March 5, Week 8

Today: Chapter 6, Work

Homework #5, Due Today.
Mastering Physics: 10 problems from chapters 4 and 5
Written Question: 5.74

If interested in Physics 110, please see me after lecture.

Exam 3: Friday, March 9
Review Session: Thursday, March 8, 7:30PM Practice
Exam now available on website
Practice Problems on Mastering Physics

Beyond Newton's Laws

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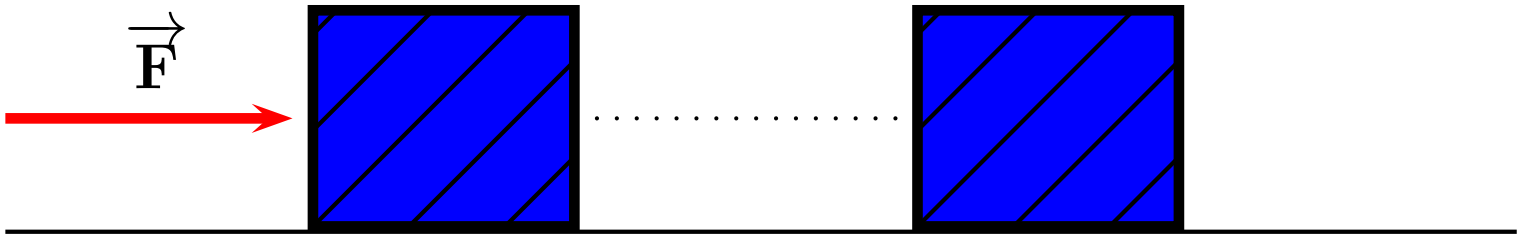

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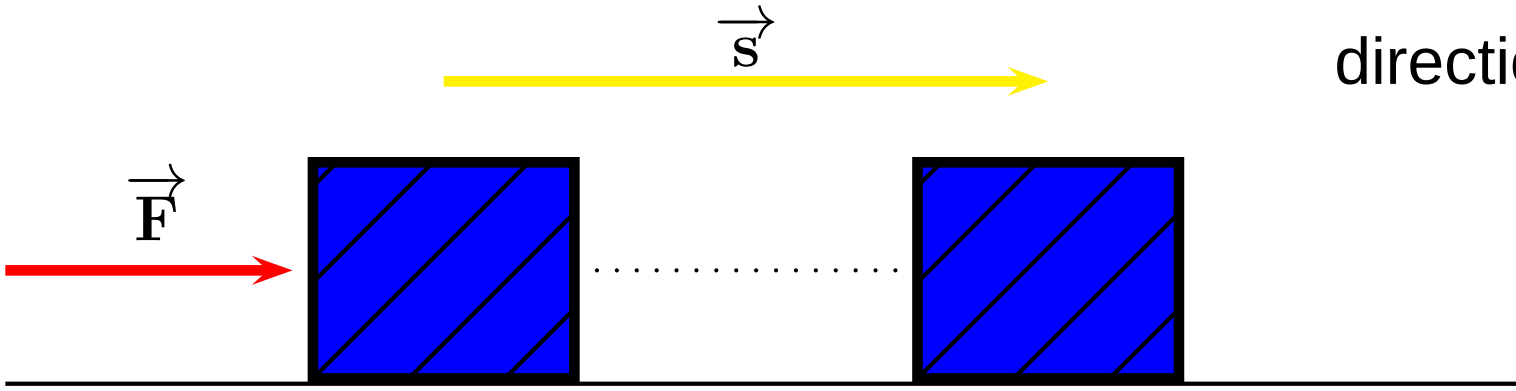

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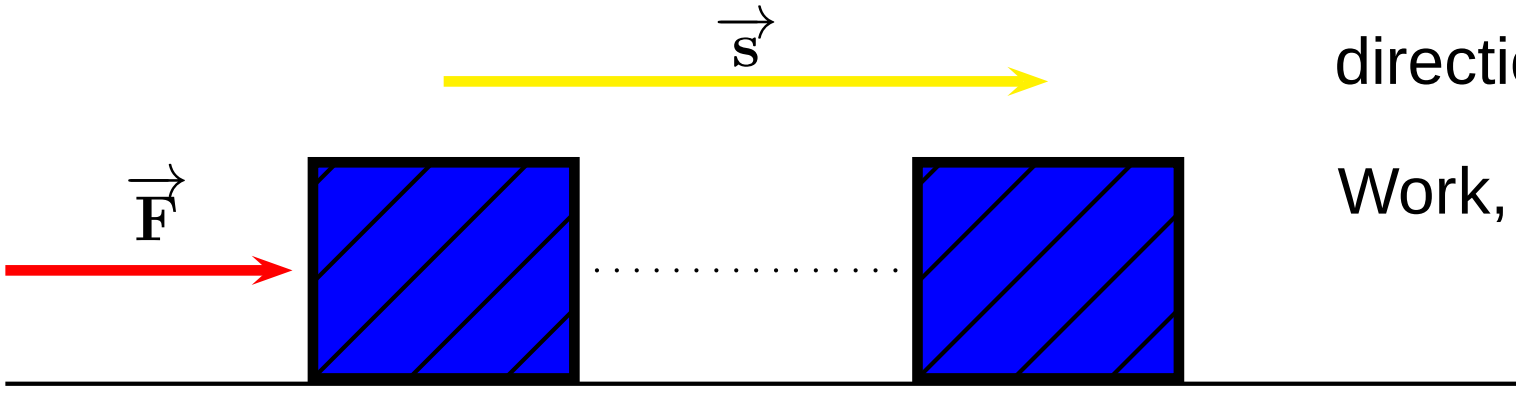

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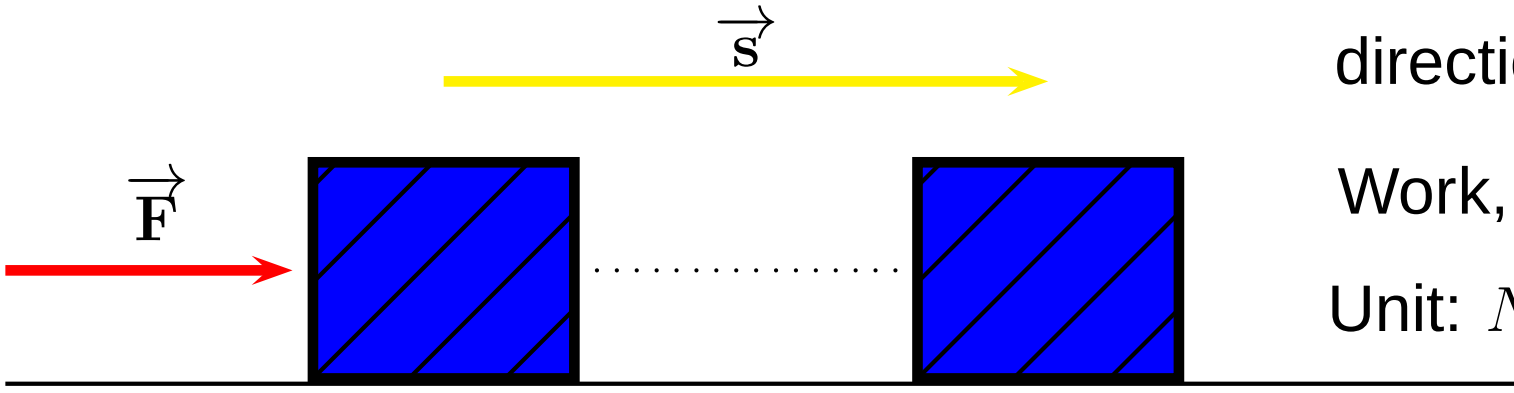
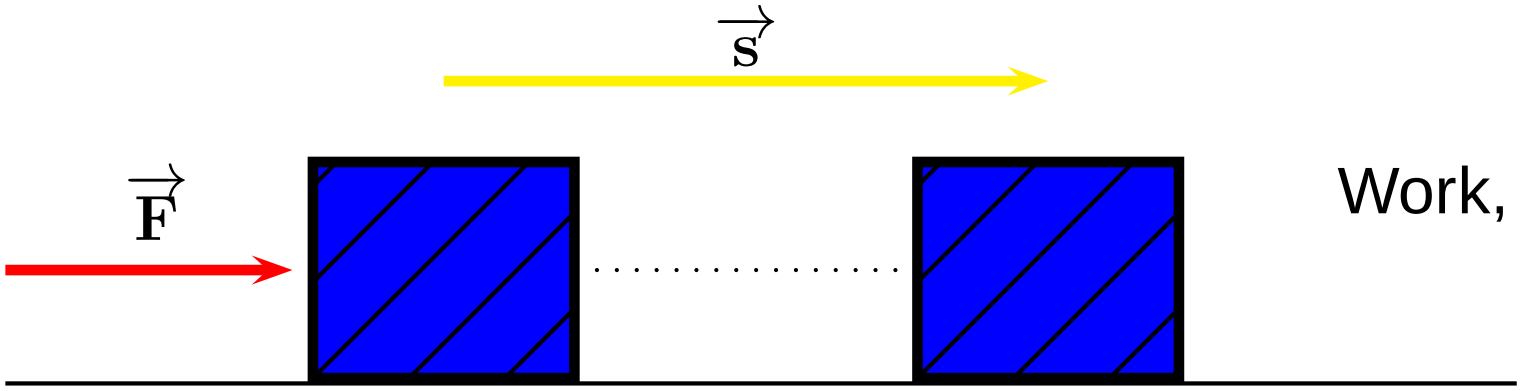


Work, $W = Fs$

Unit: $N \cdot m = J$

Joule

Restrictions



Work, $W = Fs$

This equation is correct only in the situation that:

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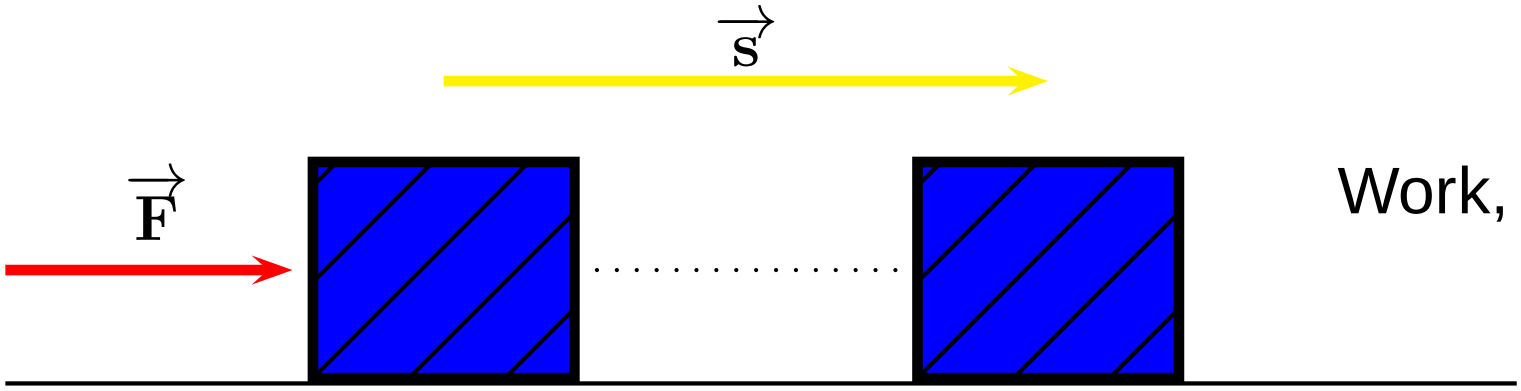

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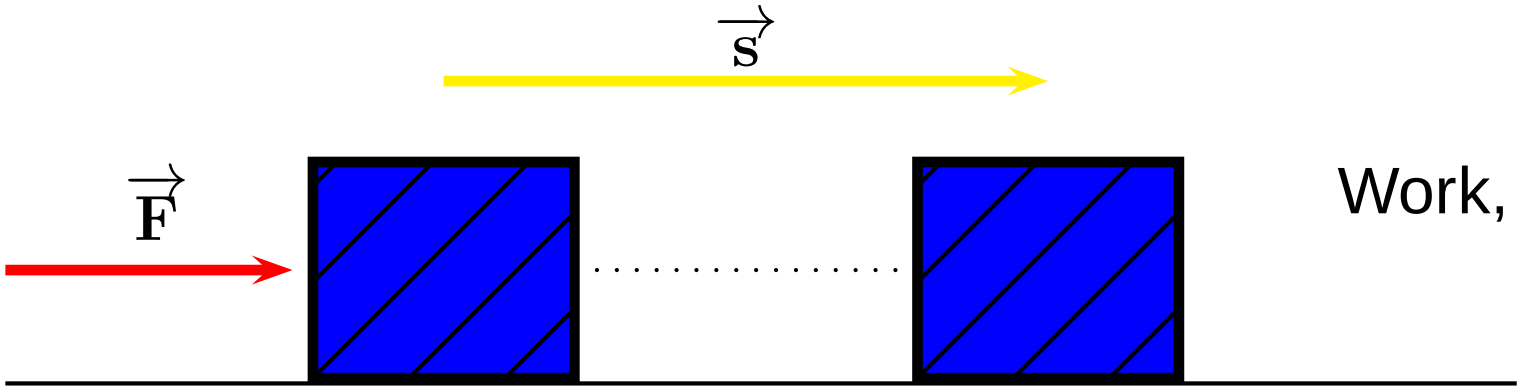

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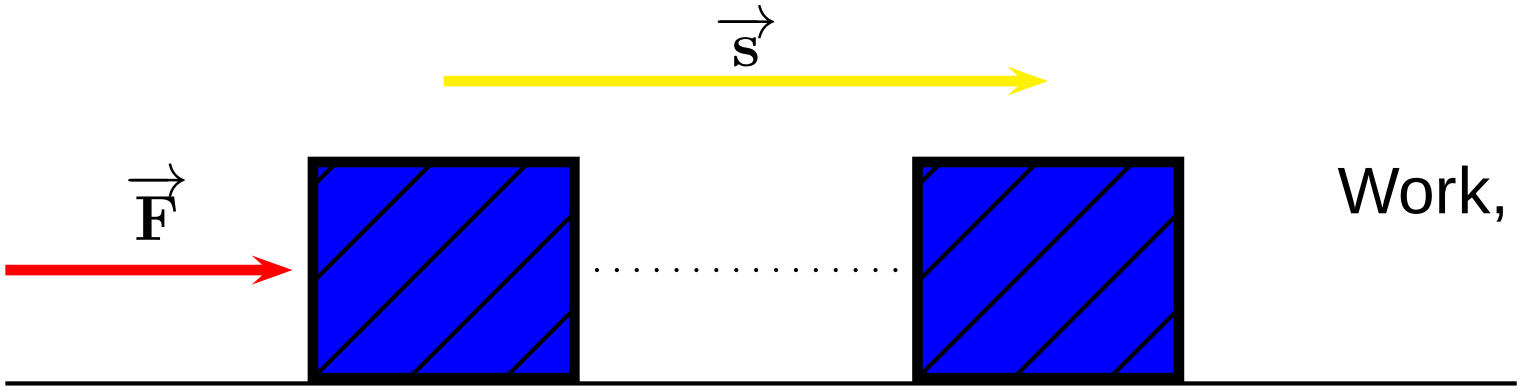

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This equation is correct only in the situation that:

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$\vec{\mathbf{F}}$ and $\vec{\mathbf{s}}$ are in the same direction.

Example

Example: How much work is done by someone lifting a $5\,kg$ mass $1\,m$ vertically at constant speed?

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A force perpendicular to the displacement does no work.

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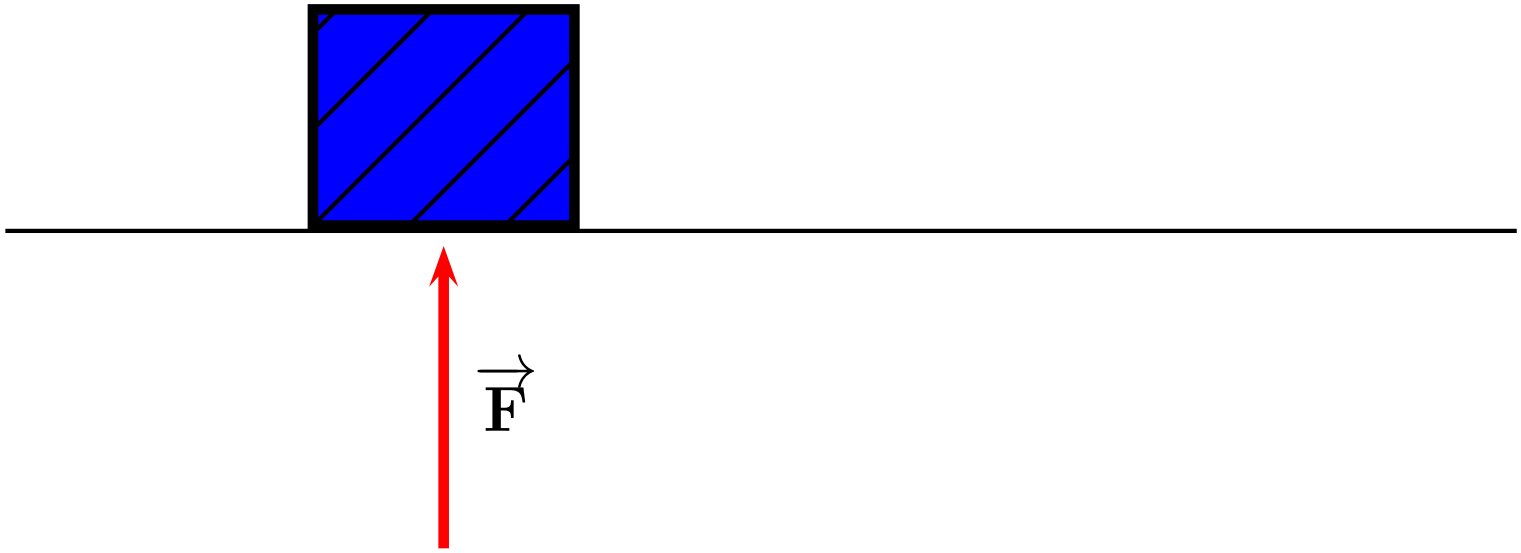

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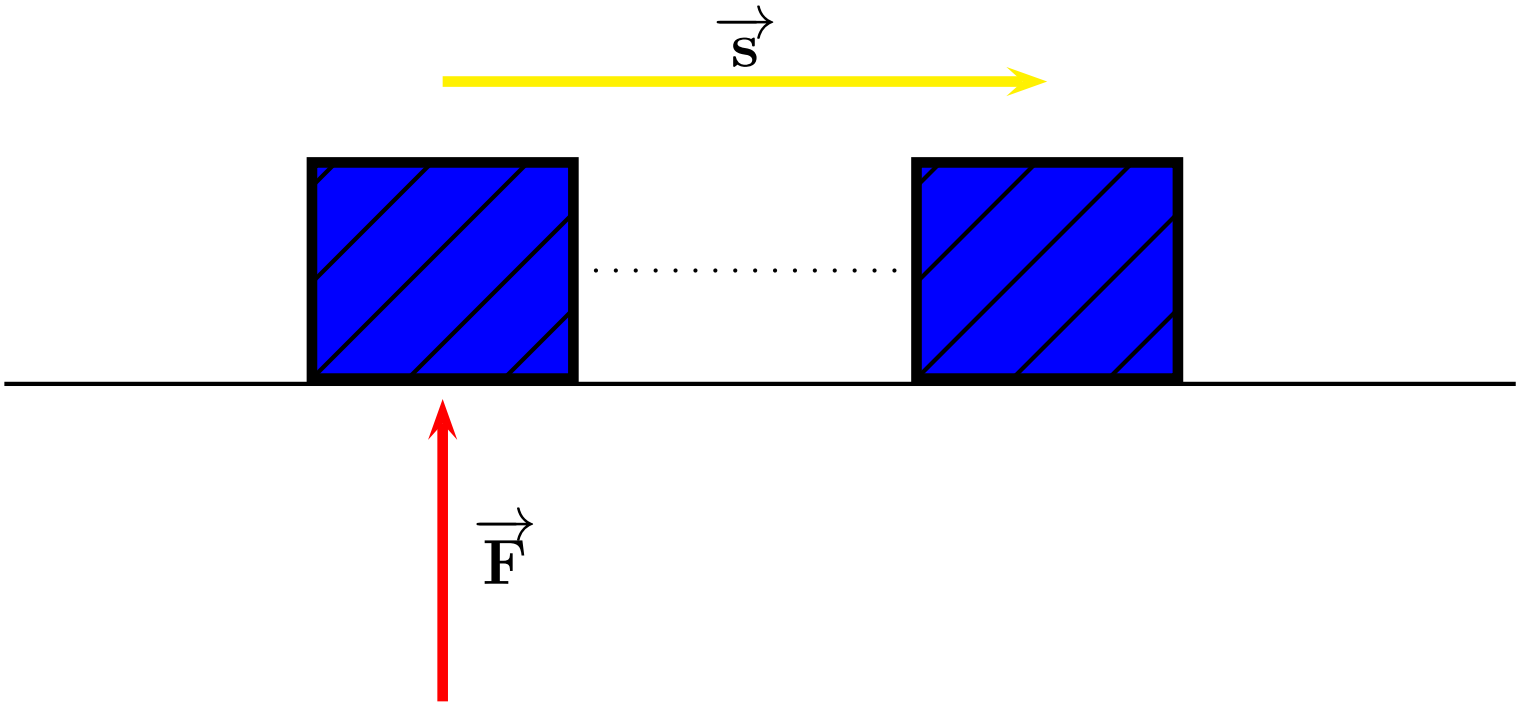

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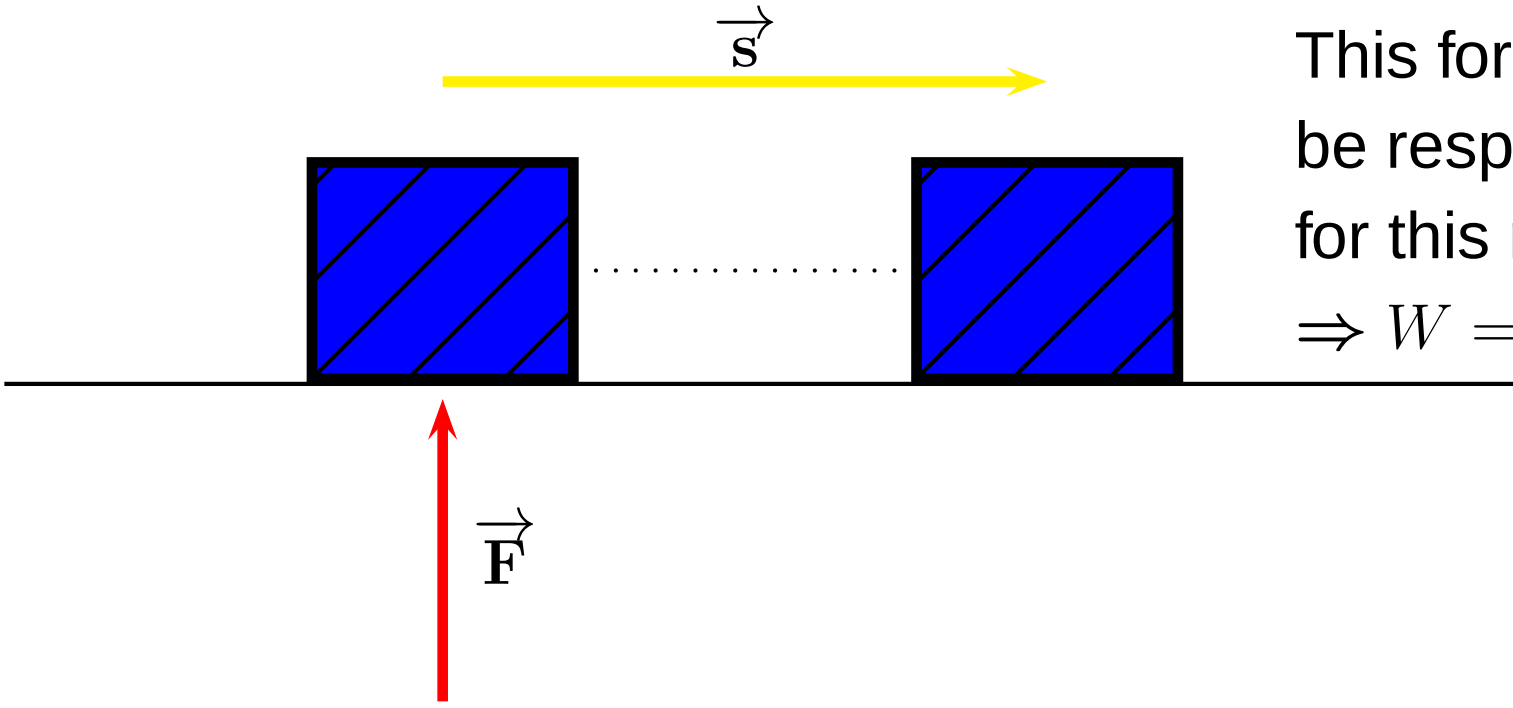

This force cannot be responsible for this motion

$\Rightarrow W = 0$

Arbitrary Direction

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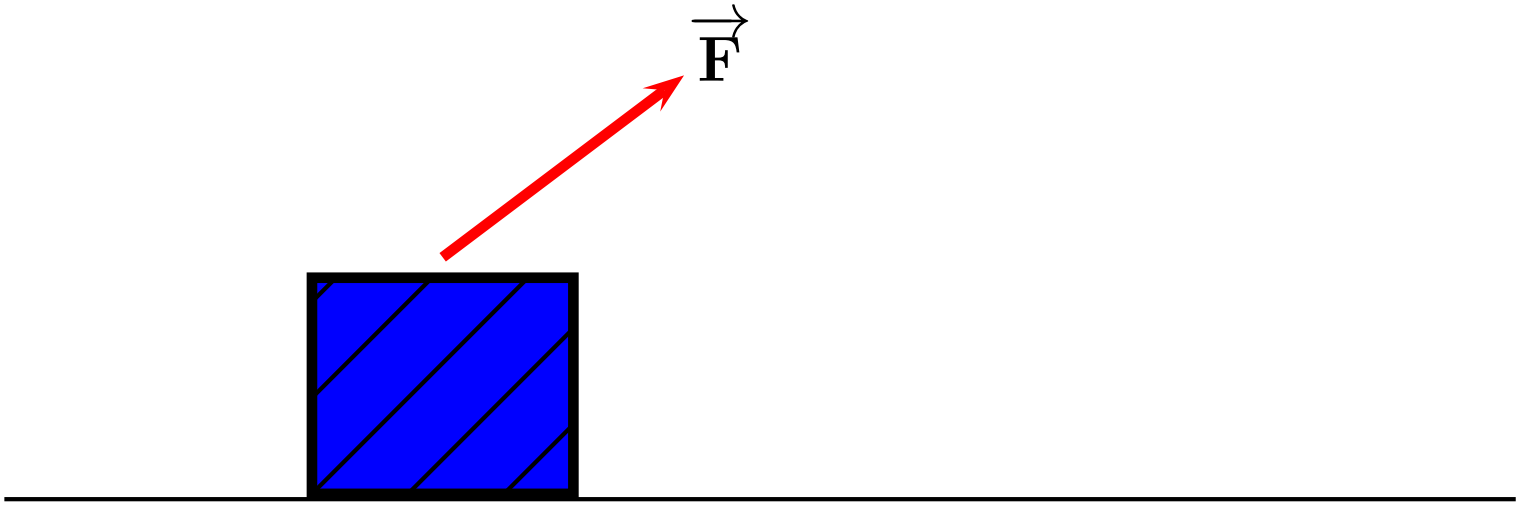

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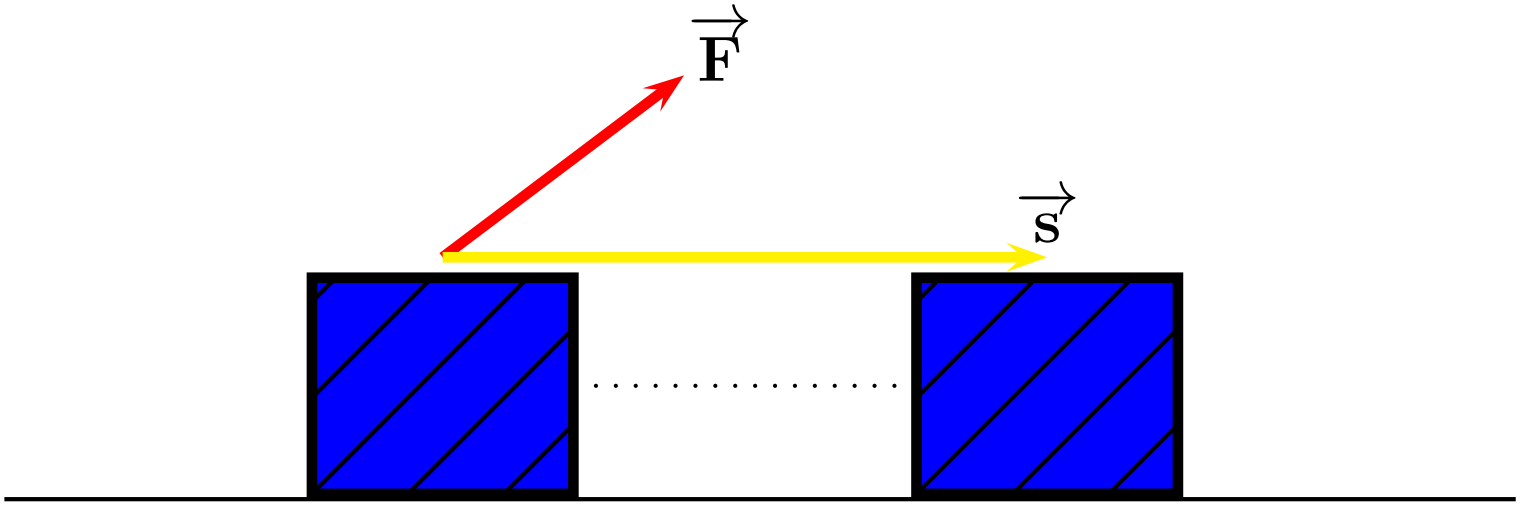

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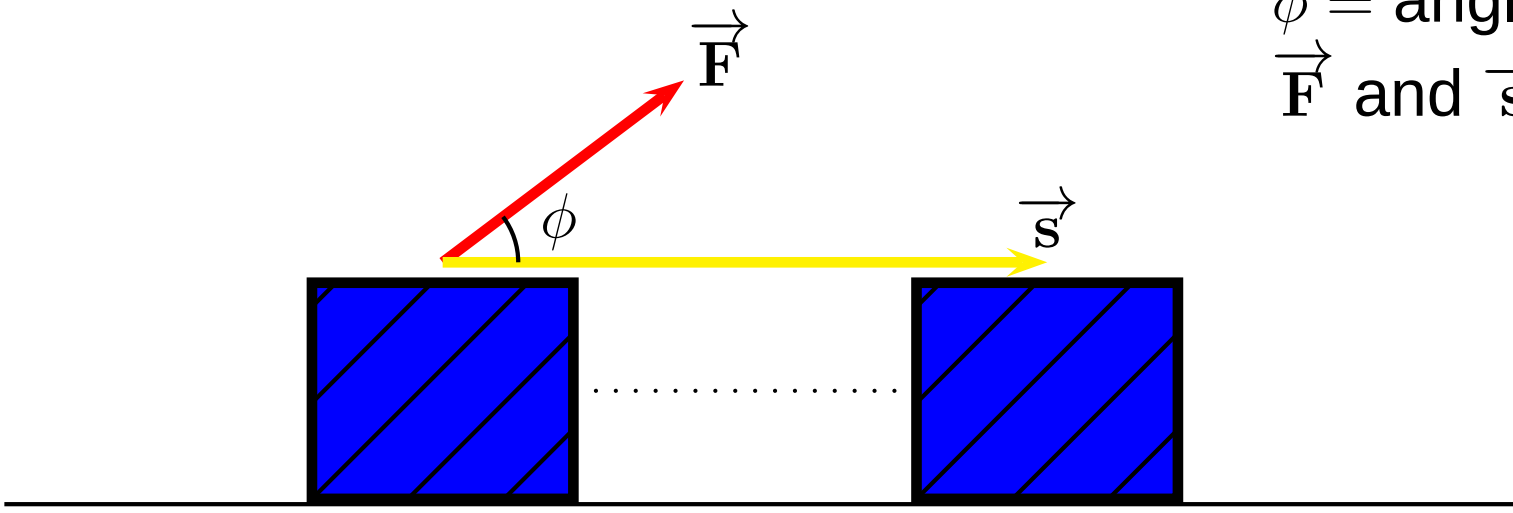

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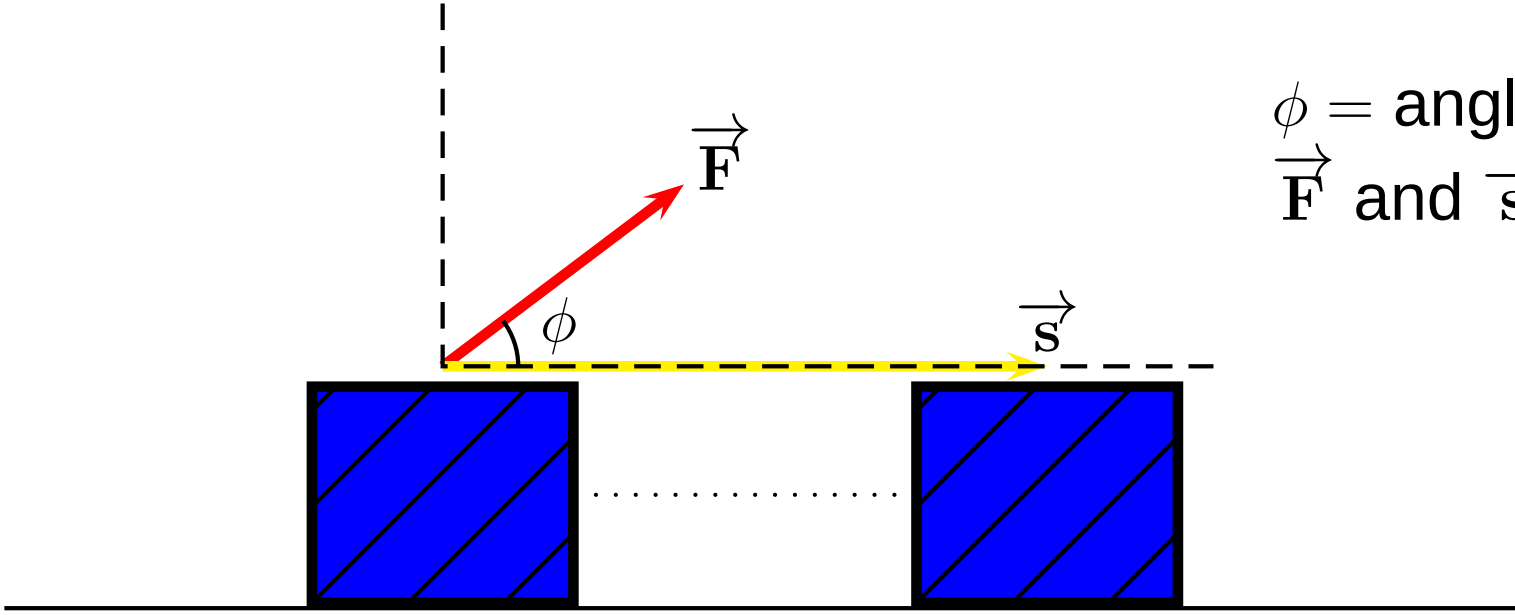

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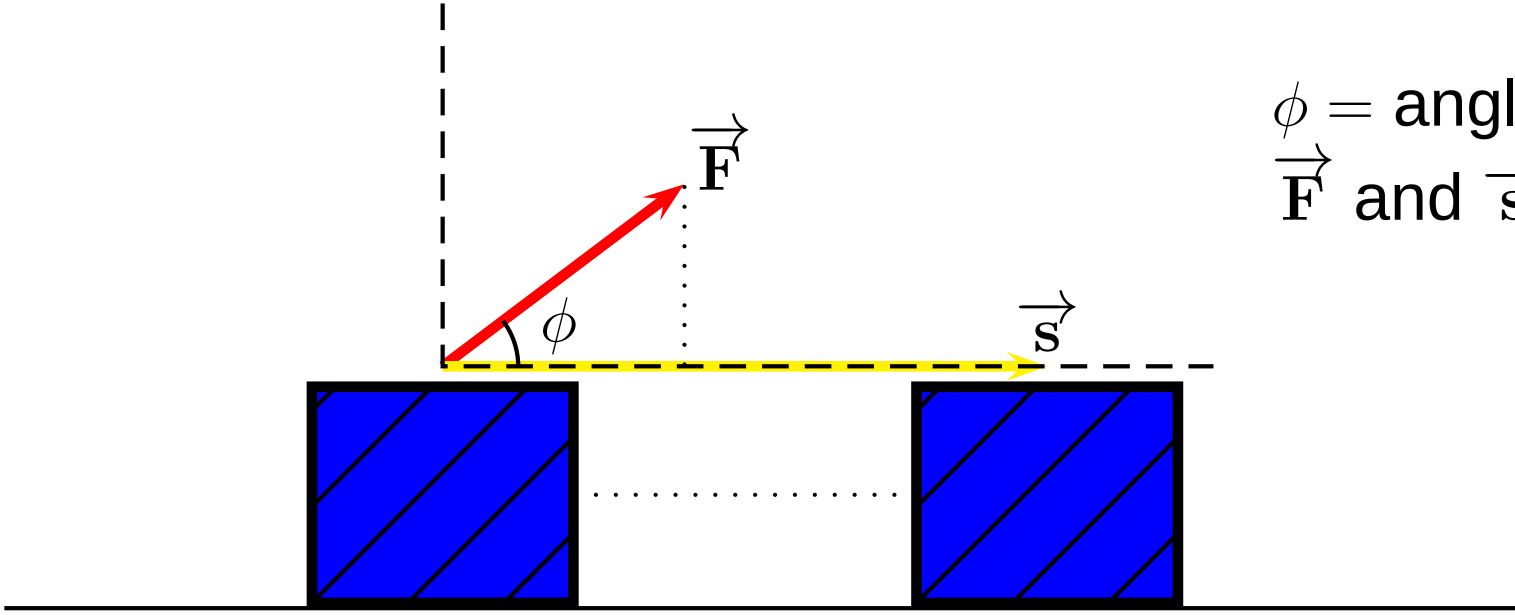

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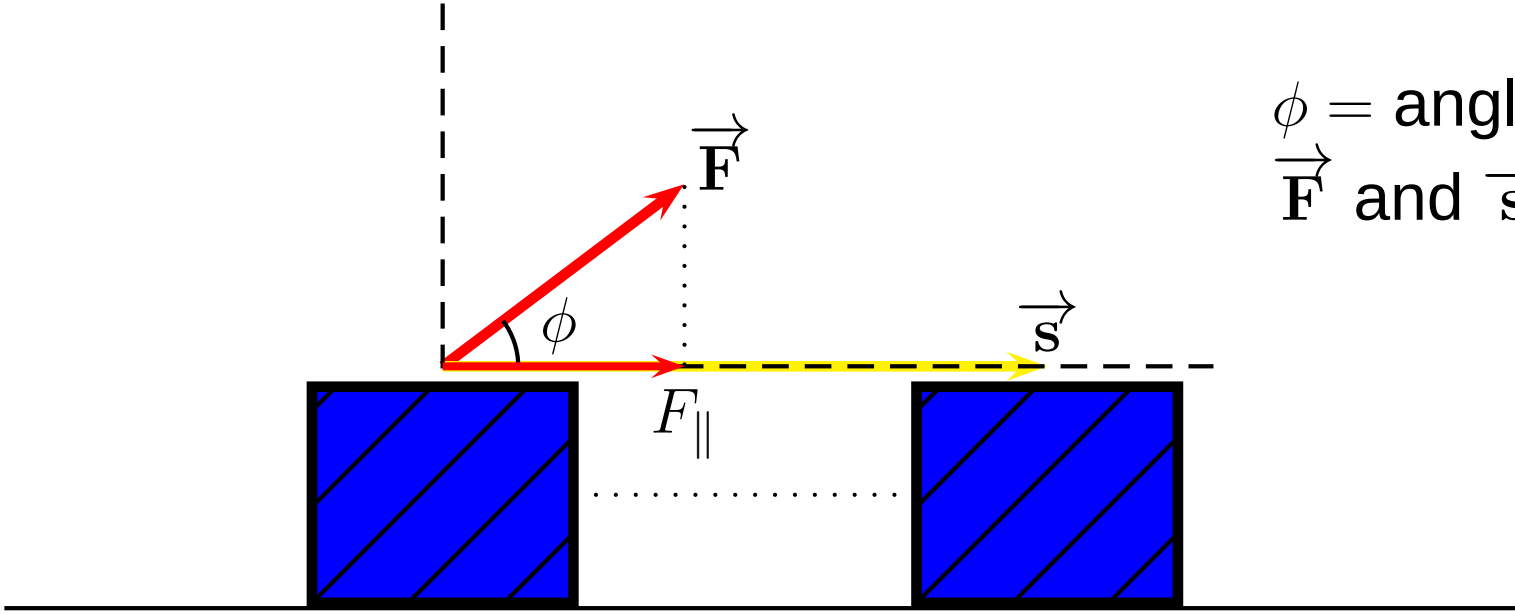

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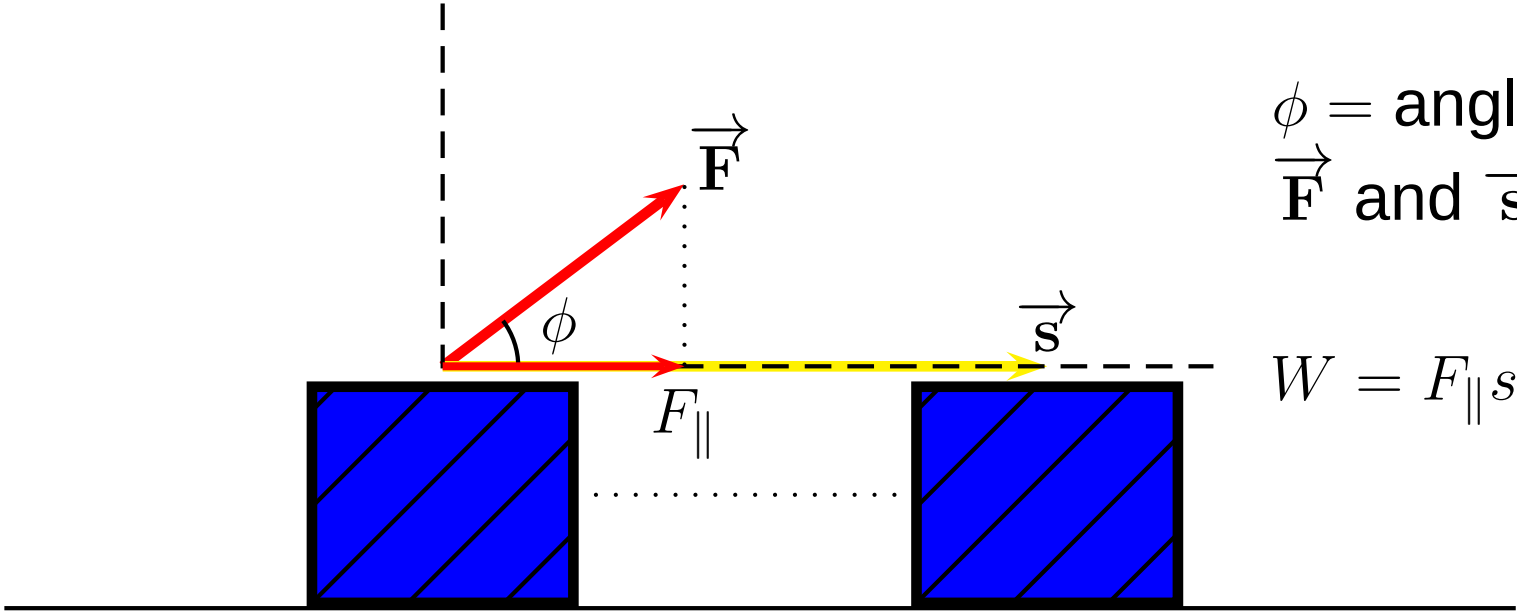

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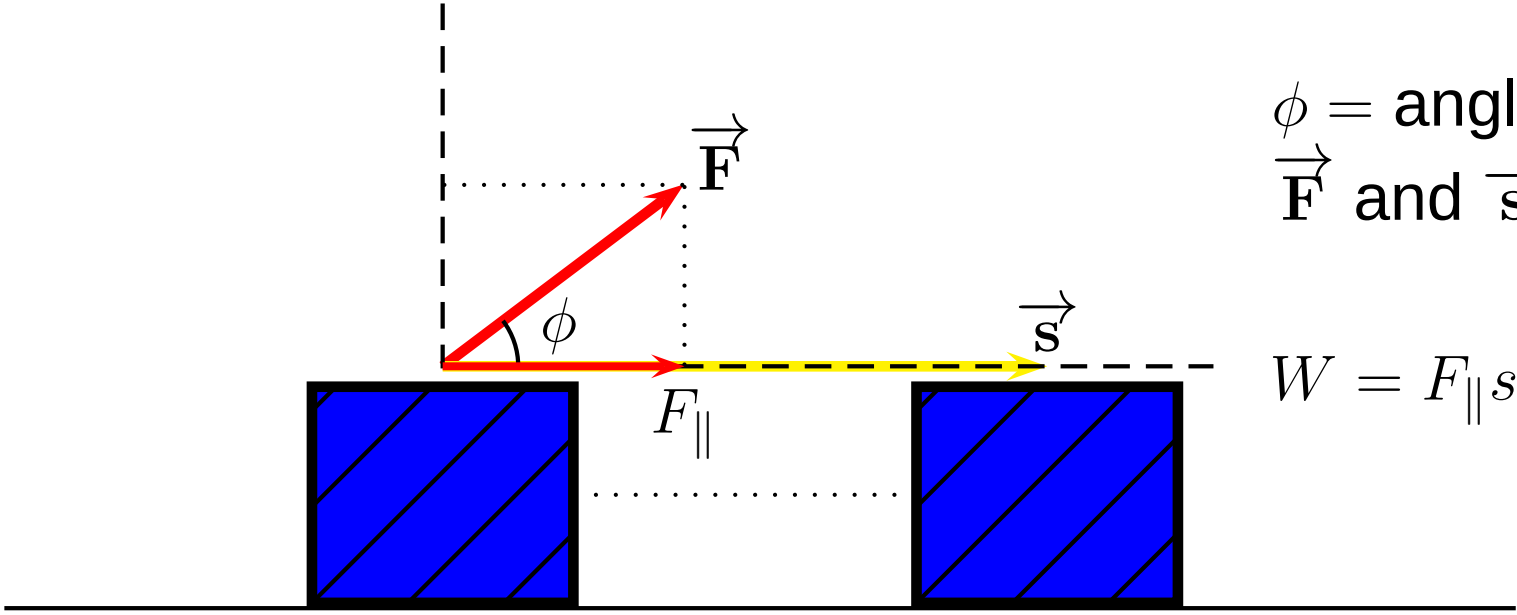

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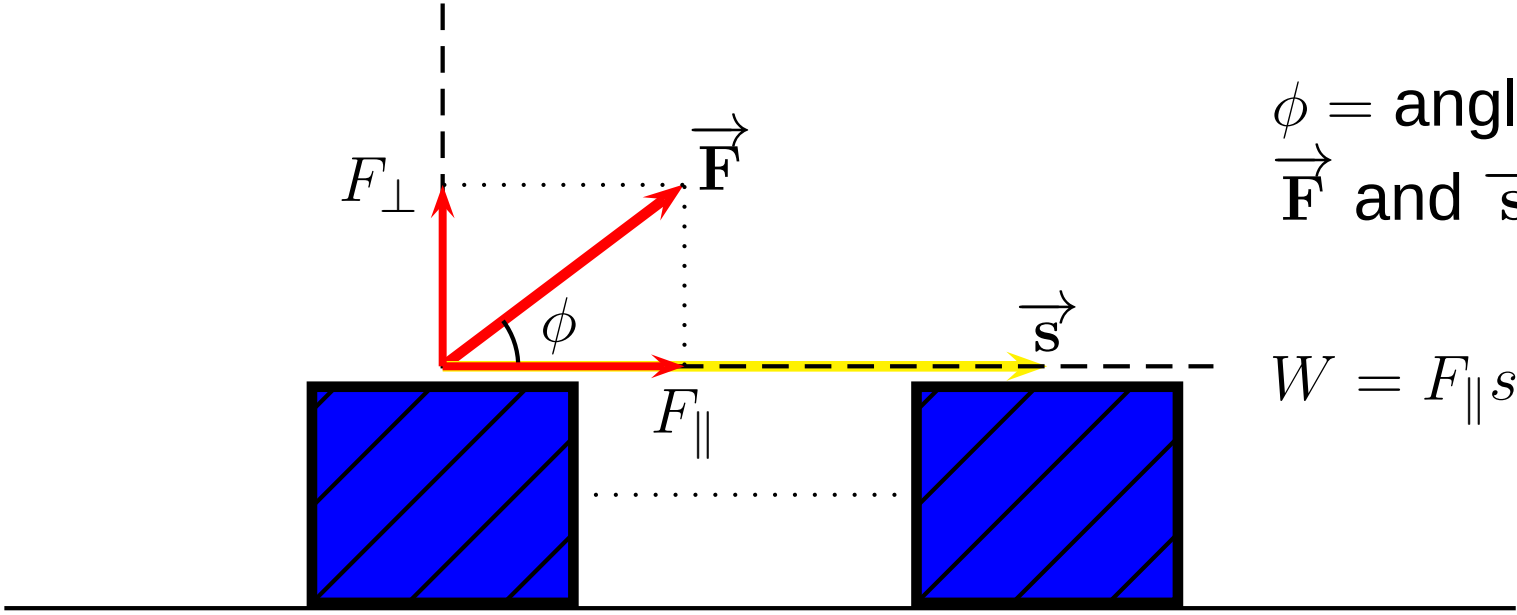

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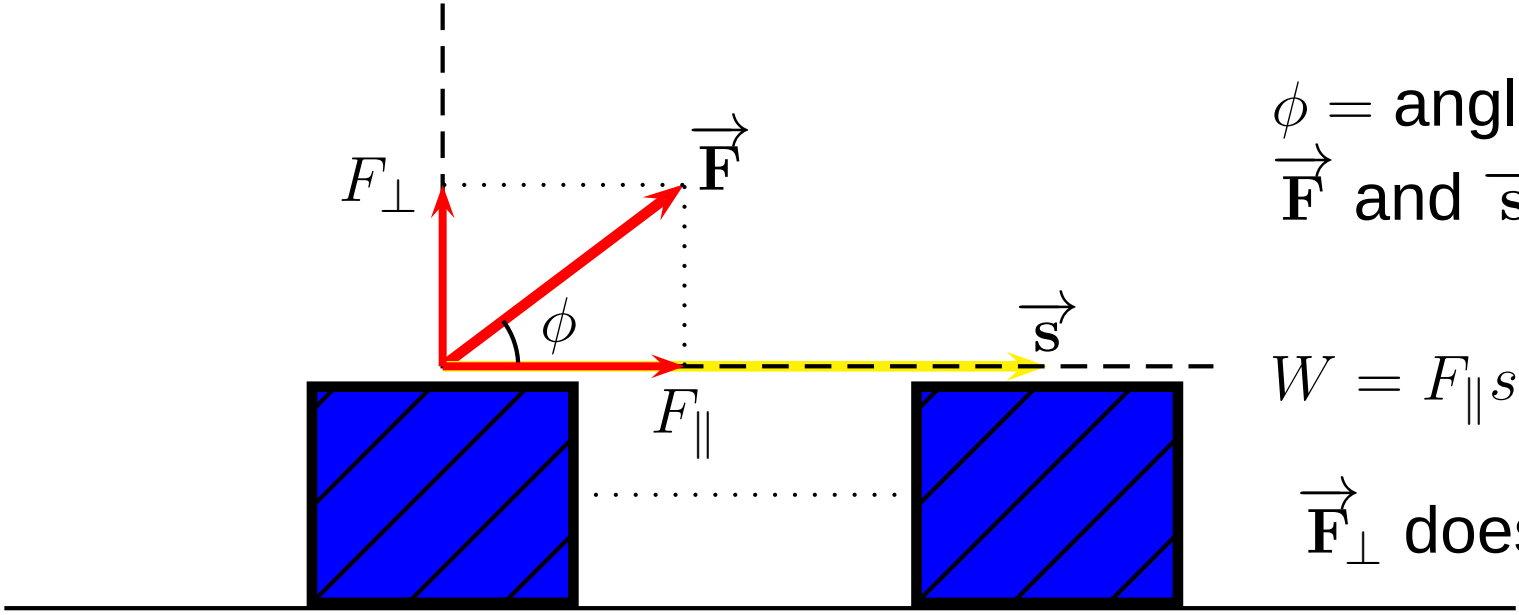

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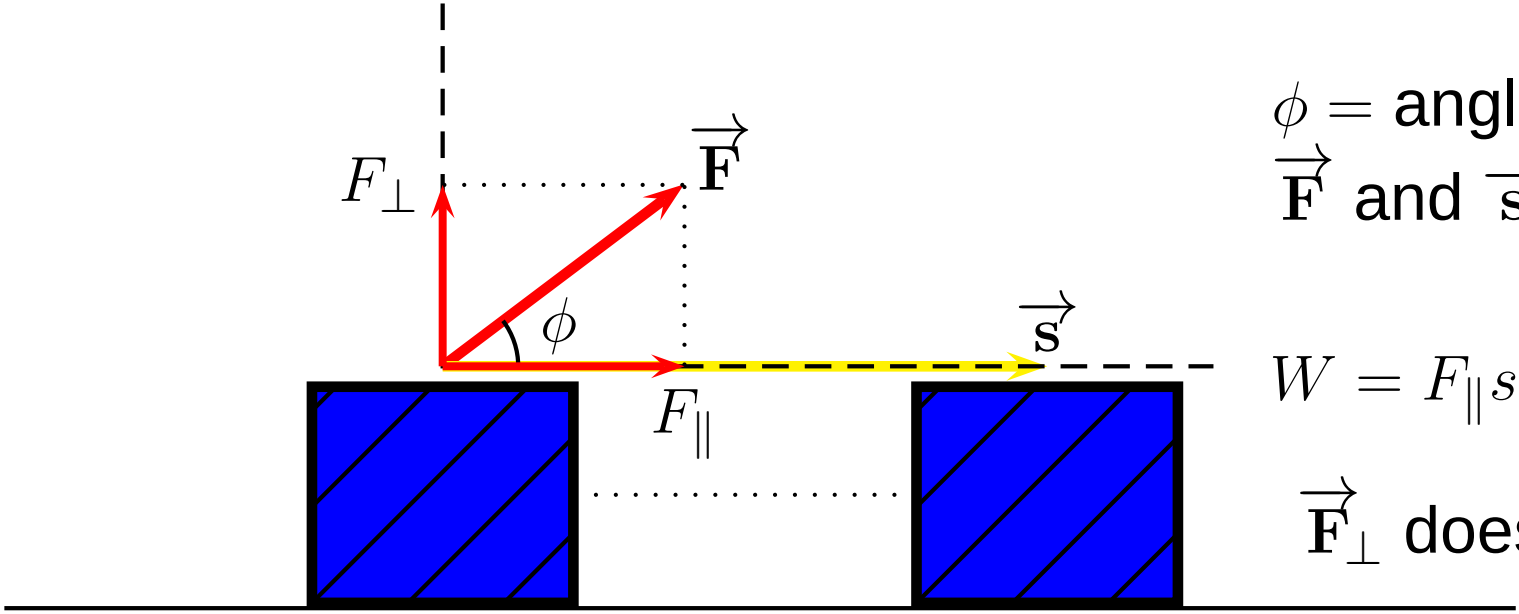

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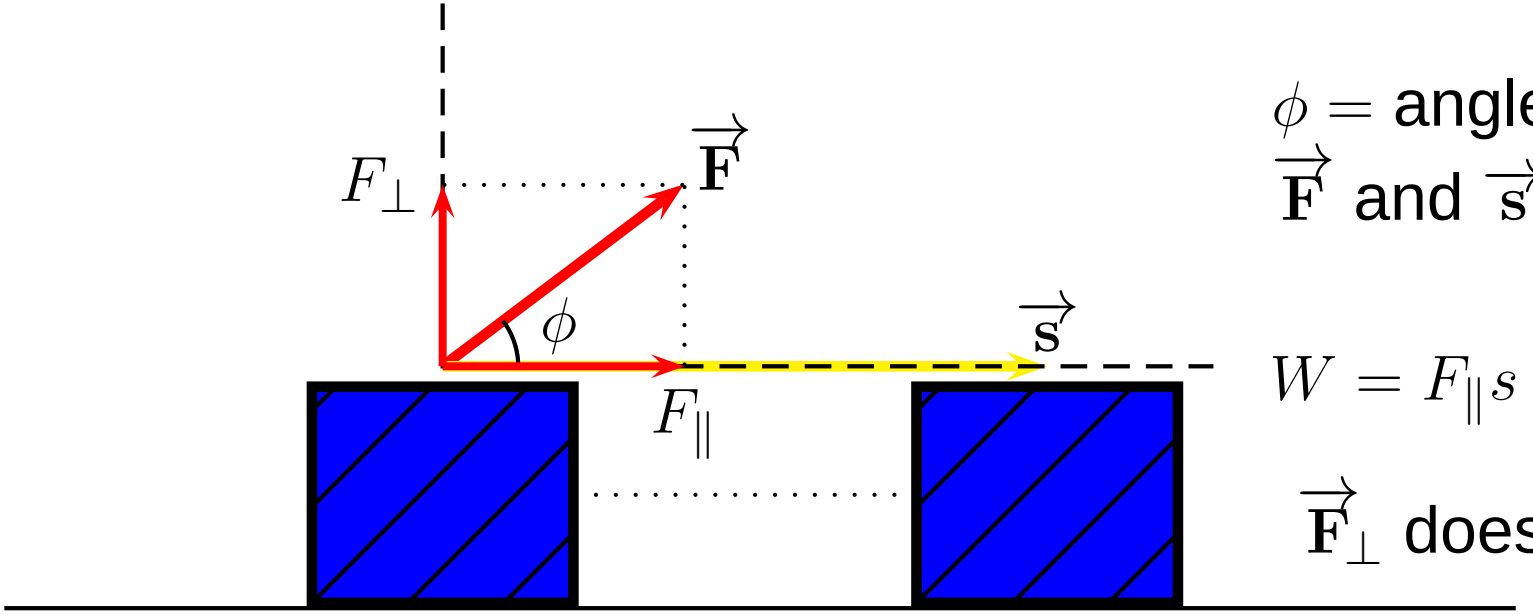

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Only correct for Constant force & Straight-line displacement

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If the two constant forces below have equal magnitude, which of them does more work during the displacement shown?

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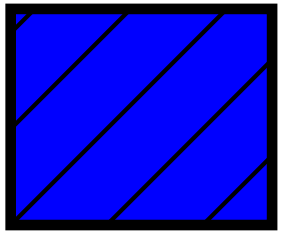

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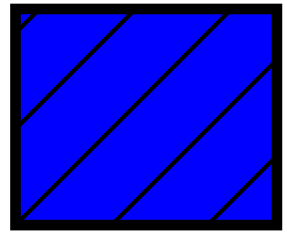

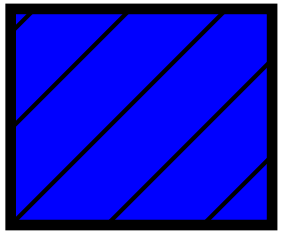

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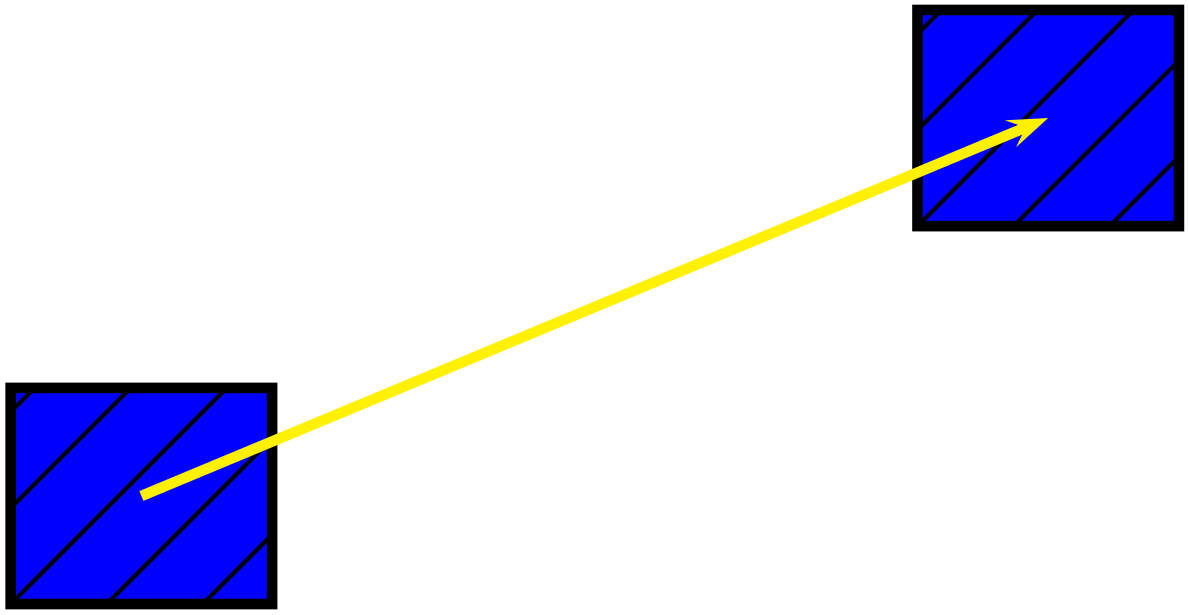

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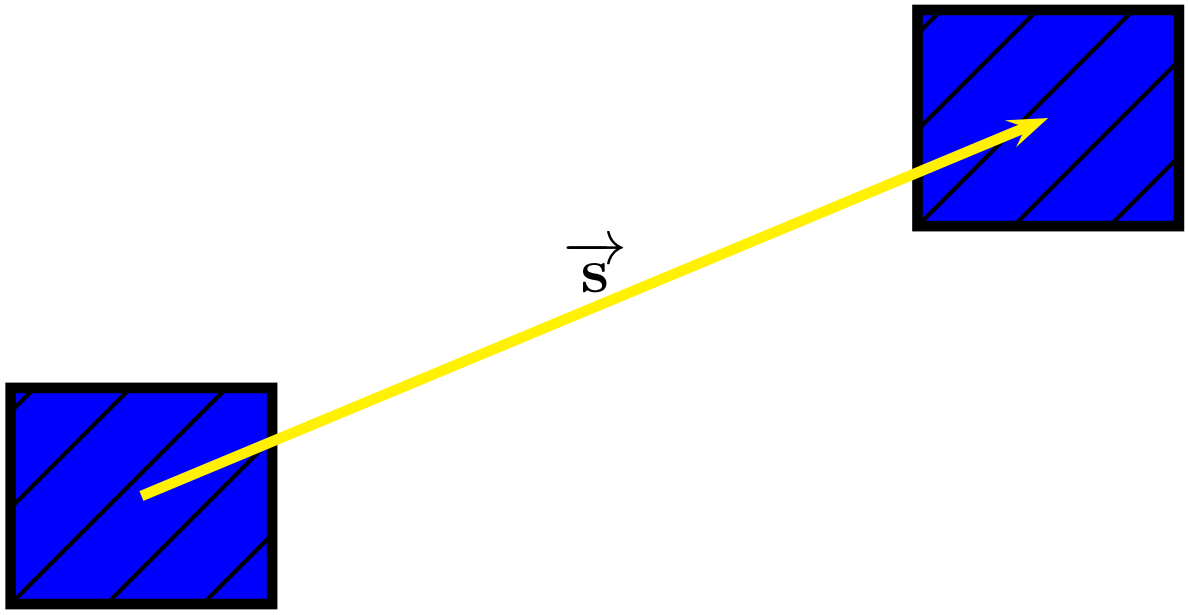

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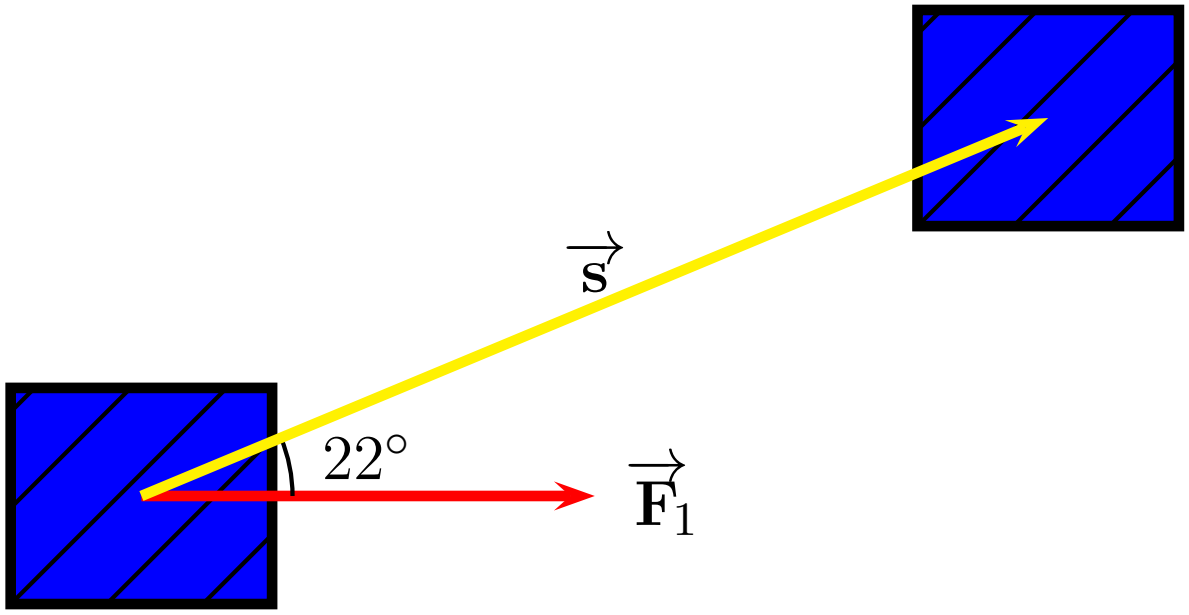

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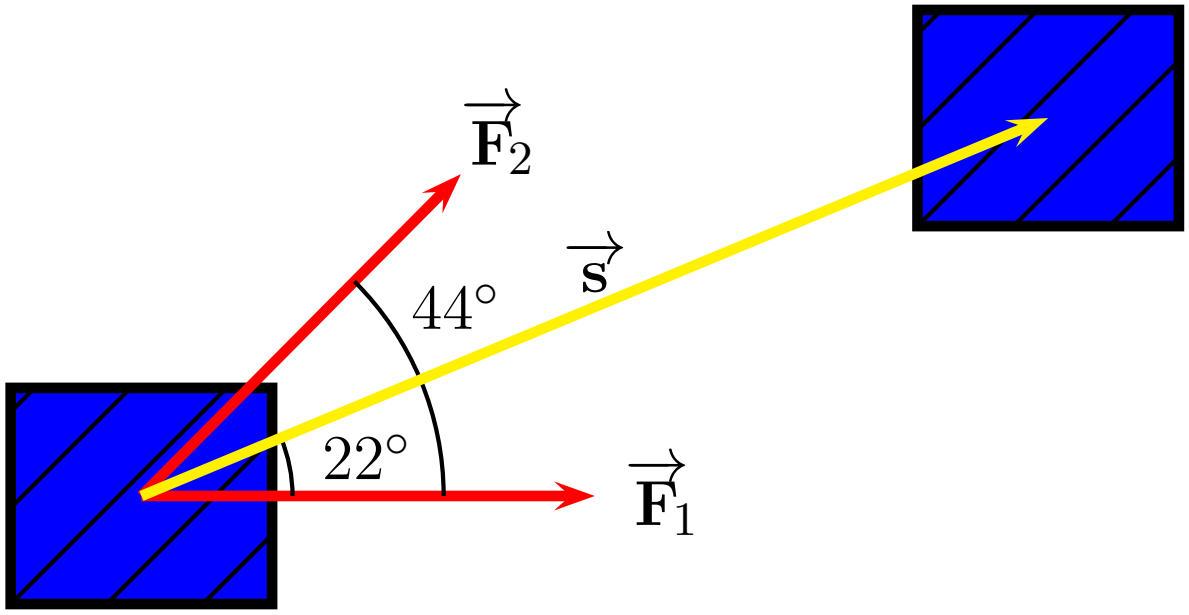

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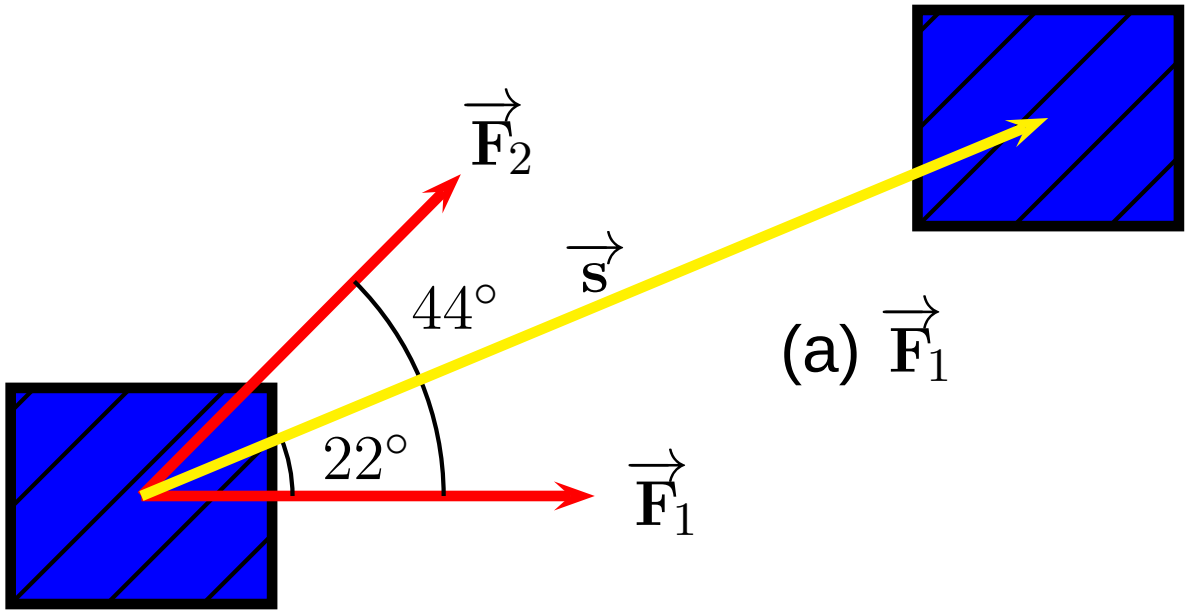

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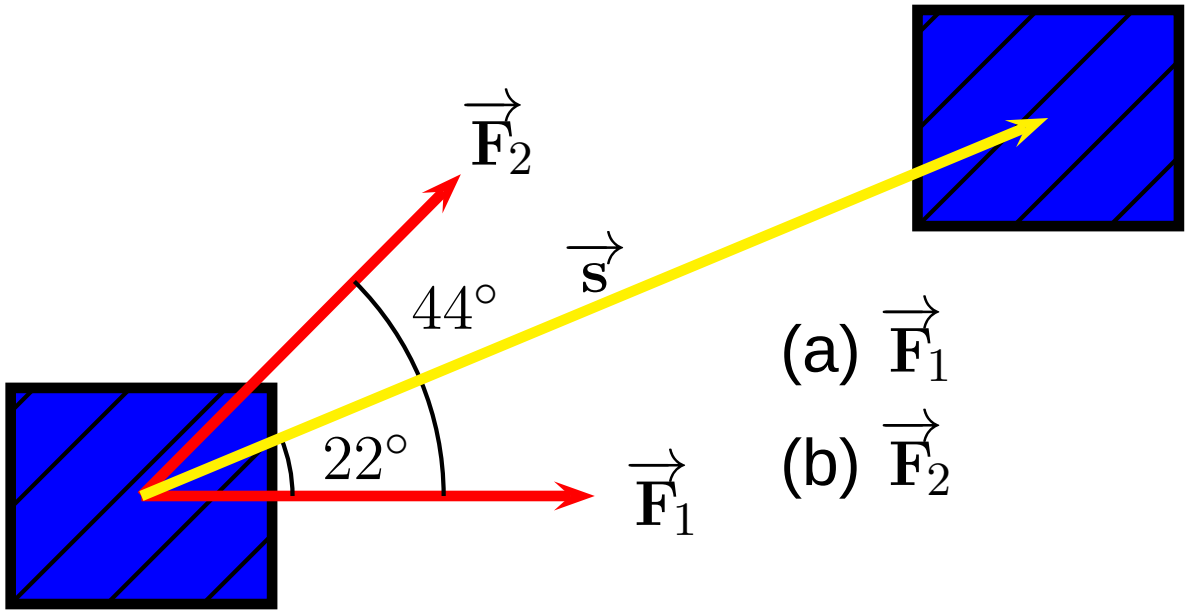

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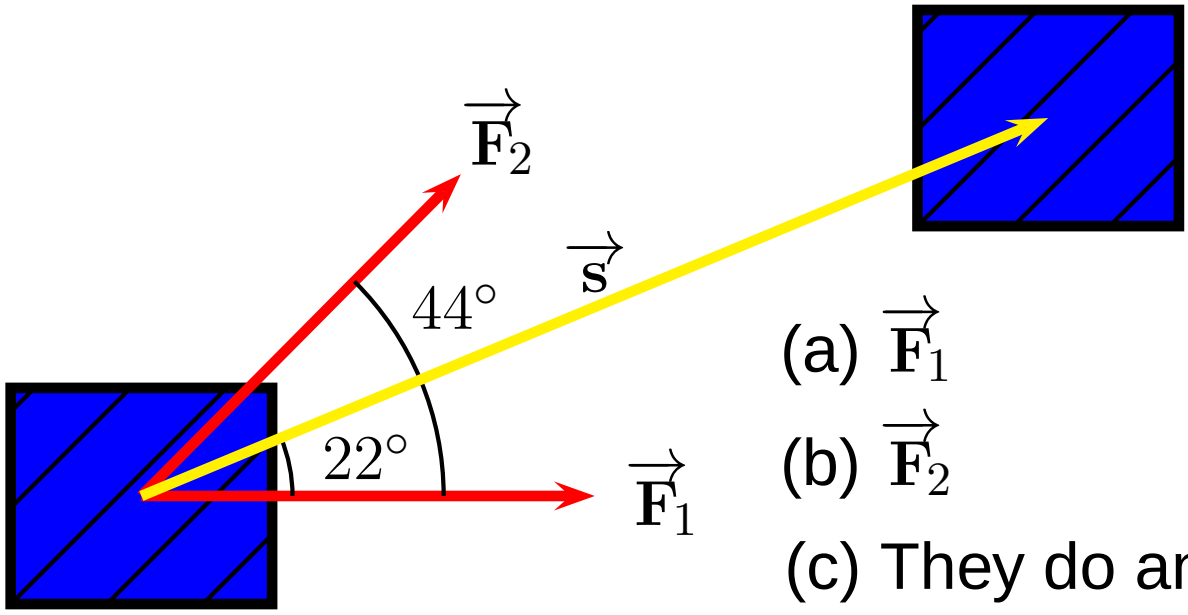

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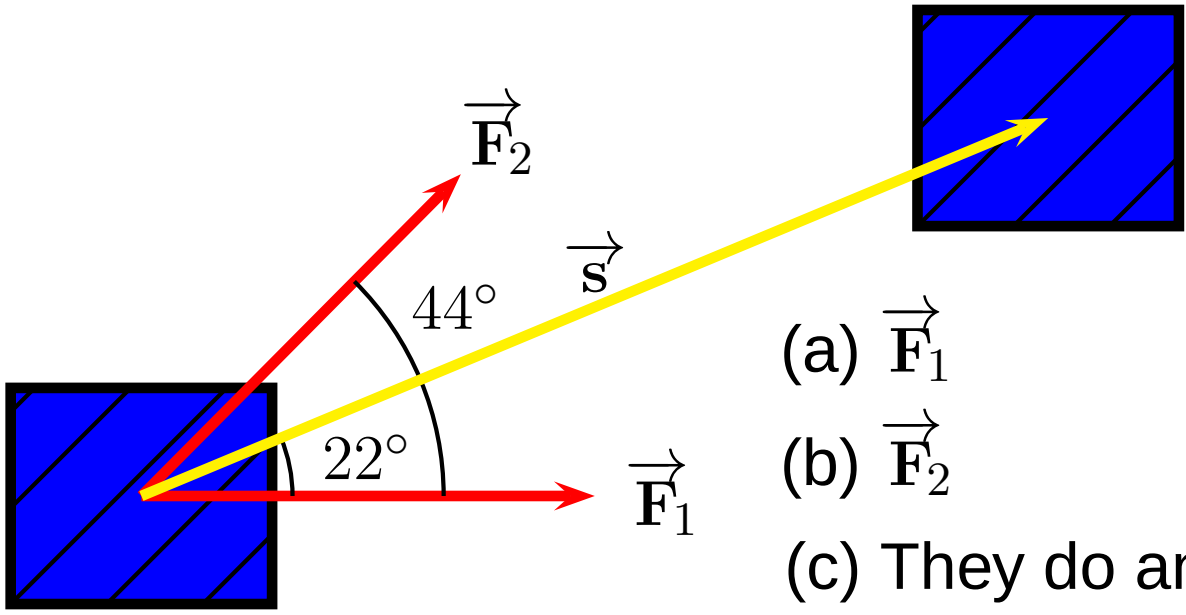

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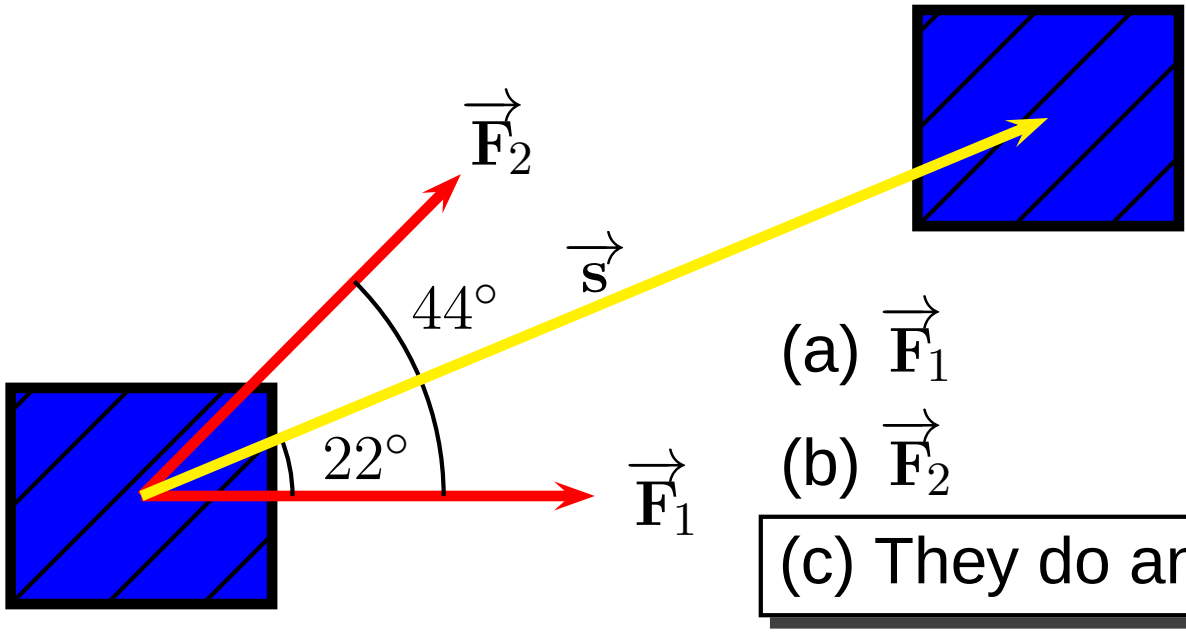

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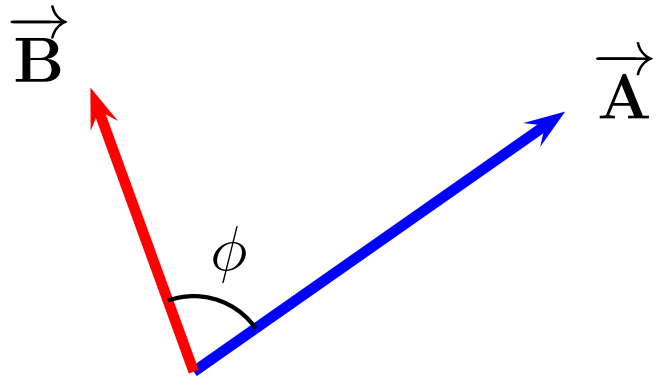

$$\overrightarrow{\mathbf{A}} \cdot \overrightarrow{\mathbf{B}} = AB\cos\phi$$

The Dot Product II

Like with work, the dot product gives us the parallel component of one vector relative to another, and therefore, how much two vectors “overlap".

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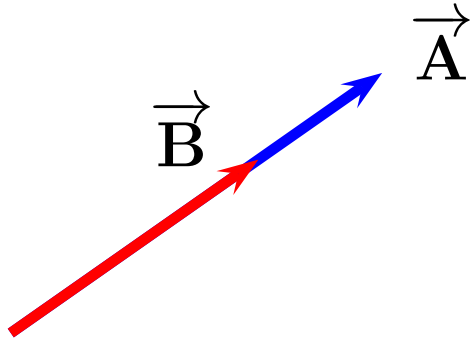

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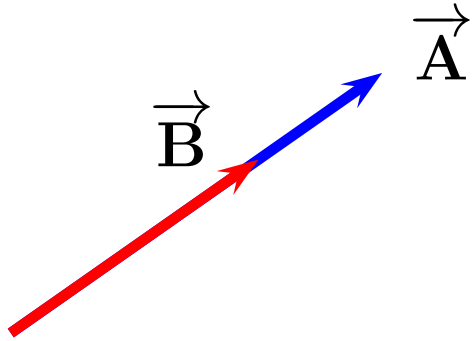

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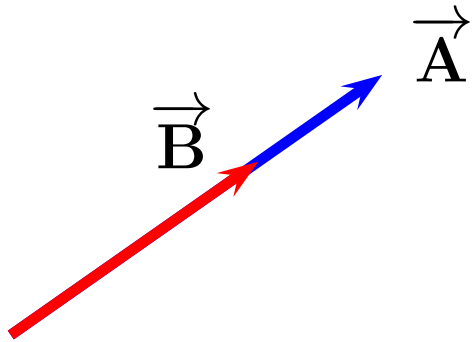

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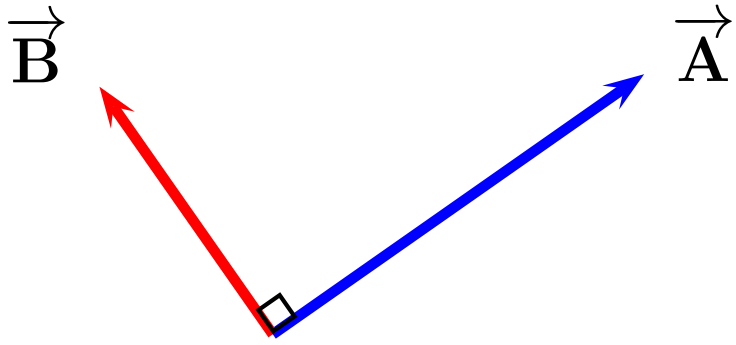

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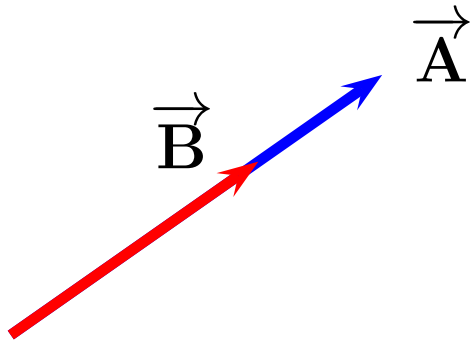

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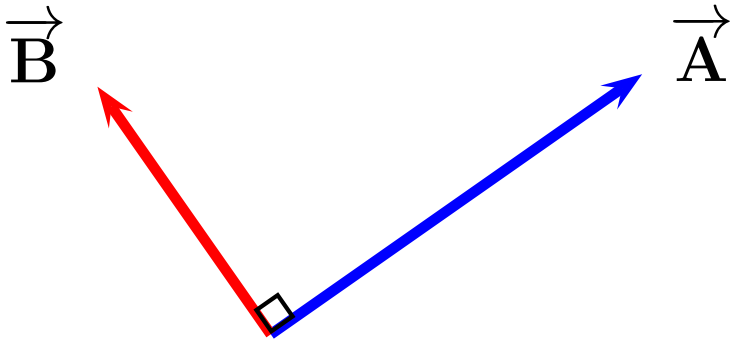

$$\vec{\mathbf{A}} \cdot \vec{\mathbf{B}} = AB\cos 90^\circ = 0$$

$\Rightarrow$ no overlap

Example II

For constant force and straight-line displacement:

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Example: How much work is done by a force of $50\,N$ applied at 23° if the mass moves $5\,m$ at 195°?