What kinds of energy are there?

Question #1

a) Kinetic to Potential
b) Potential to Kinetic
c) Work to Kinetic
d) Work to Potential

What energy transfer is taking place?

Question #2

a) Work to Kinetic
b) Work to Potential and Kinetic
c) Work to Potential
d) Potential to Kinetic

What energy transfer is taking place?

Question #3

A tow rope pulls a skier up a **rough** slope at **constant speed**. What energy transfer (or transfers) is taking place?

a. $W \rightarrow U_g$

b. Both A and E

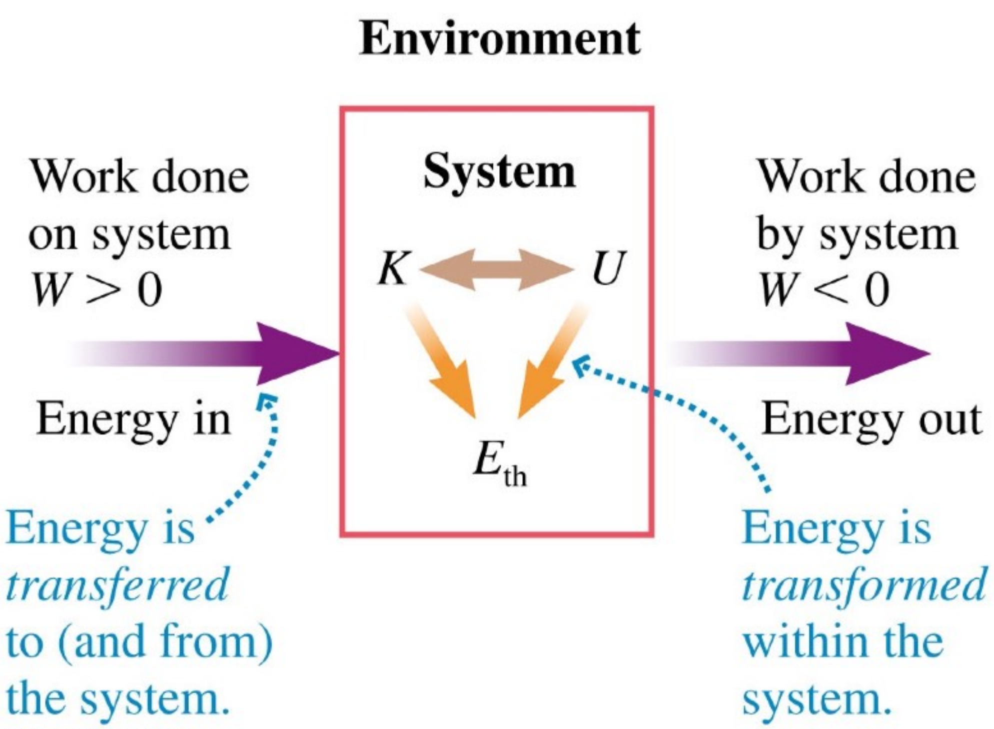
c. $W \rightarrow E_{th}$

d. Both A and C.

e. $W \rightarrow K$.

Quiz

A tow rope pulls a skier up a rough slope at constant speed. What energy transfer (or transfers) is taking place?



a. $W \rightarrow U_g$

b. Both A and C

c. $W \rightarrow E_{th}$

d. Both A and B.

e. $W \rightarrow K$.

Question #4

A child is on a playground swing, motionless at the highest point of his arc. What energy transformation takes place as he swings back down to the lowest point of his motion?

a. $K \rightarrow U_g$
b. $E_{th} \rightarrow K$
c. $K \rightarrow E_{th}$
d. $U_g \rightarrow E_{th}$
e. $U_g \rightarrow K$

Question #5

A skier is gliding down a slope at a constant speed.
What energy transformation is taking place?

E $K \rightarrow U$

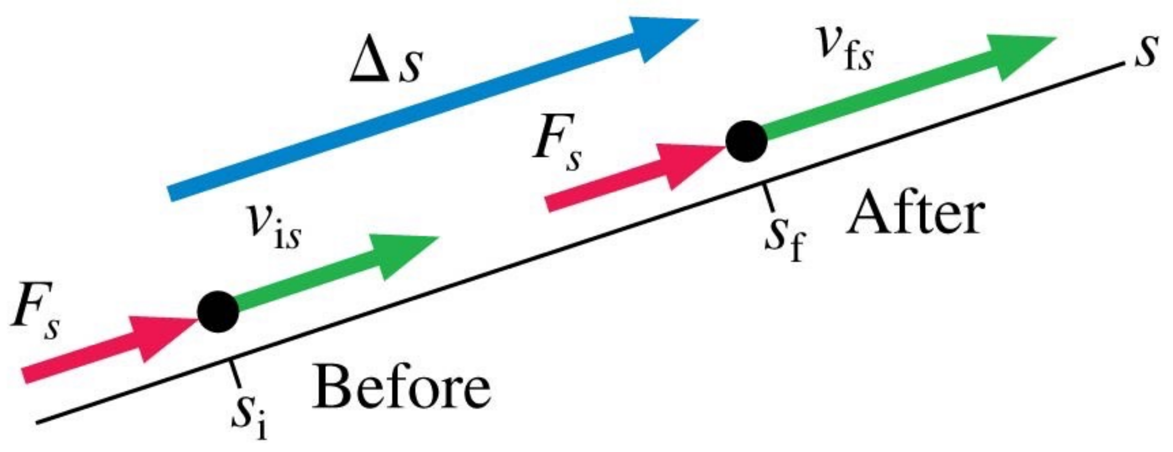
B $U \rightarrow K$

A $E_{\text{th}} \rightarrow K$

C $U \rightarrow E_{\text{th}}$

D $K \rightarrow E_{\text{th}}$

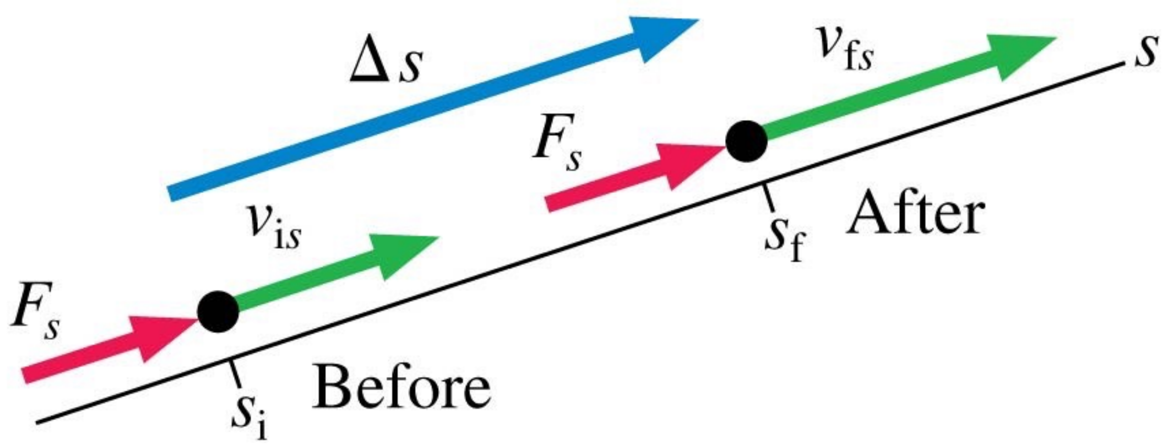
Work and Kinetic Energy



Before-and-after representation

Work and Kinetic Energy

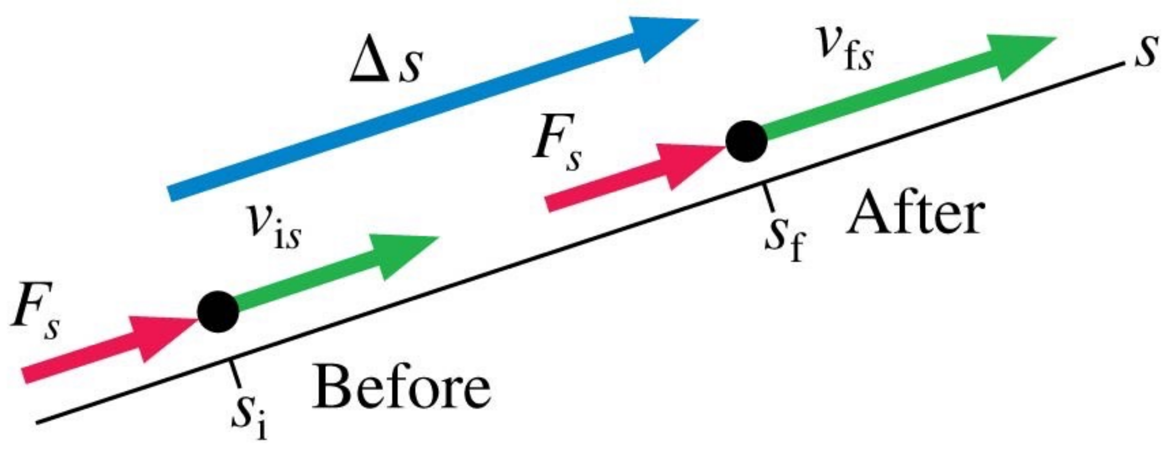
$$K = \frac{1}{2}mv^2$$ Kinetic Energy



Before-and-after representation

Work and Kinetic Energy

$$K = \frac{1}{2}mv^2$$ Kinetic Energy



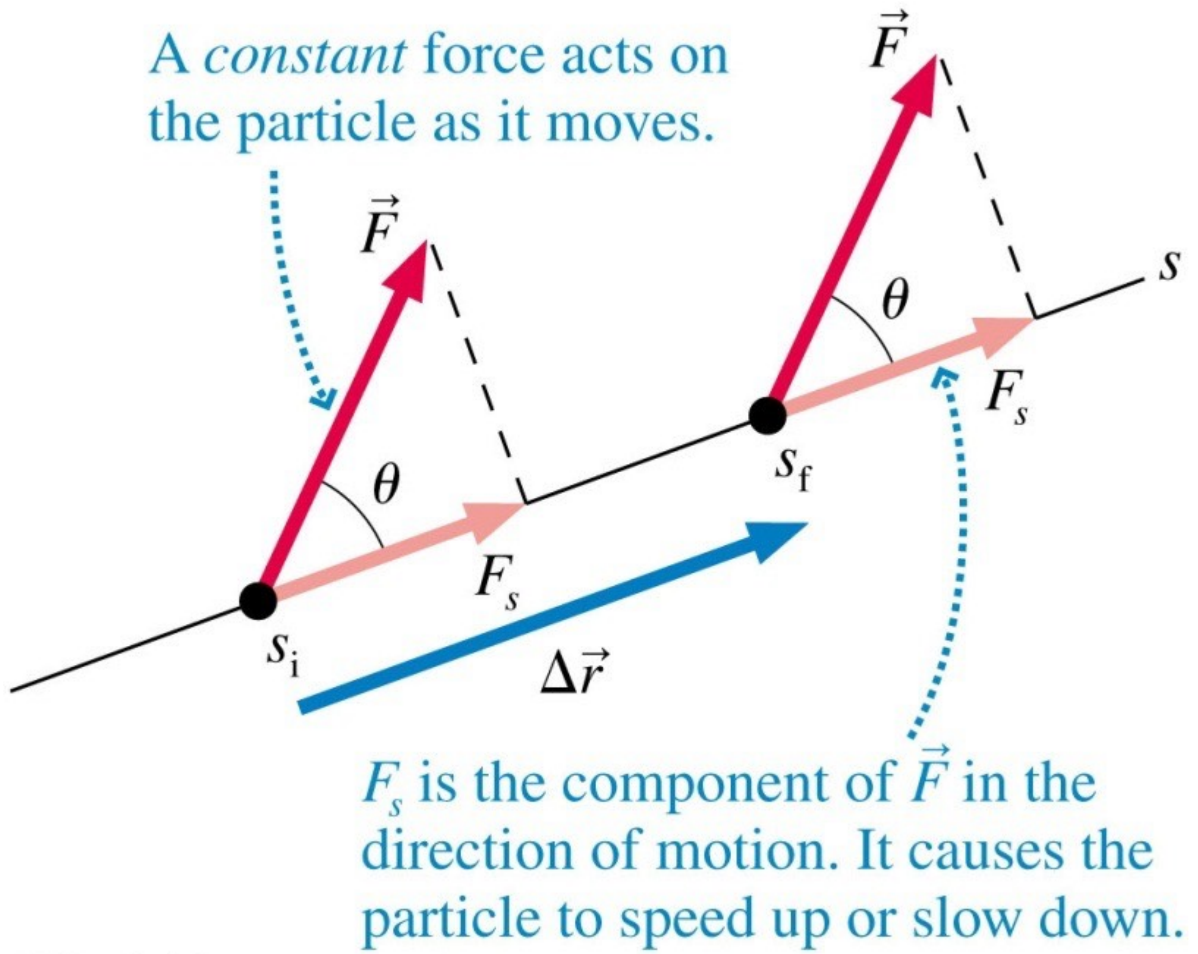
Before-and-after representation

$$W = \int F\,ds$$ Work

Units?

Work Done by a Constant Force

$$W = \int_{s_i}^{s_f} F_s \, ds = \int_{s_i}^{s_f} F \cos\theta \, ds$$



$$W = F\cos\theta \int_{s_i}^{s_f} ds = F\cos\theta (s_f - s_i) = F(\Delta r)\cos\theta$$

Question #6

A crane lowers a girder into place at constant speed. Consider the work W_g done by gravity and the work W_T done by the tension in the cable. Which is true?

a. $W_g > 0$ and $W_T > 0$

b. $W_g < 0$ and $W_T > 0$

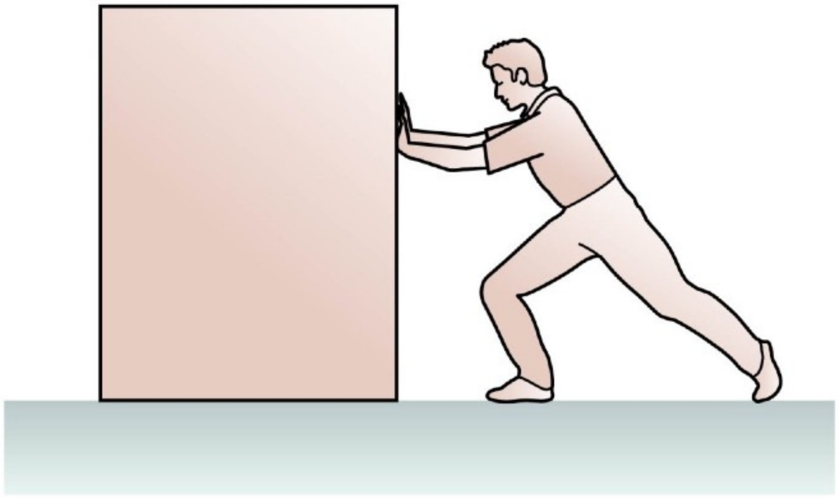
c. $W_g = 0$ and $W_T = 0$

d. $W_g < 0$ and $W_T < 0$

e. $W_g > 0$ and $W_T < 0$

Question #7

Robert pushes the box to the left at constant speed. In doing so, Robert does _______ work on the box.

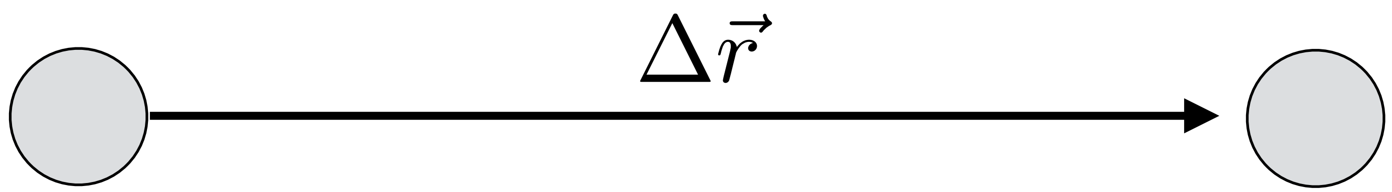


c) negative

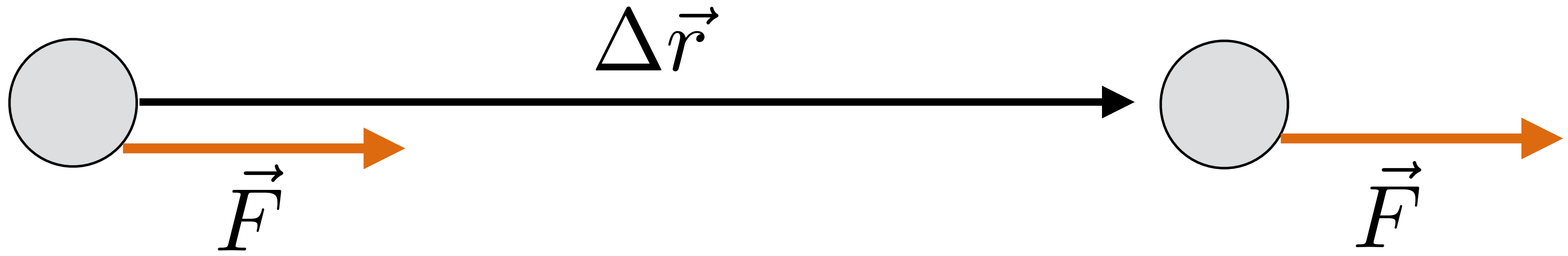
d) zero

e) positive

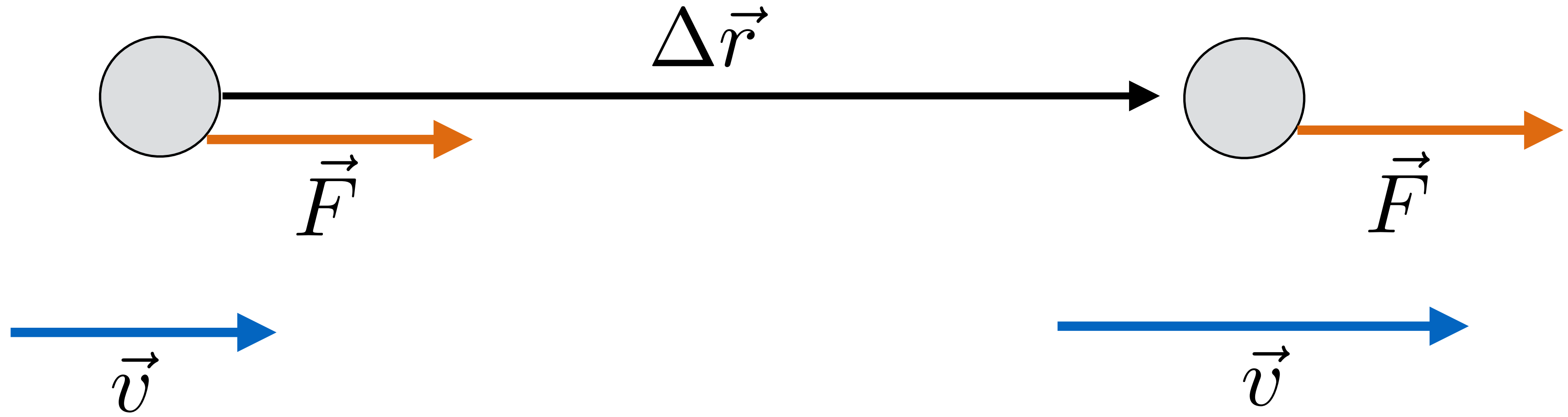
Work done by a constant force



Work done by a constant force

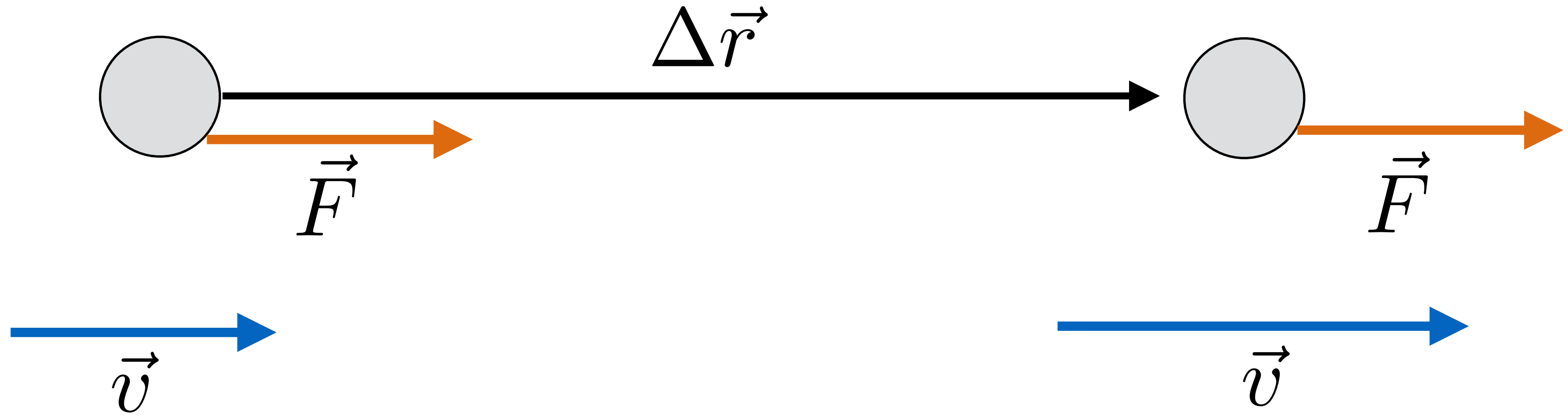


Work done by a constant force

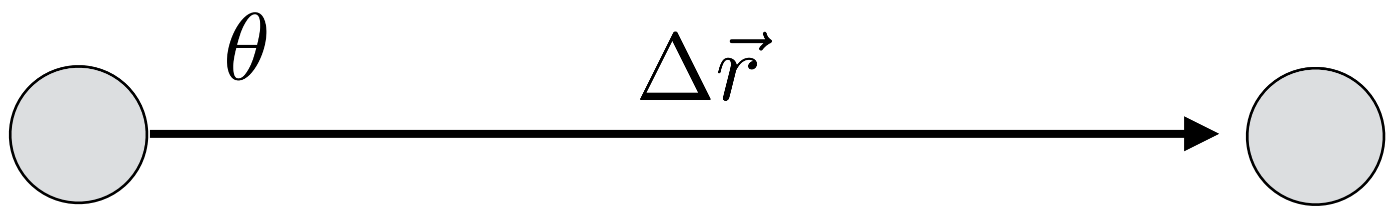


Work done by a constant force

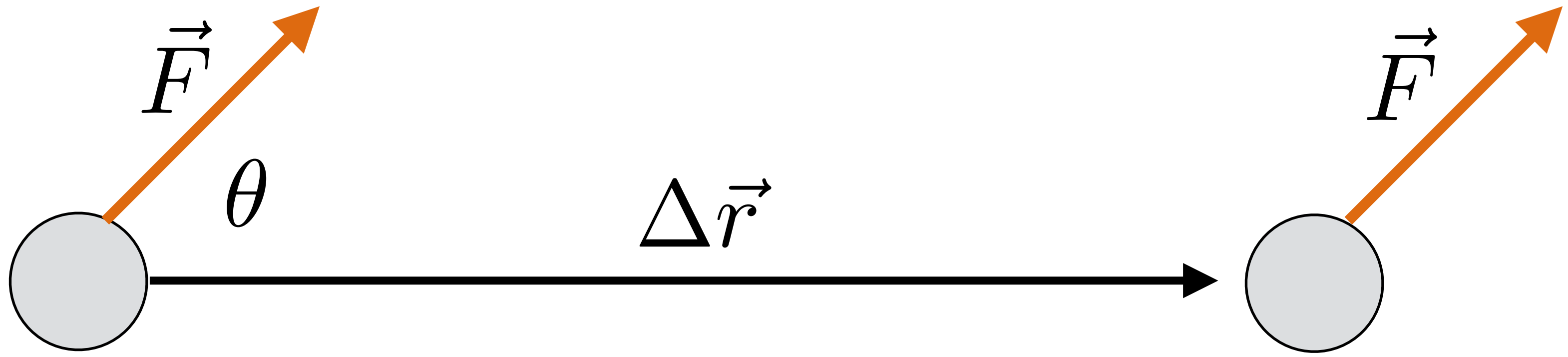
$$W = F\Delta r$$



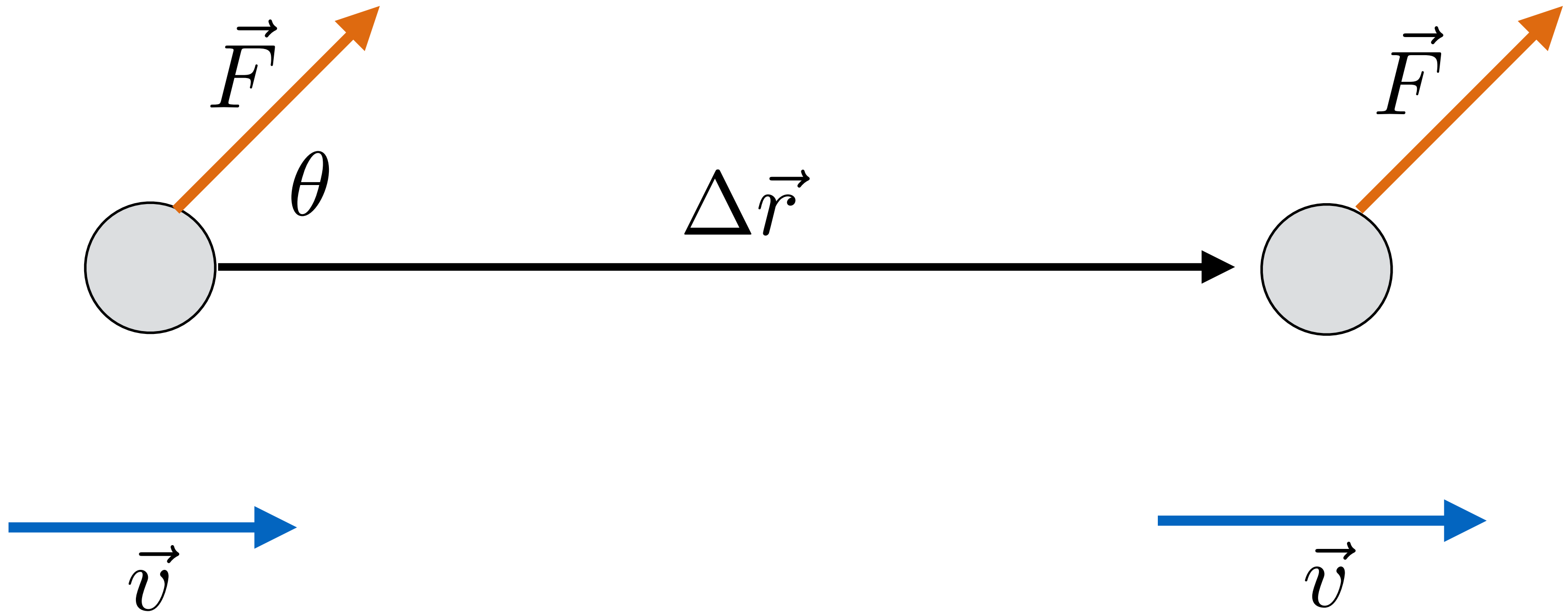
Work done by a constant force



Work done by a constant force

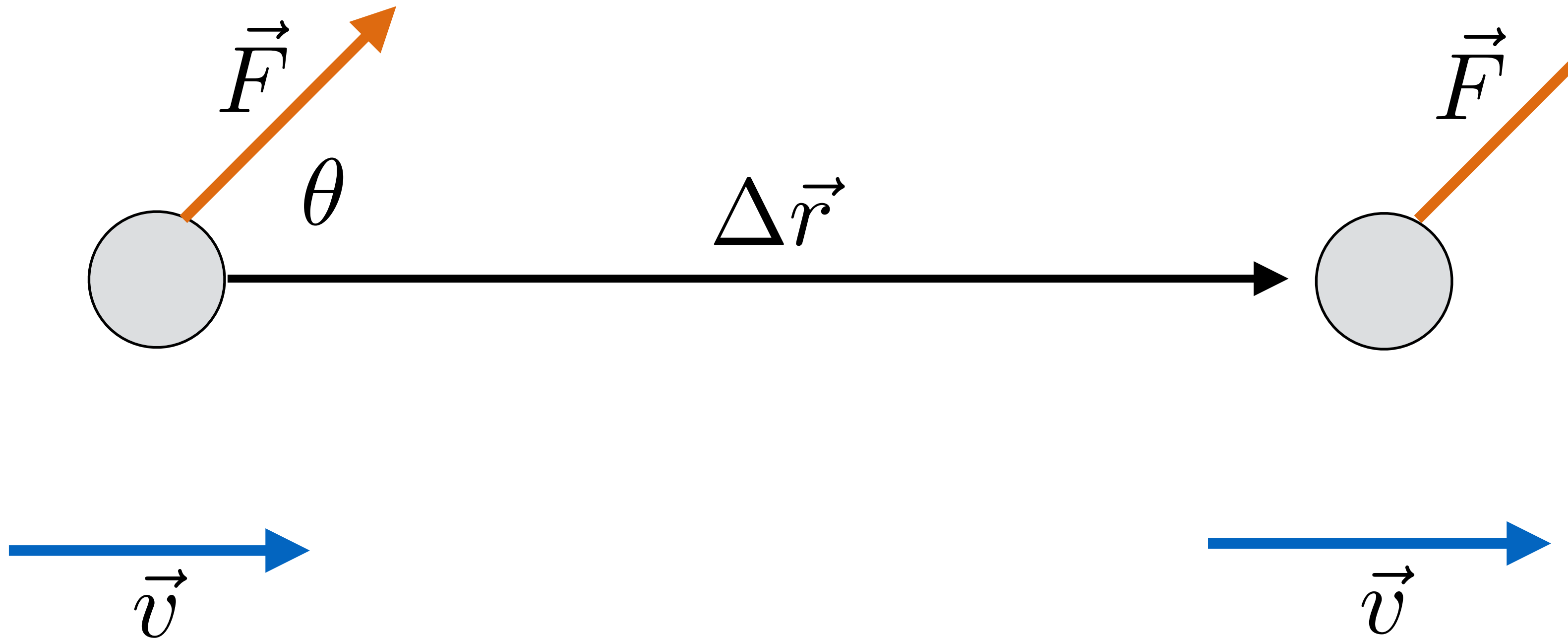


Work done by a constant force

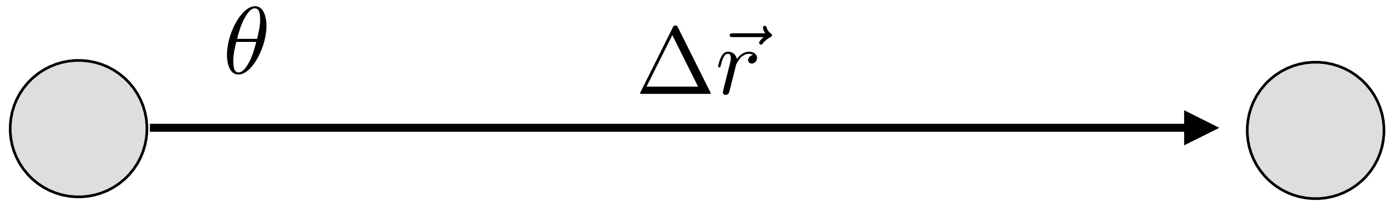


Work done by a constant force

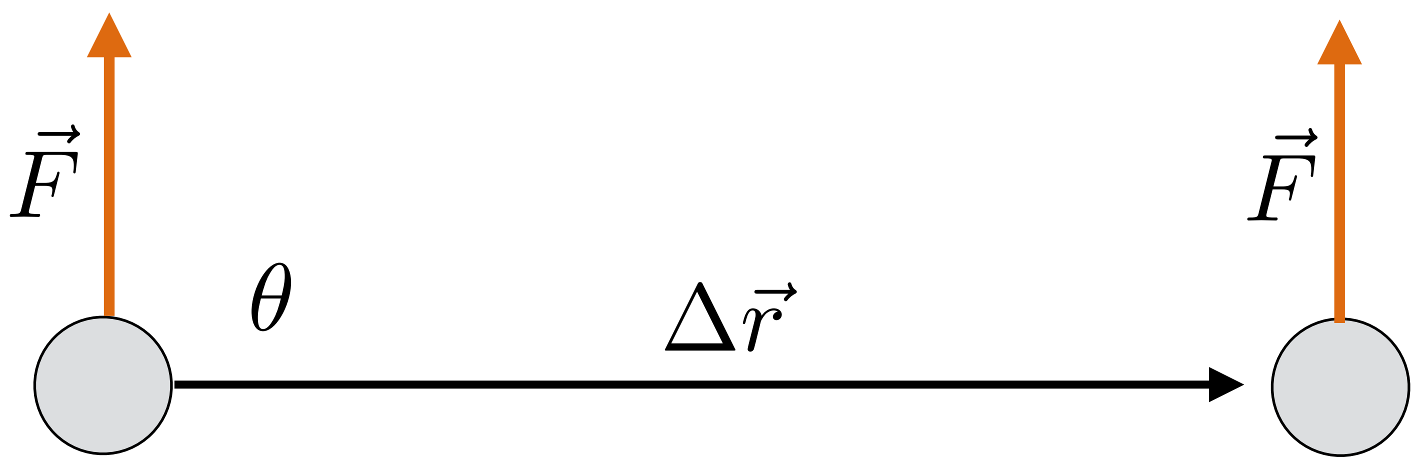
$$W = F\cos\theta\,\Delta r$$



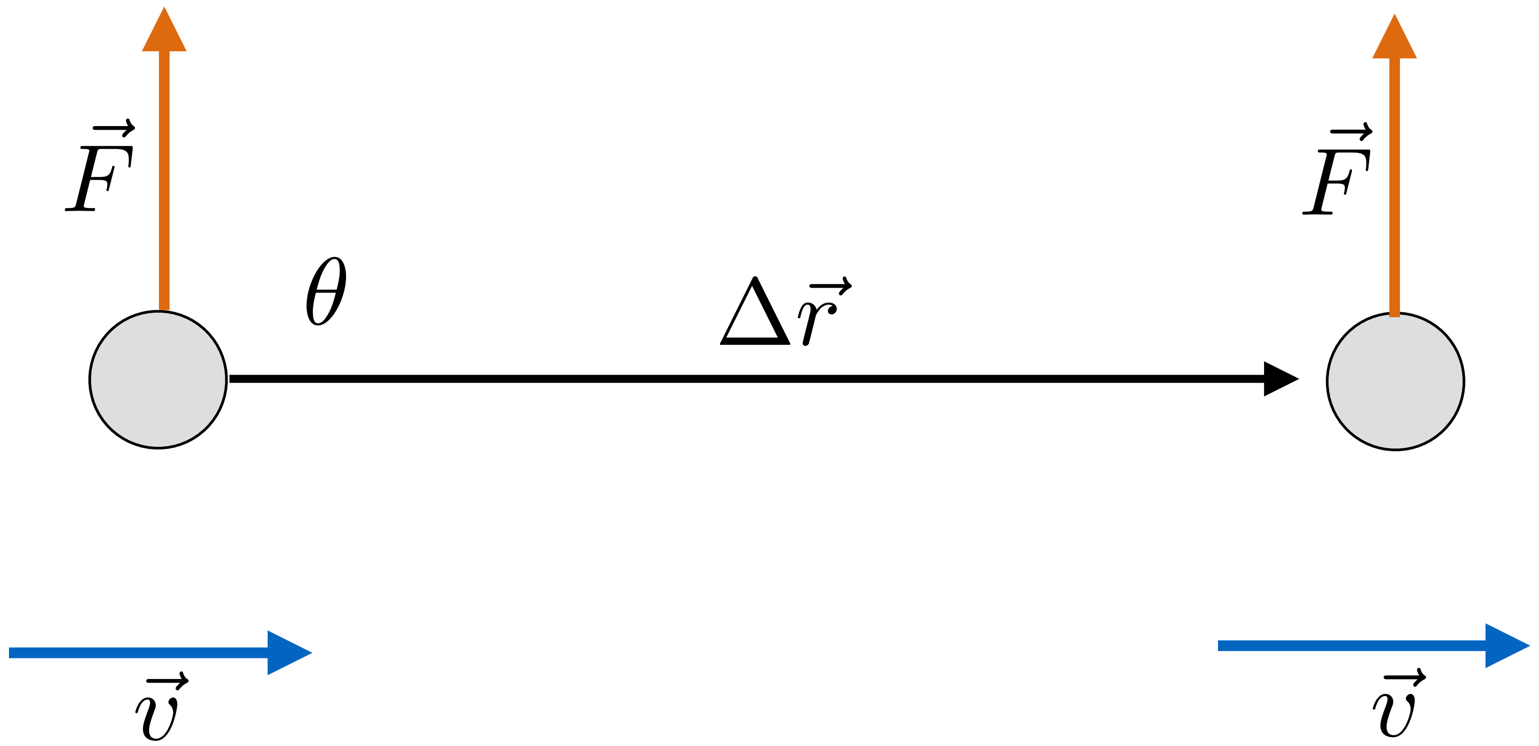
Work done by a constant force



Work done by a constant force

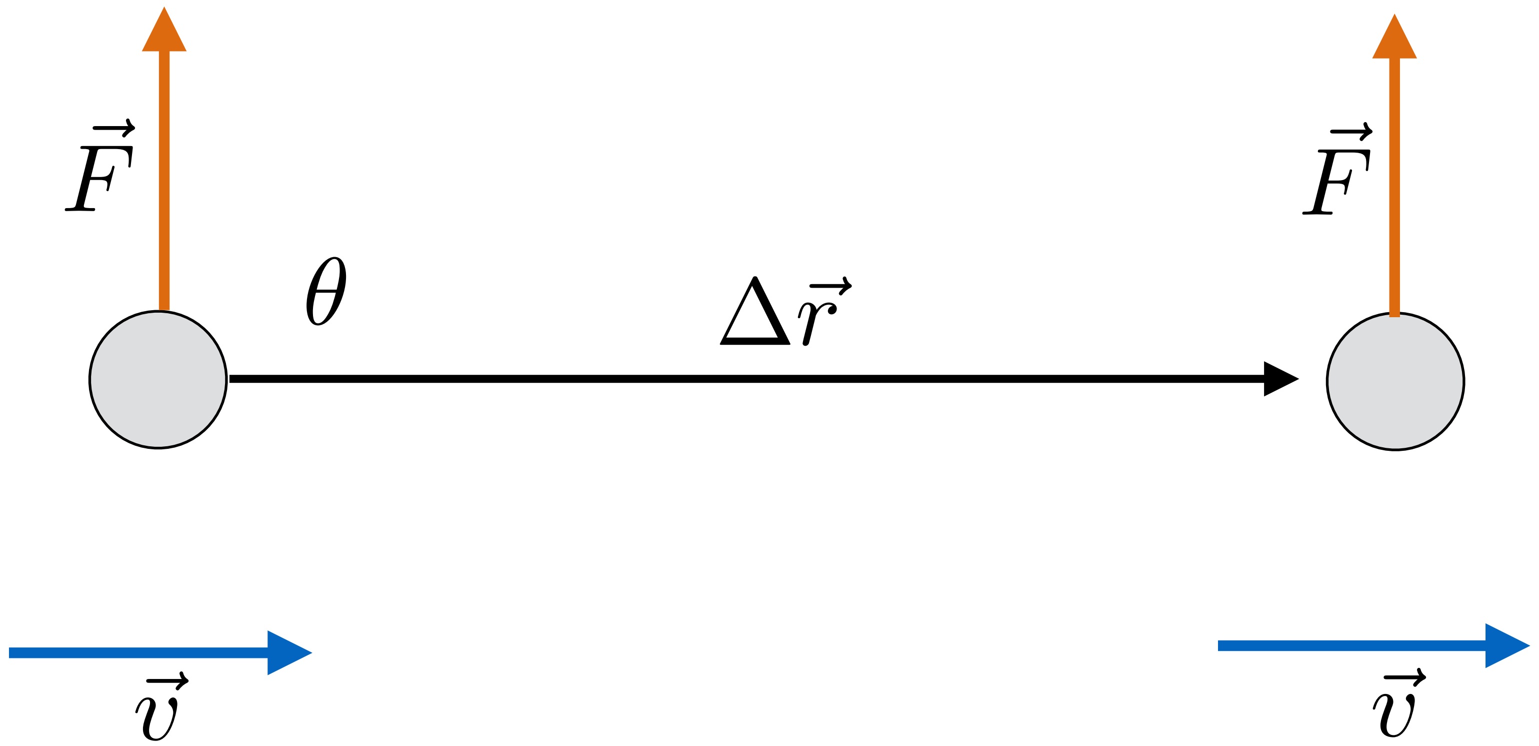


Work done by a constant force

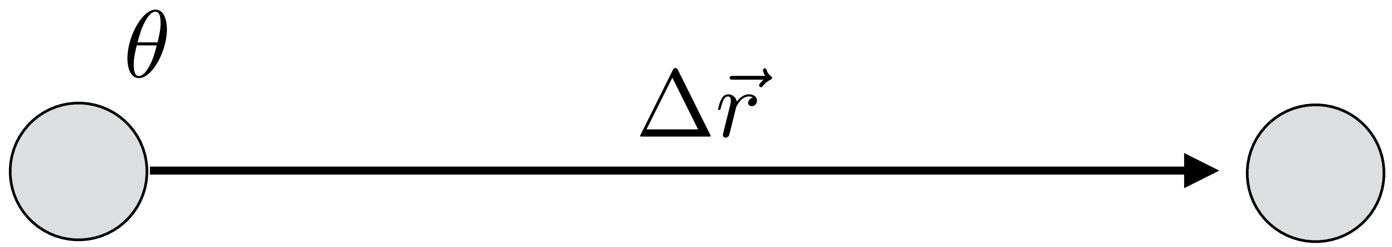


Work done by a constant force

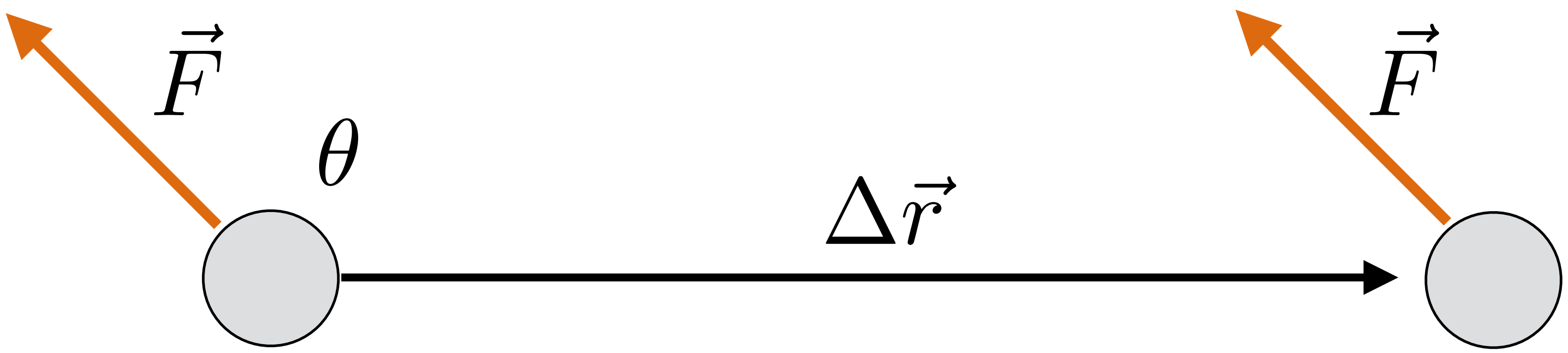
$$W = 0$$



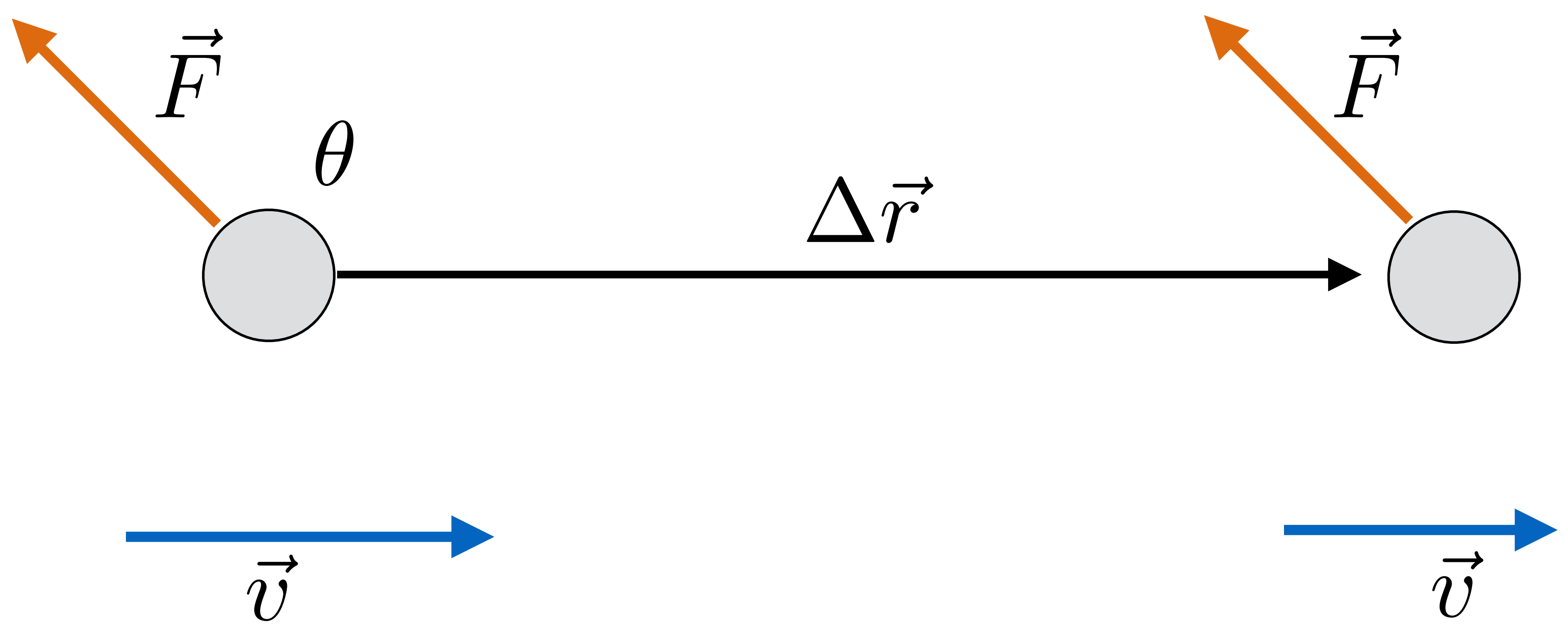
Work done by a constant force



Work done by a constant force

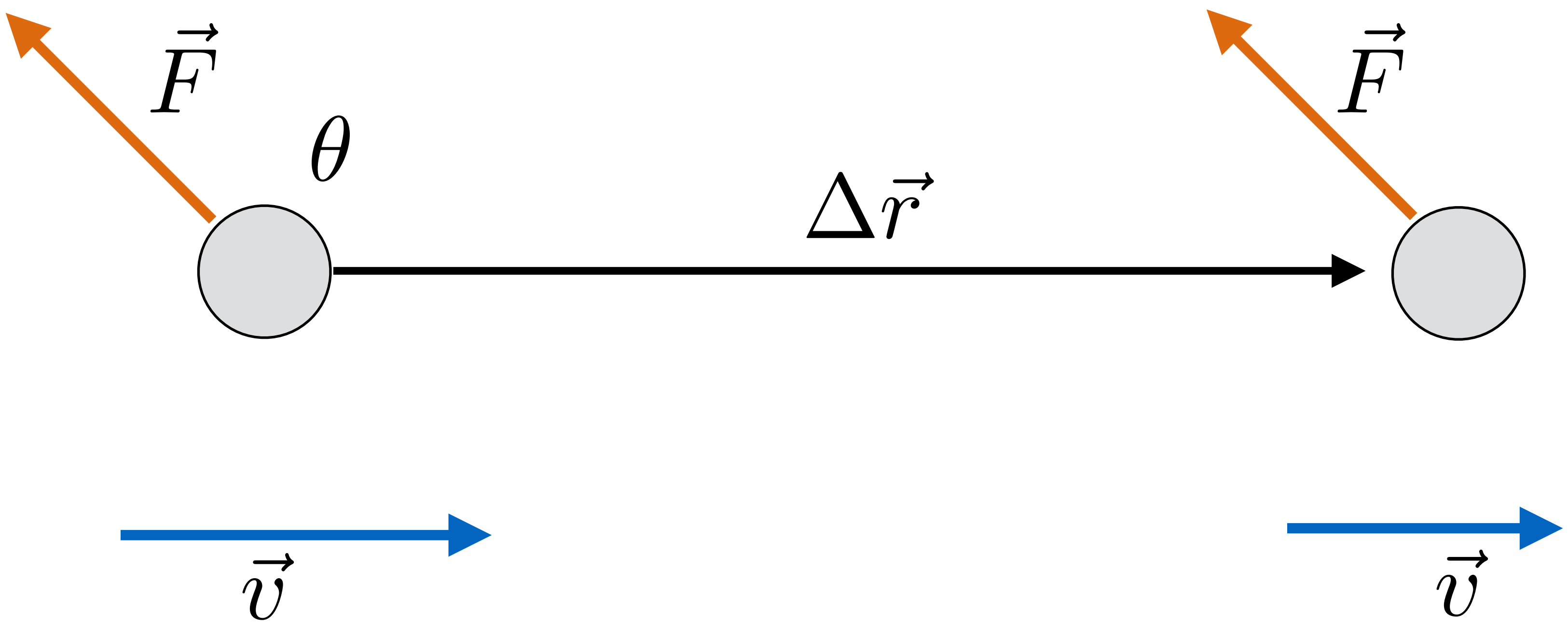


Work done by a constant force

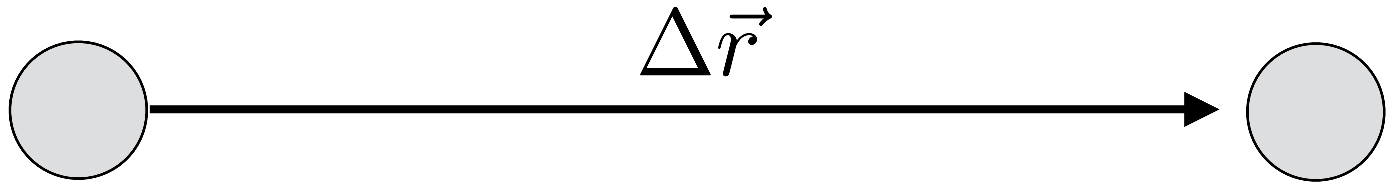


Work done by a constant force

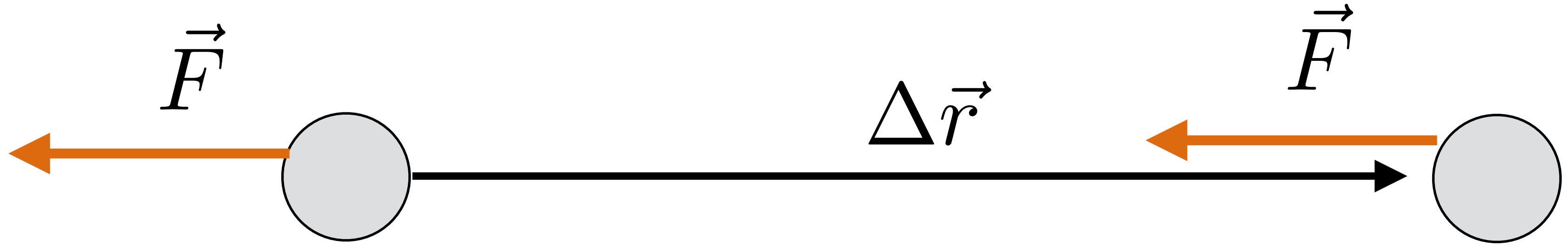
$$W = F\cos\theta\Delta r$$



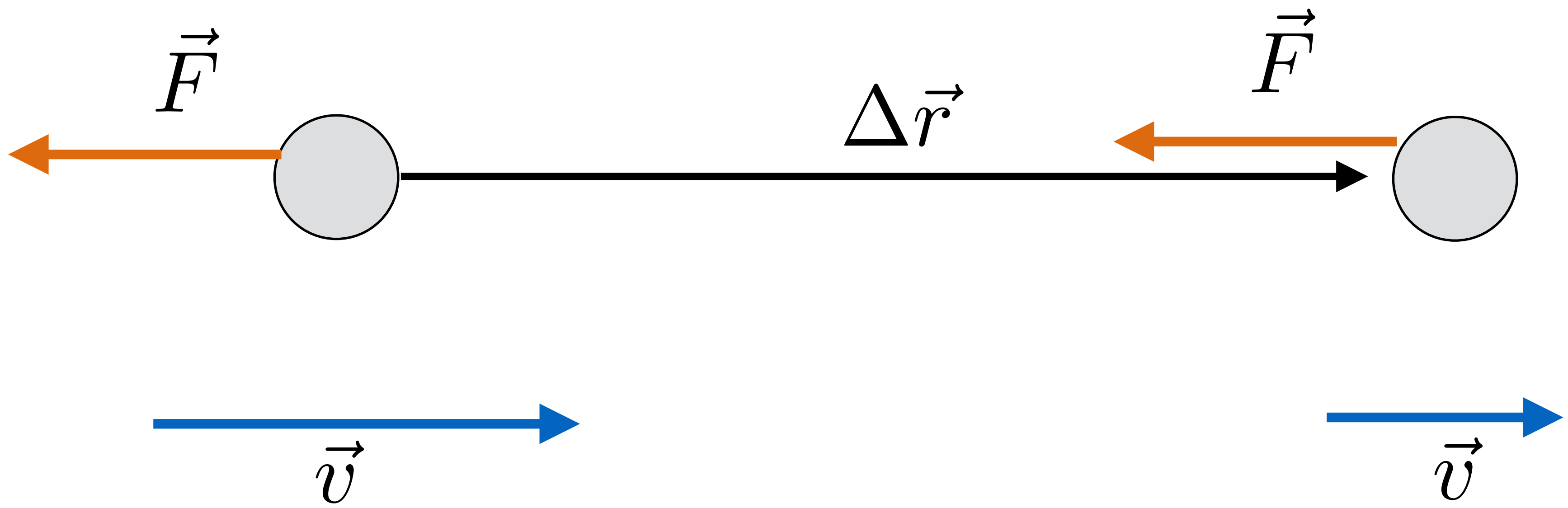
Work done by a constant force



Work done by a constant force

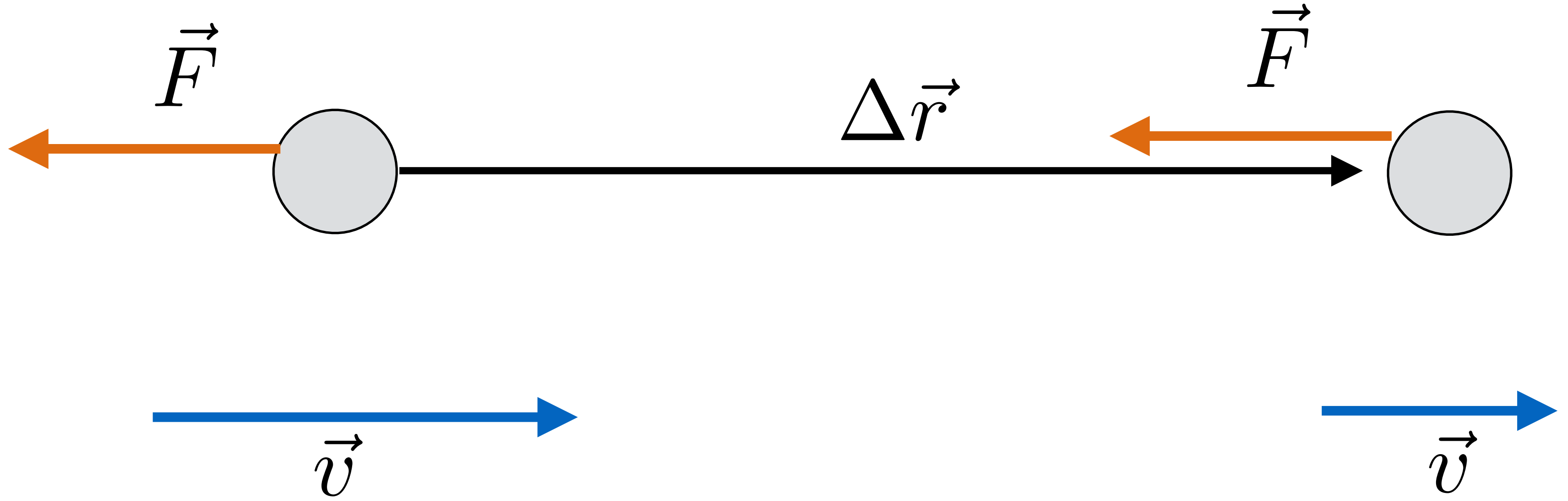


Work done by a constant force



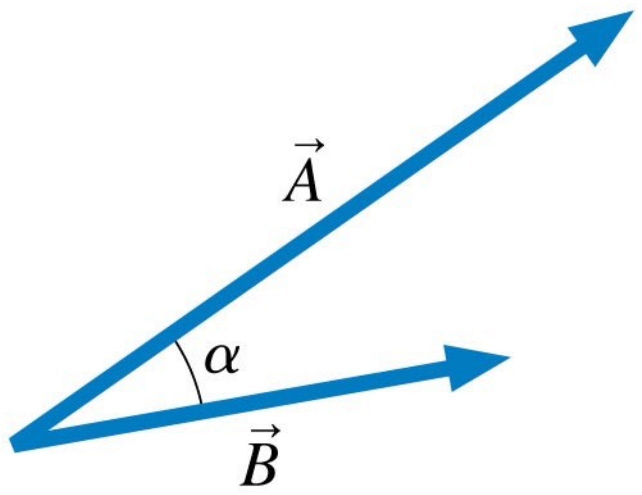
Work done by a constant force

$$W = -F\Delta r$$



The Dot Product

$$\vec{A} \cdot \vec{B} = AB\cos\alpha$$

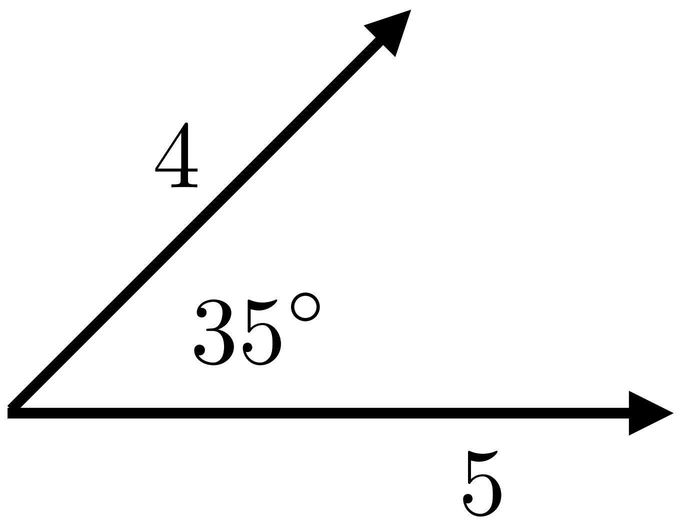


Also called the scalar product because the result is a scalar

Question #8

Compute the dot product of the two vectors

a) 12
b) -18
c) 16
d) 11



Dot Product using components

$$\vec{A} = A_x \hat{\imath} + A_y \hat{\jmath}$$

and $\vec{B} = B_x \hat{\imath} + B_y \hat{\jmath}$,

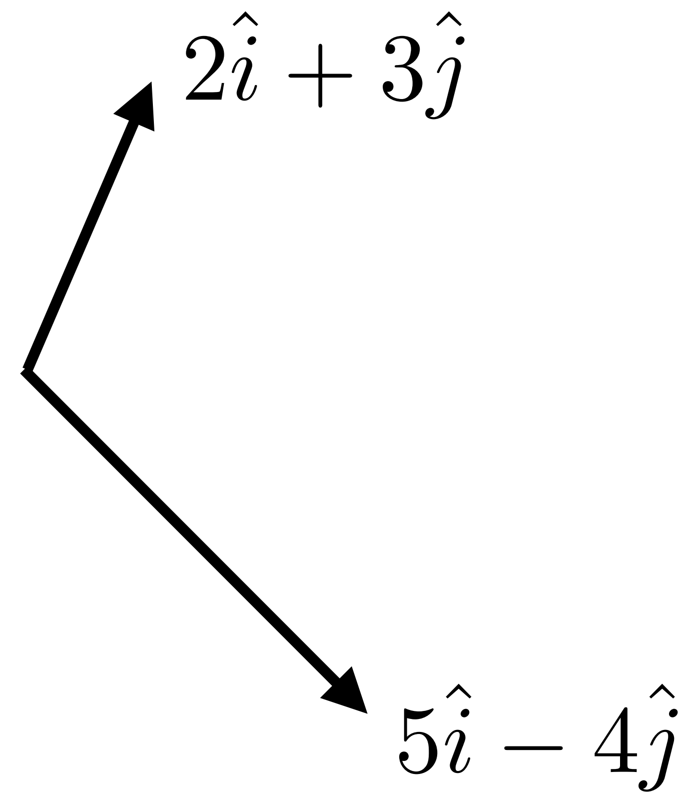
the dot product is the sum of the products of the components:

$$\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y$$

Question #9

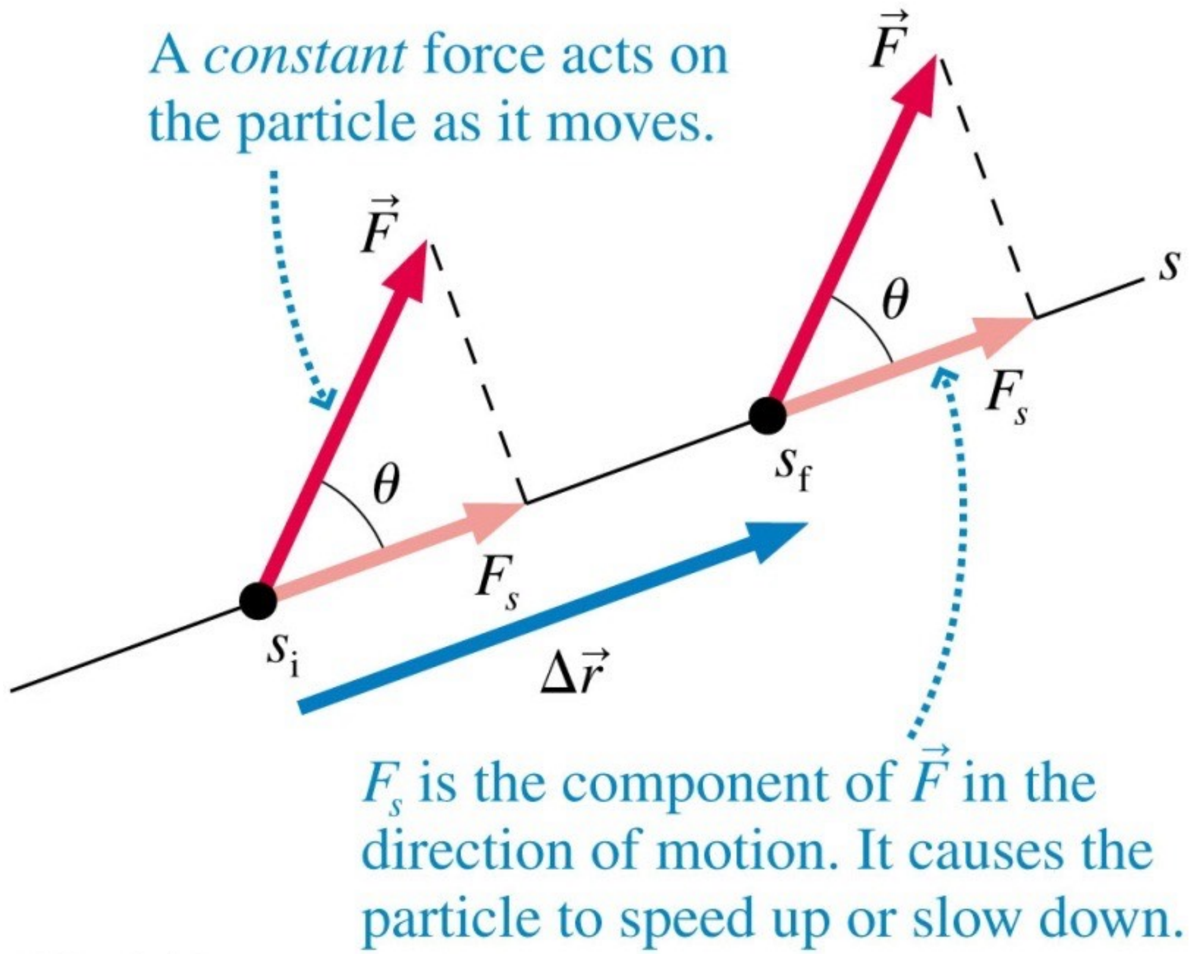
Compute the dot product of the two vectors

a) 12
b) -2
c) -22
d) 16
e) 22



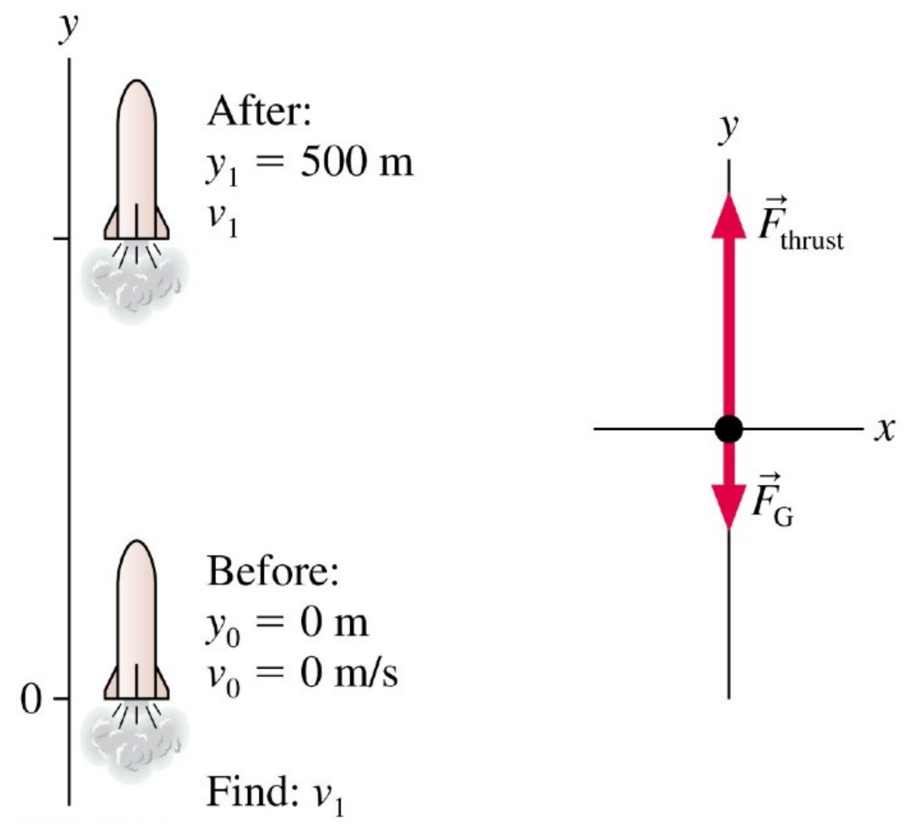
Work Done by a Constant Force

$$W = \vec{F} \cdot \Delta\vec{r}$$



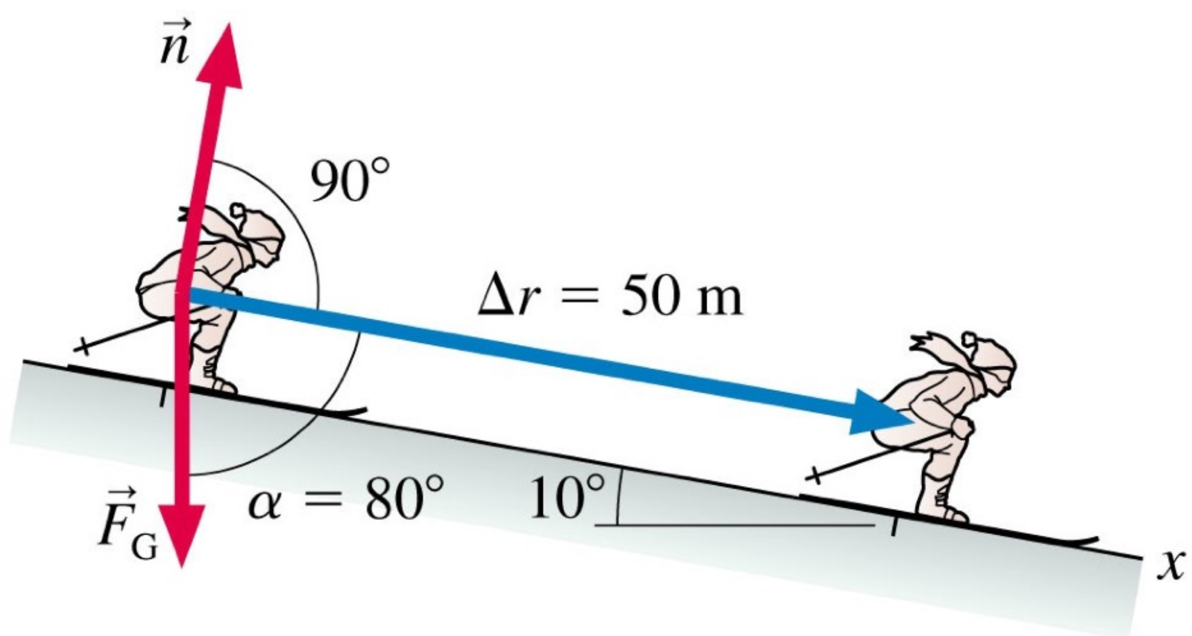
Work during a rocket launch

A 150,000 kg rocket is launched straight up. The rocket motor generates a thrust of 4,000,000 N. What is the rocket's speed at a height of 500 m? Ignore air resistance and mass losses.



Using the dot product to compute work

A 70-kg skier is gliding at 2.0 m/s when he starts down a very slippery 50-m long, 10 degree slope. What is his speed at the bottom?



Before:

$x_0 = 0$ m
$v_0 = 2.0$ m/s
$m = 70$ kg

After:

$x_1 = 50$ m
v_1

Find: v_1