

1 Exercice 2 Page 19

1.1

Système conservatif car pas de frottements

$$E_T(M) = E_P(M) + E_C(M)$$

$$\Delta E_C = -\Delta E_P$$

1.2

$$O\vec{M} = -R \sin(\theta)\vec{x} + z(R - R \cos(\theta))$$

$$z_r = R(1 - \cos(\theta))$$

$$E_P(M) = mg\Delta z$$

$$\Delta z = z_M - z_0 = z_M$$

$$\Rightarrow E_p(A) = mgR(1 - \cos(\alpha))$$

1.3

$$E_m(A) = E_c(A) + E_p(A) = \frac{1}{2}mv^2(A) + E_p(A)$$

$$\Rightarrow E_m(A) = mgR(1 - \cos(\alpha))$$

$$E_m(O) = E_c(O) + E_p(O) = E_c(O) = \frac{1}{2}mv_O^2$$

$$\Rightarrow E_m(A) = E_m(O)$$

$$\Rightarrow mgR(1 - \cos(\alpha)) = \frac{1}{2}mv_O^2$$

$$\Rightarrow v_O = \sqrt{2gR(1 - \cos(\alpha))} = 20m/s$$

1.4

1.4.1

$$W_{AO} = \int_A^O \vec{f} \cdot d\vec{l} = - \int_A^O f \cdot \underbrace{dl}_{R \cdot d\theta} = - \int_\alpha^O f \cdot R \cdot d\theta = f \cdot R \cdot \alpha$$

Frottements \Rightarrow système non conservatif $\Rightarrow \Delta E_m = W_{AO}$

1.4.2

$$\frac{1}{2}mv_0^2 = mgR(1 - \cos(\alpha)) = -fR\alpha$$

$$\Leftrightarrow f = m \frac{gR(1 - \cos(\alpha)) - \frac{V_0^2}{2}}{R\alpha} = 215.86N$$

2

2.1

$$\vec{V}_0 = V_0 \vec{x}$$

2.2

$$m \cdot \vec{a} = \sum \vec{F}_{ext} = m \cdot g \cdot \vec{z}$$

$$\frac{d^2 x}{dt^2} = 0$$

$$\frac{d^2 z}{dt^2} = g$$

$$\Leftrightarrow v_x = \underbrace{A}_{V_0}$$

$$\Leftrightarrow v_z = -gt \underbrace{B}_{=0}$$

$$\Leftrightarrow x = V_0 t + \underbrace{C}_{=0}$$

$$\Leftrightarrow z = -g \frac{t^2}{2} + \underbrace{D}_{=0}$$

$$x = V_0 t \quad z = -g \frac{t^2}{2}$$

$$t = \frac{x}{V_0}$$

$$z(x=7) = -2.45m$$