

## Phys171 - Fri 2/2

Th 130pm-330pm; Room: MTH B0429

Informal discussion session(i.e. a room for you to meet in) the TA will be available 2pm-3pm for discussion

- No office hours Monday
- MON: Problem solving Chapters 2,3
- TUE/Thu: Chapter 4
- Fri start Chapter 5

NOTE: Several HW due next Fri

## Equation for falling object

Vertical direction:  $y$

Gravitational acceleration:  $g = 9.8 \text{ m/s}^2$

Objects starts at position  $y_i$  with velocity  $v_i$

At time  $t$ , it is at position  $y(t)$

$$y(t) = y_i + v_i t + \frac{1}{2} g t^2$$

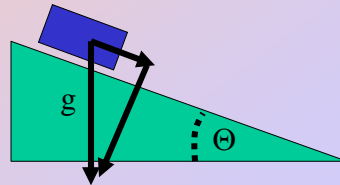
## Object on inclined planes

Gravitational acceleration  $g$   
pulls objects toward earth  
center

BUT: Surface CONSTRAINS  
direction of motion to angle  
 $\Theta$  relative to horizontal

-> Coordinate system:  $x$  along  
the incline,  $y$  perpendicular

-> Vector is the sum of two  
vectors one in  $x$ , one in  $y$   
direction



$$\text{Acceleration } a = g \sin(\Theta)$$

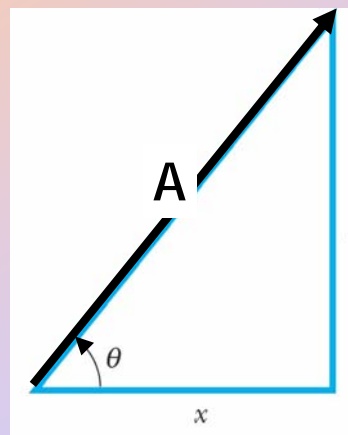
## Vector Math

Magnitude  $r$

$$r = \sqrt{x^2 + y^2}$$

Direction:  $\theta$  generally  
counter clockwise from  
positive  $x$  axis

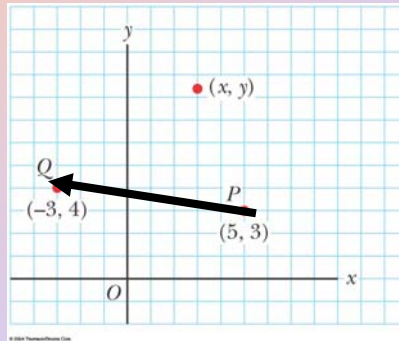
$$\tan \theta = \frac{y}{x}$$



## Magnitude and direction of a vector

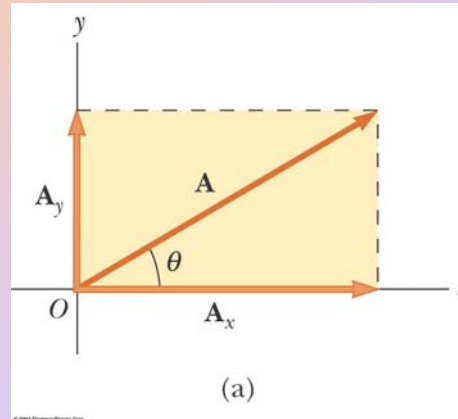
$$\tan \theta = \frac{y}{x}$$
$$r = \sqrt{x^2 + y^2}$$

Magnitude: 8.06 units  
Direction: ~170 degrees



## Components of a Vector

- It is useful to use **rectangular components**
  - These are the projections of the vector along the x- and y-axes



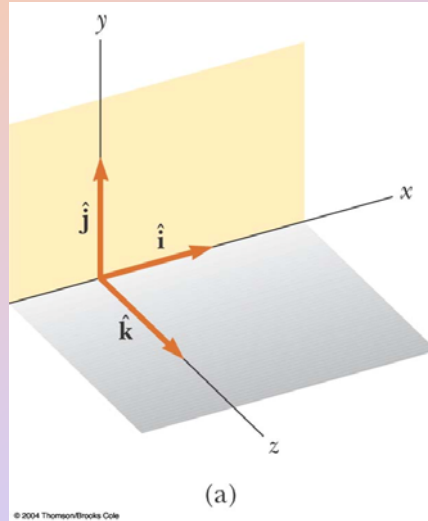
## Unit Vectors

- The symbols

$$\hat{i}, \hat{j}, (\text{and } \hat{k})$$

represent unit vectors

- Mutually perpendicular vectors that specify main **directions**
- Each dimensionless with length 1



## Vector Component Terminology

- $A_x$  and  $A_y$  are *component vectors* of  $A$ 
  - They are vectors -> follow all vector rules
- $A_x$  and  $A_y$  are scalars, and will be referred to as the *components* of  $A$

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

- In three dimensions:  $A_x$  and  $A_y$  and  $A_z$

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

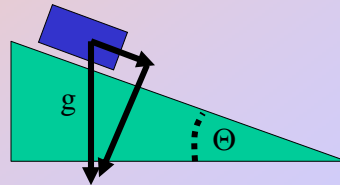
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$$\text{Acceleration } a = g \sin(\Theta)$$

- Example: The sum of all  
the forces has to equal  
zero

Example of  
vector sum

