Last Class...

**Work, Kinetic Energy, Work-Energy Theorem, Power**

B1, Ch5 Sec. 1-2, B2, Ch7 Sec. 3

Today...

Examples

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Example: Projectile Motion and Kinetic energy
iClicker Quiz 1

Work done by a gravity on a falling elephant

\[ W = F \Delta x \]

is ________.

a) Positive  
b) Negative  
c) zero

If force and displacement point the same direction, the work is _______.

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iClicker Quiz 2: Work done by a gravity on a ball that is going up

\[ W = F \Delta x \]

Is work positive, negative, zero?

a) Positive  
b) Negative  
c) zero

If force and displacement point the opposite directions, the work is _______.
Work-Energy Theorem

As shown for 1D motion,

\[ K_f - K_i = \Delta K = W_{net} \]

→ Work-Energy Theorem

Positive net work: KE increases (iClicker Quiz 1)
Negative net work: KE decreases (iClicker Quiz 2)

Example: Falling elephant

Example: Ball thrown vertically up
Examples for work in 2D

Example: Work by multiple forces

Example: Work, scalar product, angle

Work done by a constant force

\[ W = |\vec{F}| |\vec{d}| \cos \theta_{F,d} \equiv \vec{F} \cdot \vec{d} \]

Scalar (dot) product

(B2, Ch7, Sec.3)
Math Review: Scalar (dot) product

\[ \vec{A} \cdot \vec{B} = |\vec{A}| \, |\vec{B}| \cos \theta_{A,B} = A_x B_x + A_y B_y + A_z B_z \]

- \( \theta = 180^\circ \rightarrow \vec{A} \cdot \vec{B} = -|\vec{A}| \, |\vec{B}| \)
- \( \theta = 0 \rightarrow \vec{A} \cdot \vec{B} = +|\vec{A}| \, |\vec{B}| \)
- \( \theta = 90^\circ \rightarrow \vec{A} \cdot \vec{B} = 0 \)

\( \vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}, \quad (\vec{A} + \vec{B}) \cdot \vec{C} = \vec{A} \cdot \vec{C} + \vec{B} \cdot \vec{C} \)