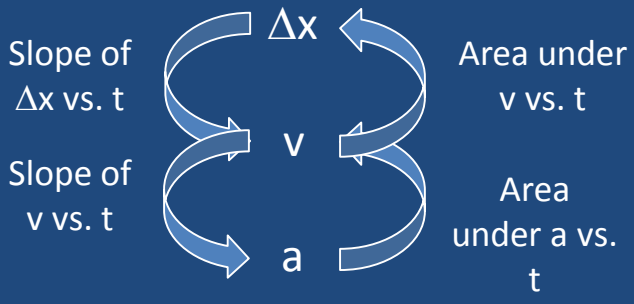
Draw FBD to determine F_{Net}



Apply Newton's 2nd Law to determine acceleration

$$\vec{F}_{Net} = m\vec{a}$$

Use Kinematics to determine/describe motion of the object



TOPICS

1. MATH
   - Vector Decomposition and Addition
   - Trigonometry

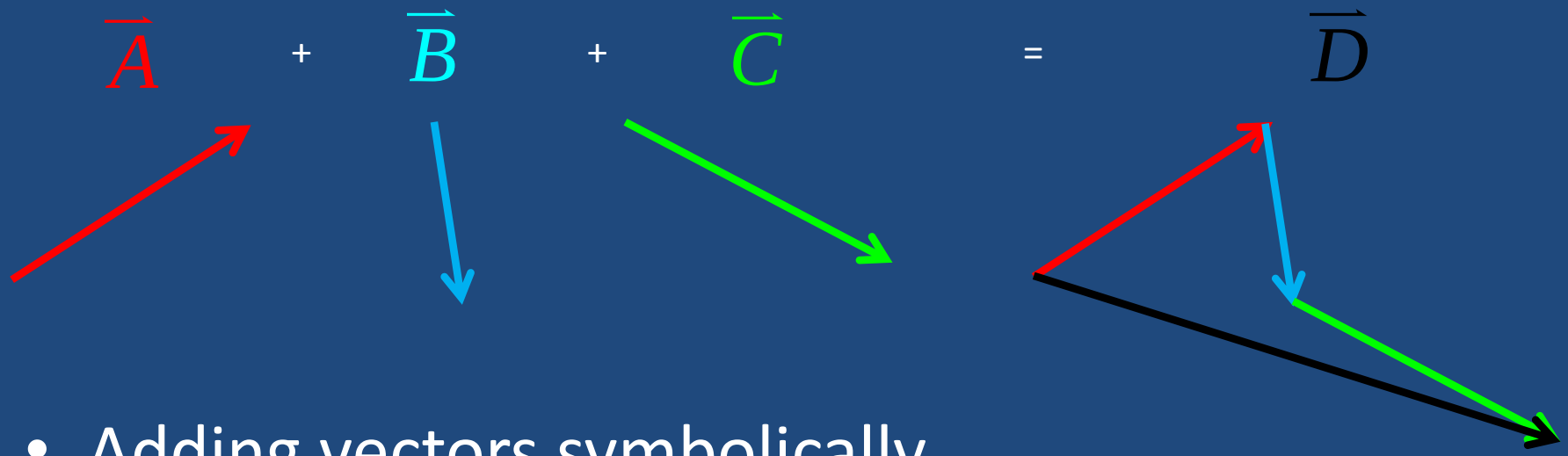
2. DESCRIPTION OF MOTION
   - Variables: displacement, velocity, acceleration
   - Kinematic equations

3. FORCES AND NEWTON'S LAWS

4. ROTATION AND CIRCULAR MOTION
   - Angular variables and kinematic equations
   - Centripetal acceleration

1. Vector Addition and Decomposition

- Adding vectors graphically: Head to Tail!



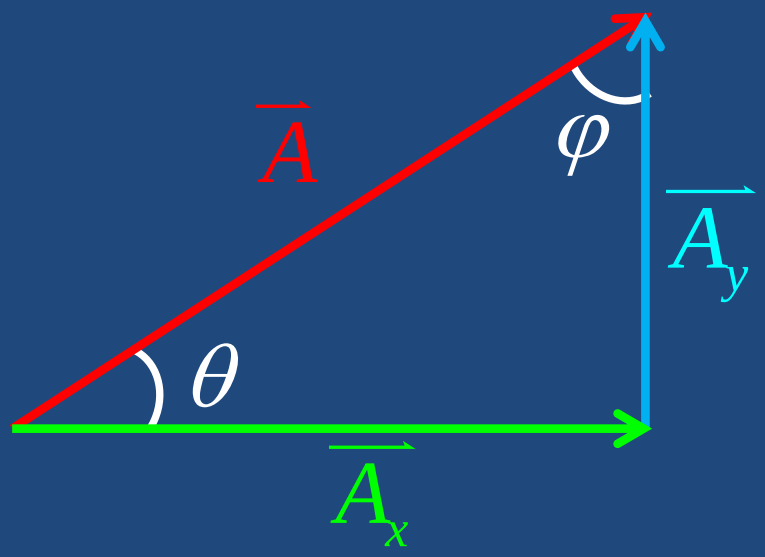
- Adding vectors symbolically
  - Decompose vectors and add components

$$D_x = A_x + B_x + C_x$$

$$D_y = A_y + B_y + C_y$$

1. Vector Addition and Decomposition

- Trigonometry



SOH CAH TOA!

$$A_x = A\cos\theta = A\sin\varphi$$

$$A_y = A\sin\theta = A\cos\varphi$$

$$A = \sqrt{A_x^2 + A_y^2}$$

Example type of problem: Relative Velocities

– Chapter 3 #80(3rd ed) / #88 (4th ed)

2. Description of Motion

1. Displacement, Δx

Slope of Δx vs. t

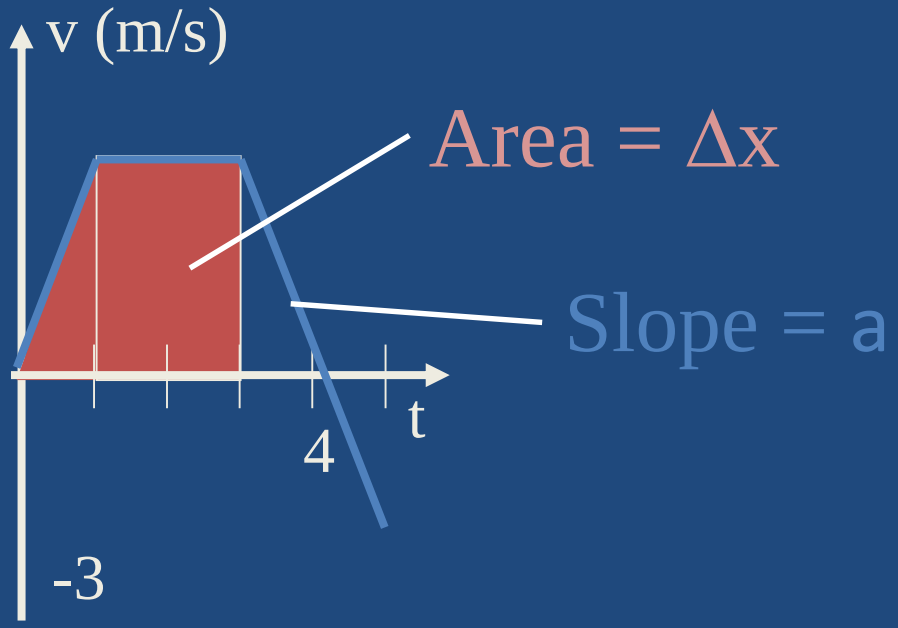
Area under v vs. t

2. Velocity, $v = \Delta x / \Delta t$

Slope of v vs. t

Area under a vs. t

3. Acceleration, $a = \Delta v / \Delta t$



2. Description of Motion

- Kinematic Equations

$$\Delta x = v_0 t + \frac{1}{2} a t^2$$

$$v_f = v_0 + at$$

$$v_f^2 = v_0^2 + 2a\Delta x$$

- Work in each dimension independently!

Example type of problem: Projectile Motion

– Chapter 4 #50 (3rd ed) / #52 (4th ed)

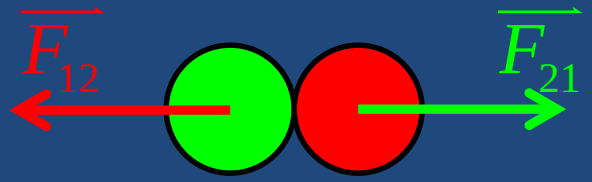
3. Forces and Newton's Laws

- First Law: An object at rest will remain at rest; an object in motion remain in motion in a straight line unless acted upon by a net external force.

- Second Law: If an object experiences a net external force, it will accelerate in the same direction as the force

$$\vec{F} = m\vec{a}$$

- Third Law: For every force between two interacting bodies, there is an equal and opposite force

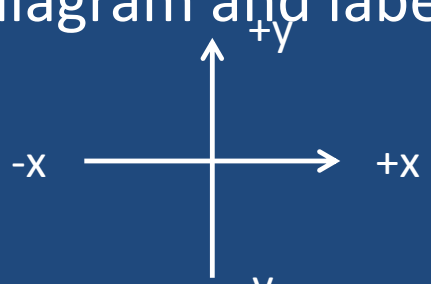


$$\vec{F}_{21} = -\vec{F}_{12}$$

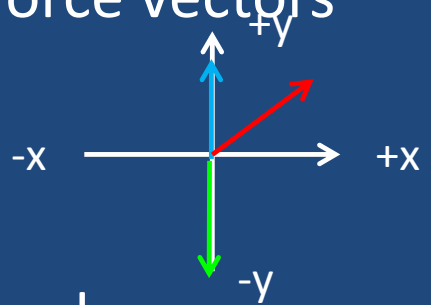
3. Forces and Newton's Laws

Applying Newton's 2nd Law:

1. Draw a free body diagram and label coordinate axes



2. Identify and draw force vectors



3. Use your drawing to decompose and add force vectors to determine the net force

Example problem: block on an inclined plane/apparent weight

- Chapter 3 #104 (3rd ed) / #112 (4th ed)
- Chapter 4 #59 (3rd ed) / #61 (4th ed)

4. Rotation and Circular Motion

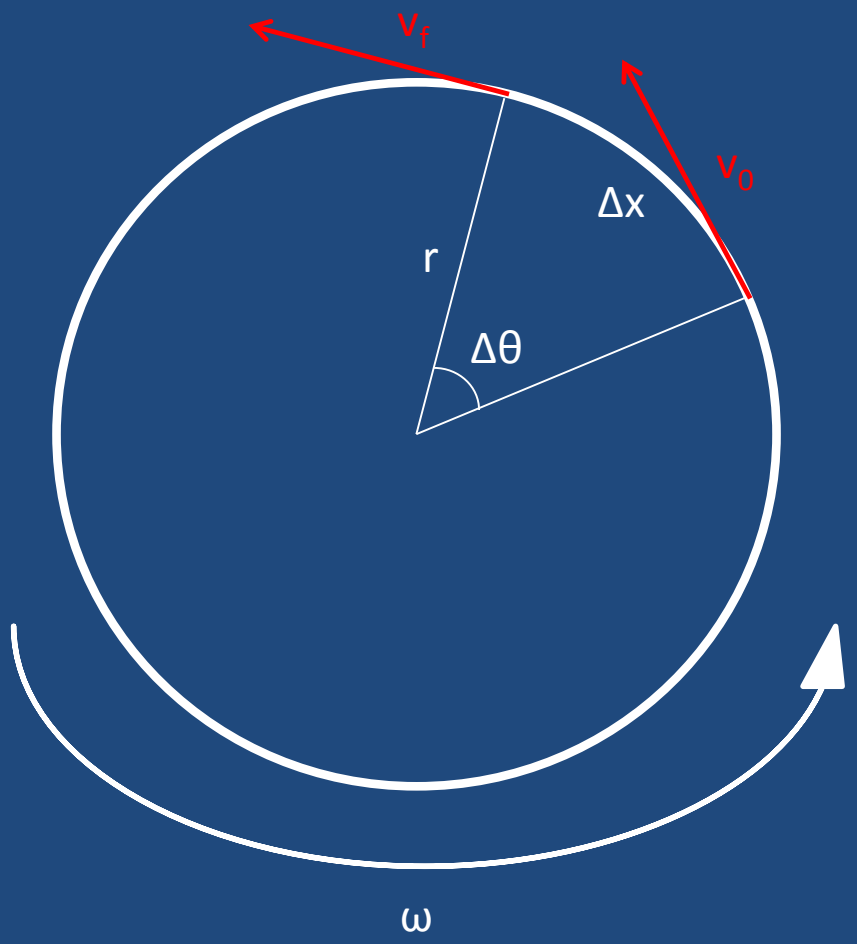
- Angular variables

$$\Delta\theta = \frac{\Delta x}{r}$$

MUST use radians!

$$\omega = \frac{\Delta\theta}{\Delta t}$$

$$\alpha = \frac{\Delta\omega}{\Delta t}$$



- Relationship to translational variables

$$\Delta x = r\Delta\theta \qquad v = r\omega \qquad a = r\alpha$$

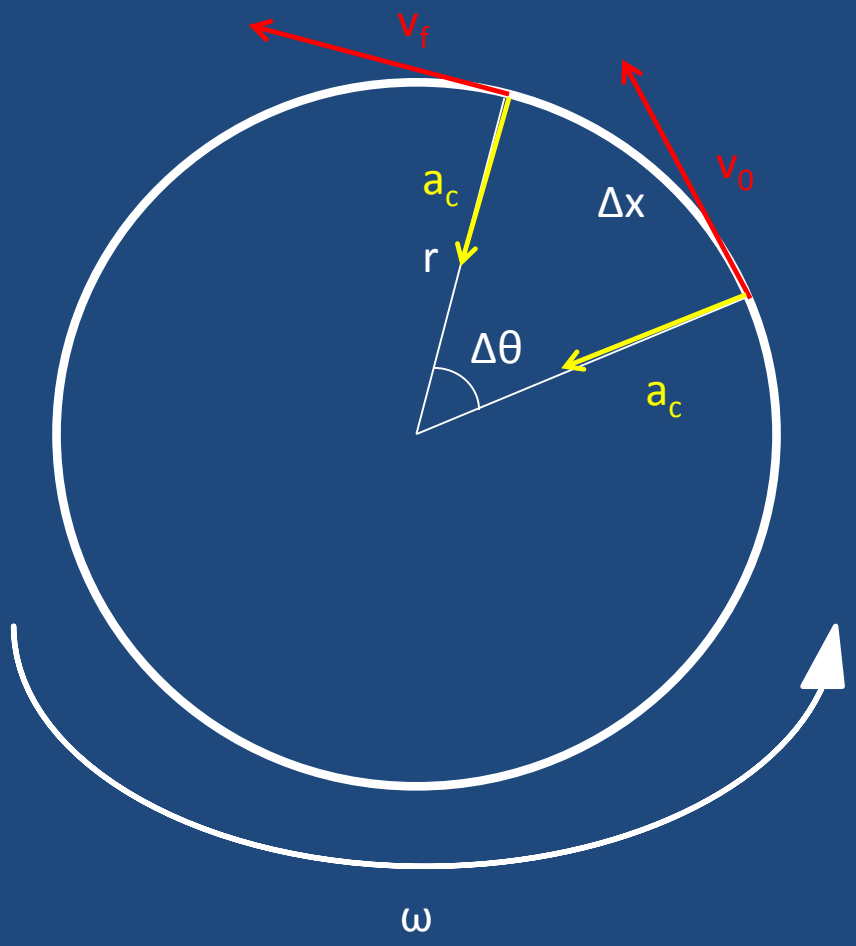
Example problem: Rotational kinematics
Chapter 5 #52 (3rd ed) / #50 (4th ed)

4. Rotation and Circular Motion

- Because the direction of v is constantly changing, there must be an acceleration!

$$a_c = \frac{v^2}{r} = \omega^2 r$$

Centripetal acceleration
Directed radially inward



Example problem: Spinning blocks

Chapter 5 #74 (3rd ed) / #79 (4th ed)