TP3

3.1)

a) $m = 5\,kg \qquad \vec{F} = (-2y + 4)\hat{i} + (-2x - 2)\hat{j} \qquad y = \frac{x}{2} \Leftrightarrow x = 2y$

$$W = \int_1^5 -2\left(\frac{x}{2}\right) + 4\,dx + \int_{1/2}^{5/2} -4y - 2\,dy = \int_1^5 -x + 4\,dx + \int_{1/2}^{5/2} -4y - 2\,dy$$

$$= \left[\frac{-x^2}{2} + 4x\right]_1^5 + \left[-2y^2 - 2y\right]_{1/2}^{5/2}$$

$$= (-12{,}5 + 20) - \left(-\frac{1}{2} + 4\right) + \left(-2\frac{25}{4} - 2\frac{5}{2}\right) - \left(-2\frac{1}{4} - 2\frac{1}{2}\right)$$

$$= 7{,}5 - 3{,}5 + \left(-\frac{25}{2} - \frac{10}{2}\right) - \left(-\frac{1}{2} - \frac{2}{2}\right)$$

$$= 4 + \left(-\frac{35}{2}\right) - \left(-\frac{3}{2}\right) = 4 - \frac{35}{2} + \frac{3}{2} = 4 - \frac{32}{2} = 4 - 16 = -12\,J$$

b)

$$W = -\Delta E_p = -(-12) = 12\,J$$

c) $x = 1$

$v_i = 4\,m/s$

$$E_{ci} = \frac{1}{2} m v_i^2 = \frac{1}{2} \cdot 5 \cdot 4^2 = 40\,J$$

$$E_{cf} = \frac{1}{2} m v_f^2$$

$$W = \Delta E_c = E_{cf} - E_{ci} \Leftrightarrow E_{cf} - 40 = -12\,J \Leftrightarrow E_{cf} = 28\,J$$

3.2)

$m = 3\,kg$

$v_i = 5\,m/s$

$x_i = 0$

$\mu = 0{,}6\,e^x$

a) $F_a = N\mu = P\mu = 9.8 \cdot 3 \cdot 0{,}6\,e^x = -18\,e^x$

b) $$W = \int_0^1 -18\,e^x = -18\left[e^x\right]_0^1 = -18[e - 1] = -30{,}9\,J$$

c)

$$W = \Delta E_c = E_{cf} - E_{ci}$$

$$E_{ci} = \frac{1}{2} \cdot 3 \cdot 5^2 = 37,5$$

$$-30,9 = E_{cf} - 37,5 \iff E_{cf} = 6.6 \iff \frac{1}{2} \cdot 3 \cdot v_f^2 = 6.6$$

$$\iff v^2 = 4.4 \iff v = 2.1 \text{ m/s}$$

3.3)

a) $p_{i_1} = m_1 v_{1i}$

$p_{i_2} = 0$

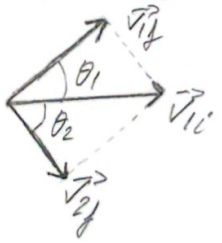
$$p_{i1} = p_{f1} + p_{f2}$$

$$\iff m_1 v_{1i} = m_1 v_{1f} + m_2 v_{2f}$$

$$\begin{cases} x: & m_1 v_{1i} = m_1 v_{1f} \cdot \cos(\theta_1) + m_2 \cdot v_{2f} \cdot \cos(\theta_2) \\ y: & 0 = m_1 v_{1f} \cdot \text{sen}(\theta_1) + m_2 \cdot v_{2f} \cdot \text{sen}(\theta_2) \end{cases}$$

$$\frac{v_{1f}}{v_{2f}} = \frac{m_2 \cdot \text{sen}(\theta_2)}{m_1 \cdot \text{sen}(\theta_1)}$$

b) $m_1 = m_2 \quad \theta_1 = 45° \quad \theta_2 = 30°$



$$\vec{v}_{1i} = \vec{v}_{1f} + \vec{v}_{2f}$$

$$\frac{1}{2} m v_{1i}^2 = \frac{1}{2} m v_{1f}^2 + \frac{1}{2} m v_{2f}^2$$

$$\iff v_{1i}^2 = \vec{v}_{1f} + \vec{v}_{2f} = (\vec{v}_{1f} + \vec{v}_{2f}) \cdot (\vec{v}_{1f} + \vec{v}_{2f}) = v_{1f}^2 + v_{2f}^2 + (2\vec{v}_{1f} + \vec{v}_{2f})$$

Para haver consv. do energ.

$$\vec{v}_{1f} \cdot \vec{v}_{2f} = 0 \qquad |\vec{v}_{1f}| \cdot |\vec{v}_{2f}| \cdot \cos(\measuredangle v_{1f}, v_{2f})$$

$$\theta_1 + \theta_2 = 45 + 30 = 75° \neq 90°$$

Logo, não há conservação do energia