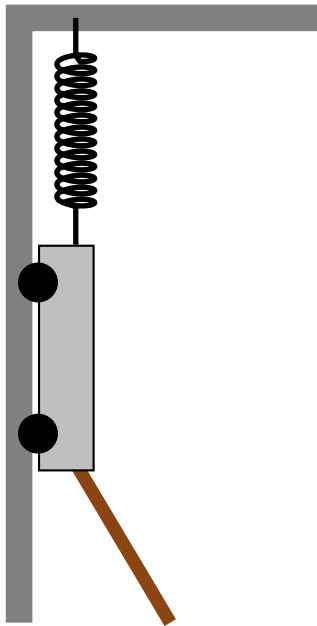# Question 1

A cart is attached to a track by frictionless rails, which restrict the motion of the cart to the vertical direction. The cart is is suspended from the ceiling by a spring.
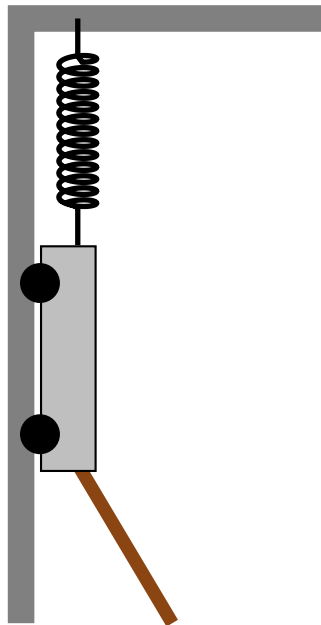

The cart is initially at rest. A rope then pulls the cart with a constant force at an angle from beneath and the cart moves down. Which of the following is true?

1. $W_{\text{spring}} > 0$ and $W_{\text{rope}} > 0$

2. $W_{\text{spring}} > 0$ and $W_{\text{rope}} < 0$

3. $W_{\text{spring}} < 0$ and $W_{\text{rope}} > 0$

4. $W_{\text{spring}} < 0$ and $W_{\text{rope}} < 0$

5. $W_{\text{spring}} = 0$ and $W_{\text{rope}} = 0$

Question 2

A cart is attached to a track by frictionless rails, which restrict the motion of the cart to the vertical direction. The cart is is suspended from the ceiling by a spring.


A rope then pulls the cart with a constant force at an angle from beneath and the cart moves down. Which of the following is true?

1. $\Delta E_{\text{mech}} = 0$

2. $\Delta E_{\text{mech}} = W_{\text{rope}}$

3. $\Delta E_{\text{mech}} = W_{\text{grav}}$

4. $\Delta E_{\text{mech}} + \Delta U_{\text{grav}} + \Delta U_{\text{spring}} = W_{\text{rope}}$

5. $\Delta E_{\text{mech}} + \Delta U_{\text{grav}} + \Delta U_{\text{spring}} = W_{\text{rope}} + W_{\text{grav}}$

Question 3

A plot of potential energy (for a complicated interaction) is indicated by the solid curve. The particle's mechanical energy is indicated by the dashed curve. The horizontal axis indicates position in meters.
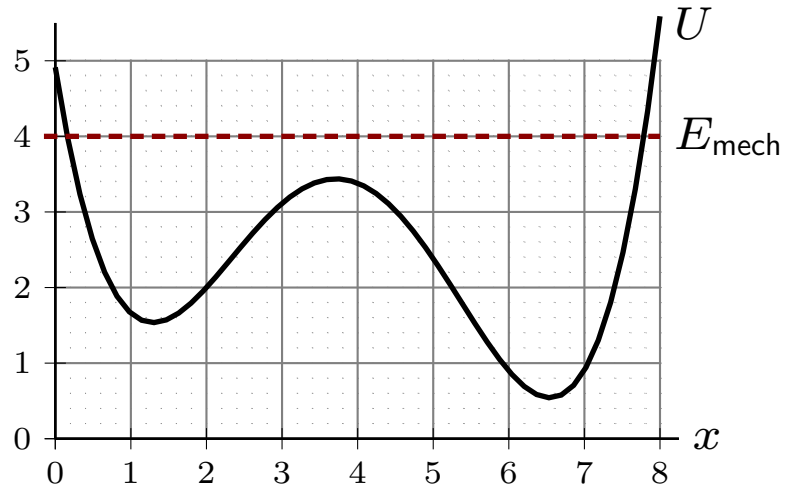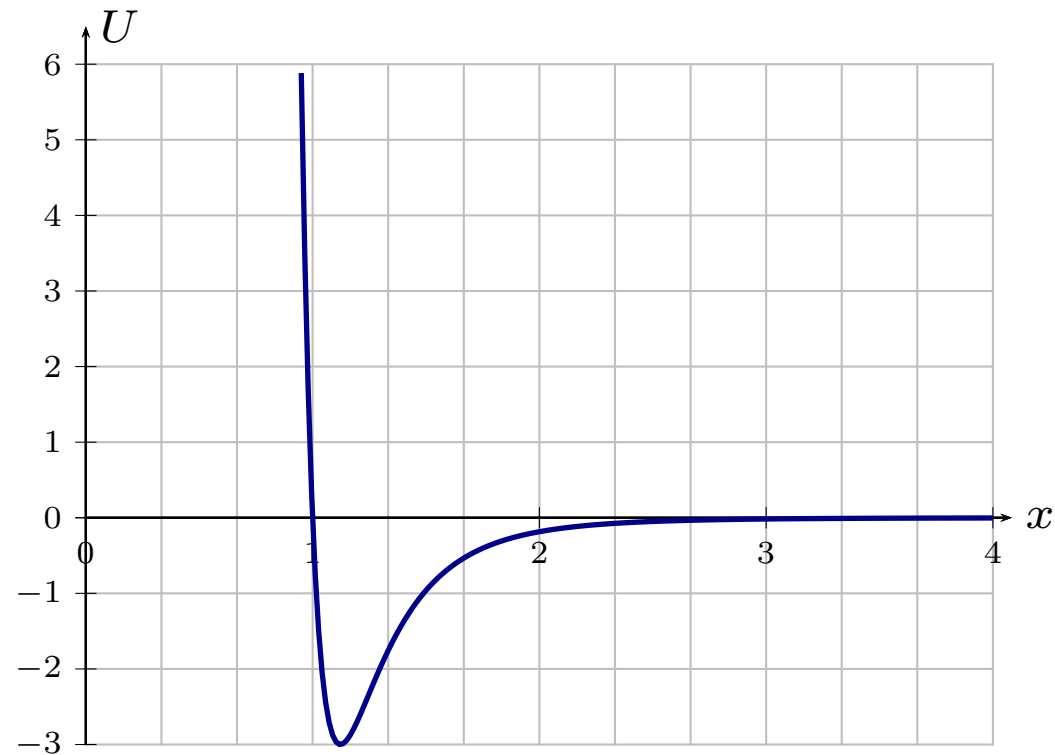

When does the particle attain its largest speed?

1. About $0.2\,\mathrm{m}$

2. About $1.4\,\mathrm{m}$

3. About $3.8\,\mathrm{m}$

4. About $6.6\,\mathrm{m}$
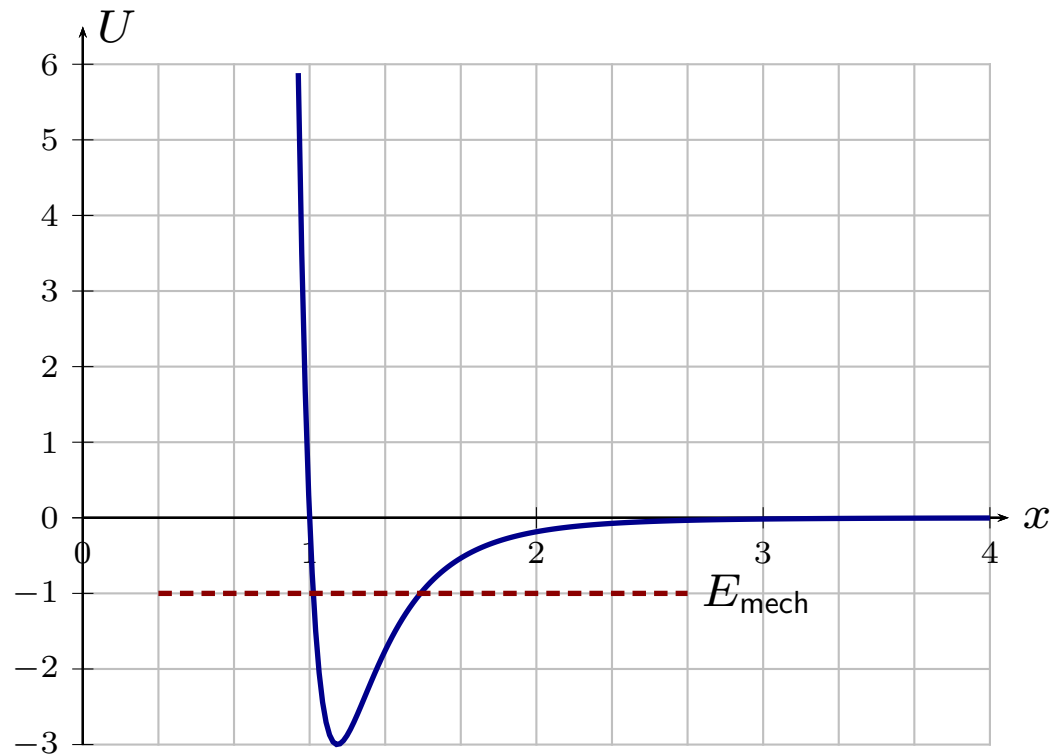
5. About $7.8\,\mathrm{m}$

Lennard-Jones Potential
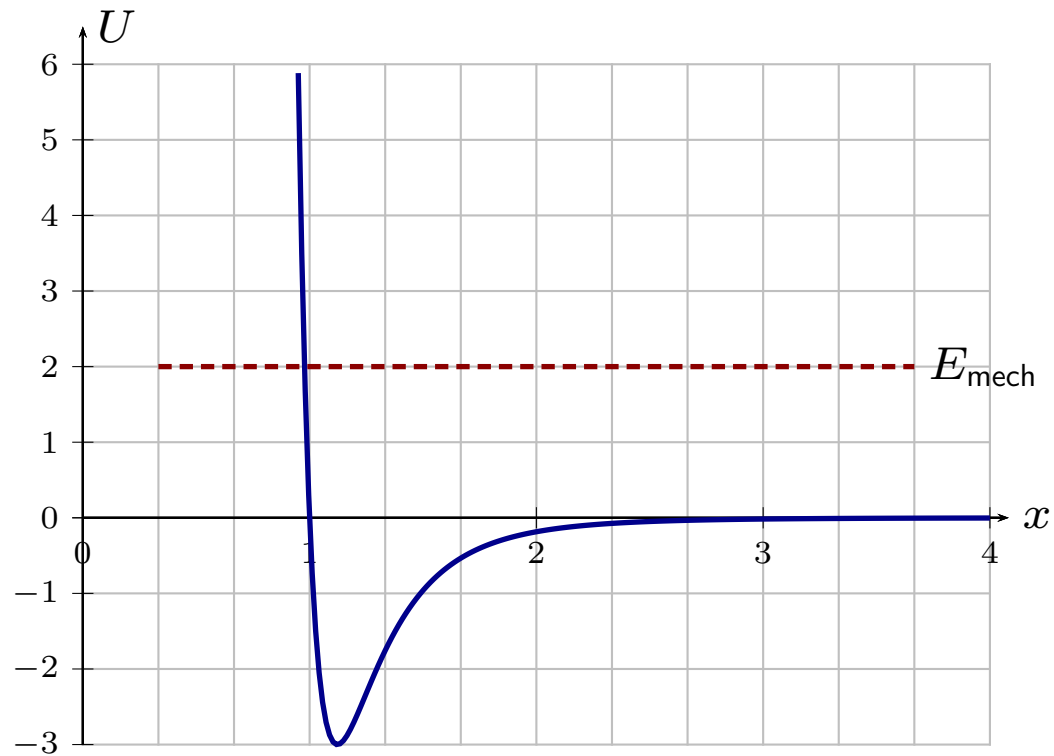
Models interactions between two molecules in a gas.
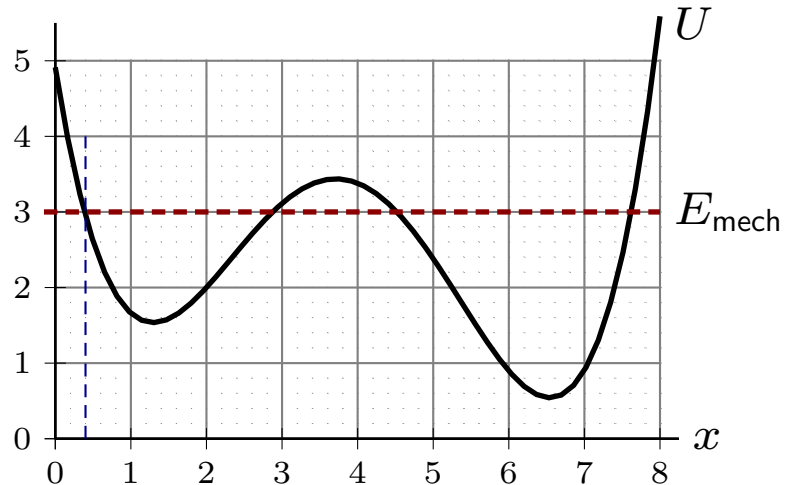
Lennard-Jones Potential

Molecules are bound.

Lennard-Jones Potential

Molecules are not bound.

Question 4

A plot of potential energy (for a complicated interaction) is indicated by the solid curve. The particle's mechanical energy is indicated by the dashed curve. The horizontal axis indicates position in meters.

At an initial moment the particle is at $x = 0.4\,\mathrm{m}$. Which of the following is true?

1. It will start to move right and will definitely reach $x = 7.5\,\mathrm{m}$

2. It will start to move right and will definitely not reach $x = 7.5\,\mathrm{m}$

3. It will start to move right and there is some chance it will reach $x = 7.5\,\mathrm{m}$ but it there is also some chance that it may not reach $x = 7.5\,\mathrm{m}$.