

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

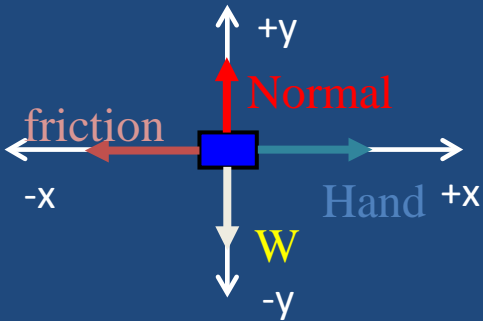
Draw FBD to
determine F_{Net}



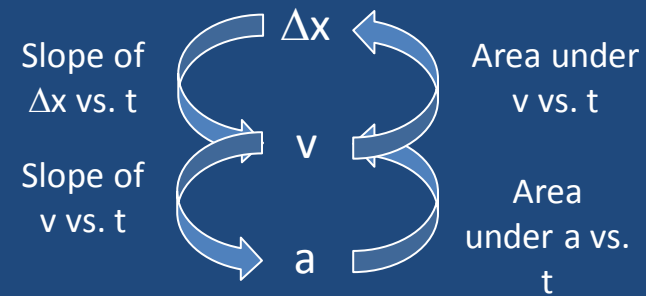
Apply Newton's 2nd
Law to determine
acceleration



Use Kinematics to
determine/describe
motion of the object



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



TOPICS

1. MATH

- Vector Decomposition and Addition
- Trigonometry

2. DESCRIPTION OF MOTION

- Variables: displacement, velocity, acceleration
- Kinematic equations

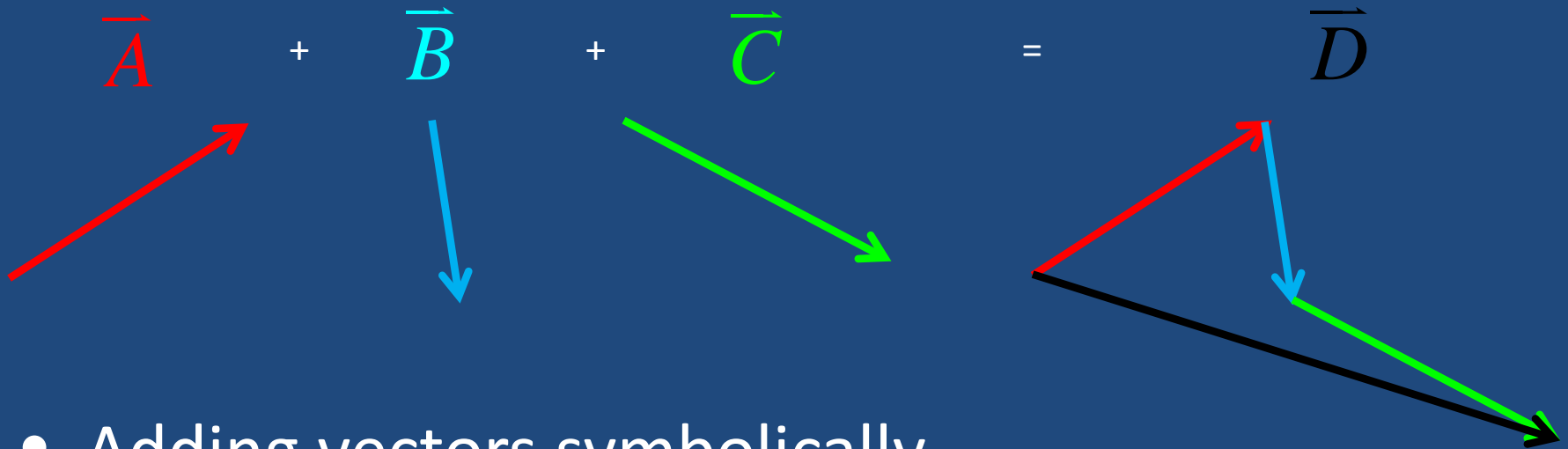
3. FORCES AND NEWTON'S LAWS

4. ROTATION AND CIRCULAR MOTION

- Angular variables and kinematic equations
- Centripetal acceleration

1. Vector Addition and Decomposition

- Adding vectors graphically: Head to Tail!



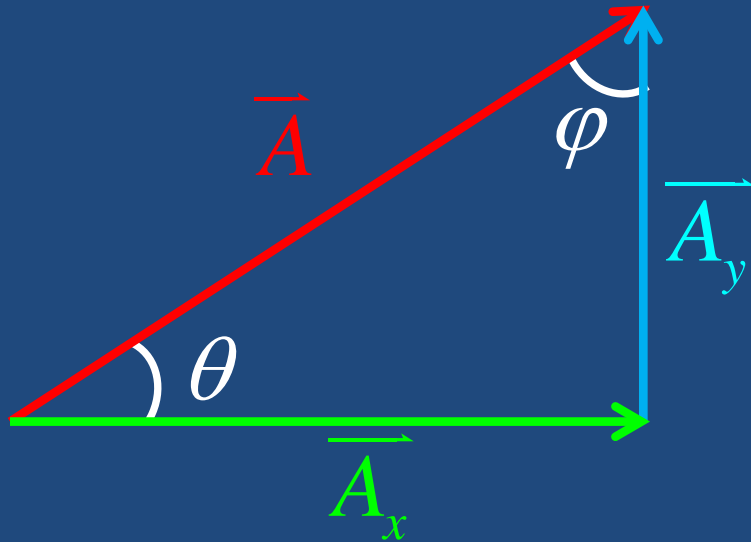
- Adding vectors symbolically
 - Decompose vectors and add components

$$D_x = A_x + B_x + C_x$$

$$D_y = A_y + B_y + C_y$$

1. Vector Addition and Decomposition

- Trigonometry



SOH CAH TOA!

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

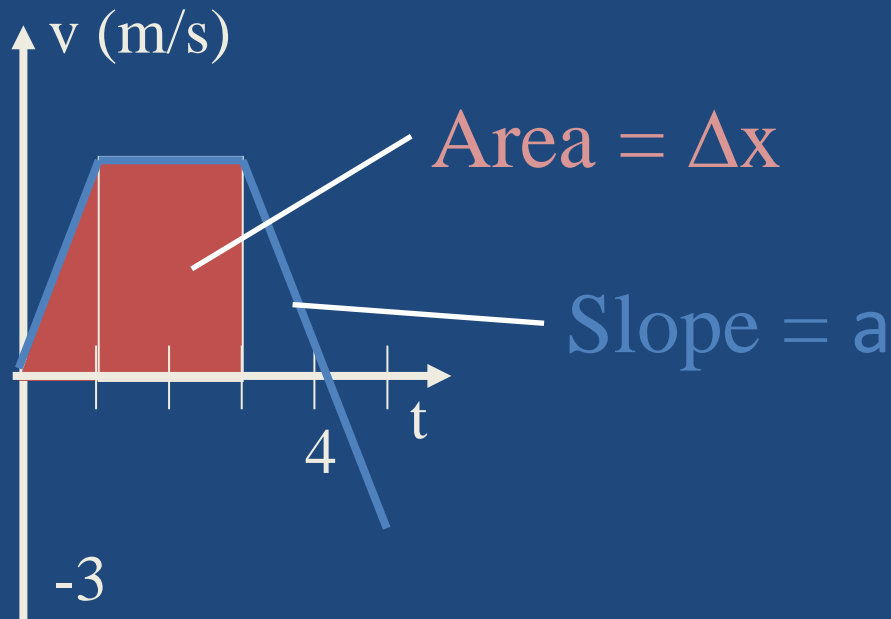
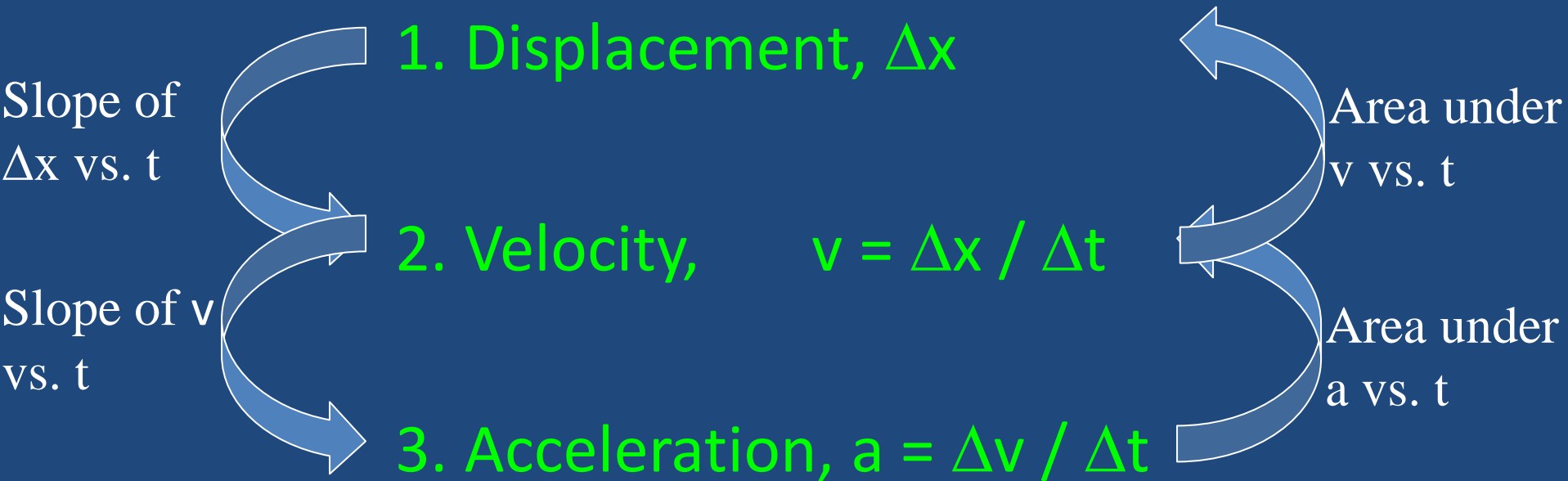
$$A_y = A \sin \theta = A \cos \varphi$$

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

Example type of problem: Relative Velocities

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

2. Description of Motion



2. Description of Motion

- Kinematic Equations

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

$$v_f = v_0 + a t$$

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

- Work in each dimension independently!

Example type of problem: Projectile Motion

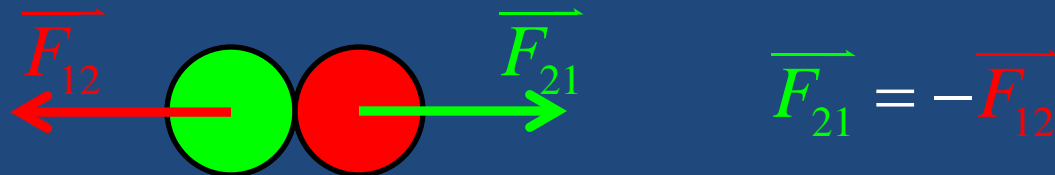
– Chapter 4 #50 (3rd ed) / #52 (4th ed)

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

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

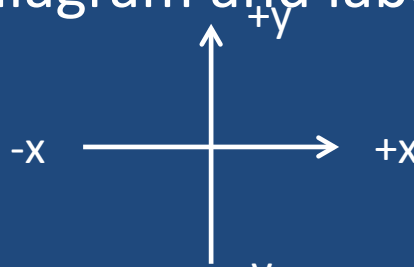
- **Third Law:** For every force between two interacting bodies, there is an equal and opposite force



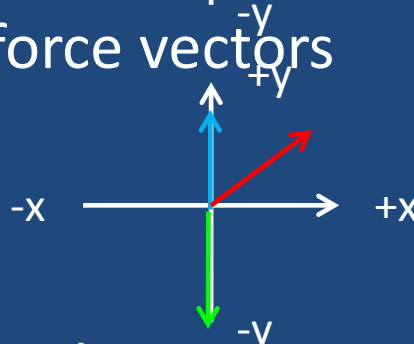
3. Forces and Newton's Laws

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

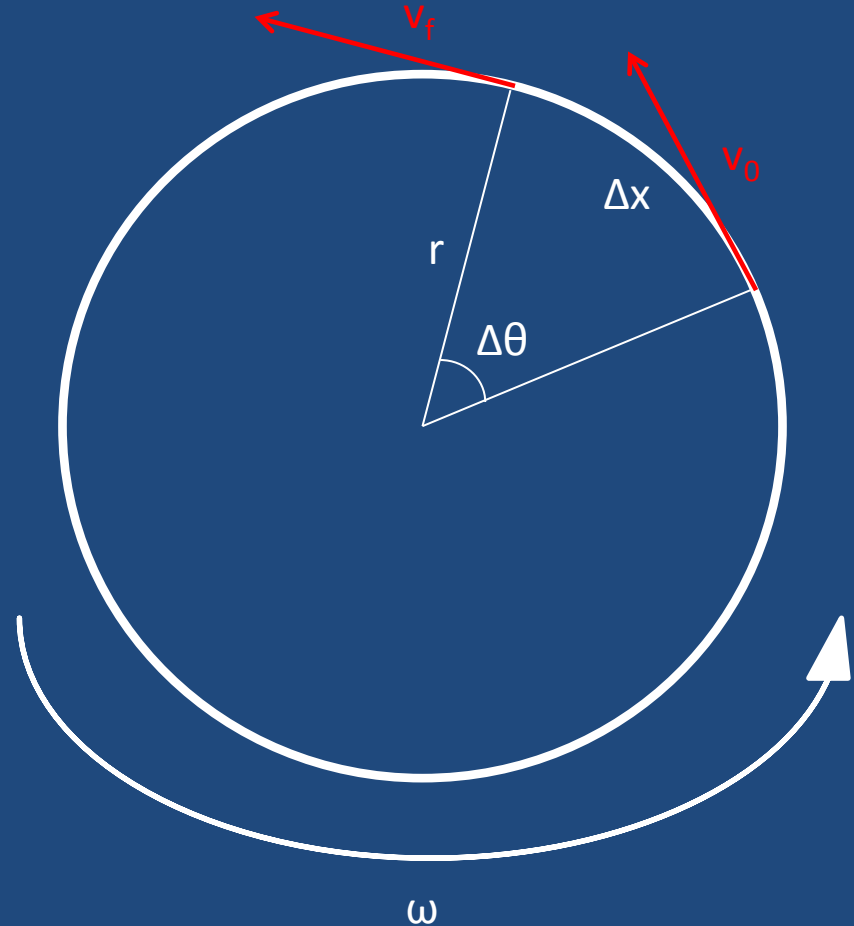
- Angular variables

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

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

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

MUST use radians!



- Relationship to translational variables

$$\Delta x = r\Delta\theta$$

$$v = r\omega$$

$$a = r\alpha$$

Example problem: Rotational kinematics

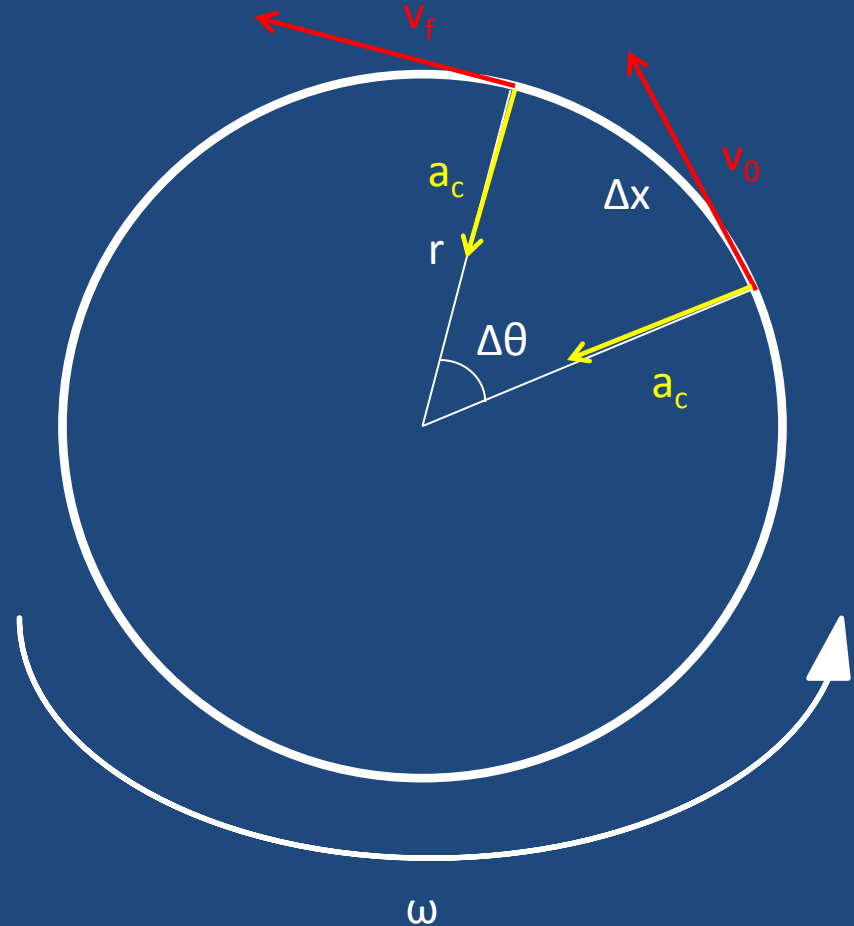
Chapter 5 #52 (3rd ed) / #50 (4th ed)

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)