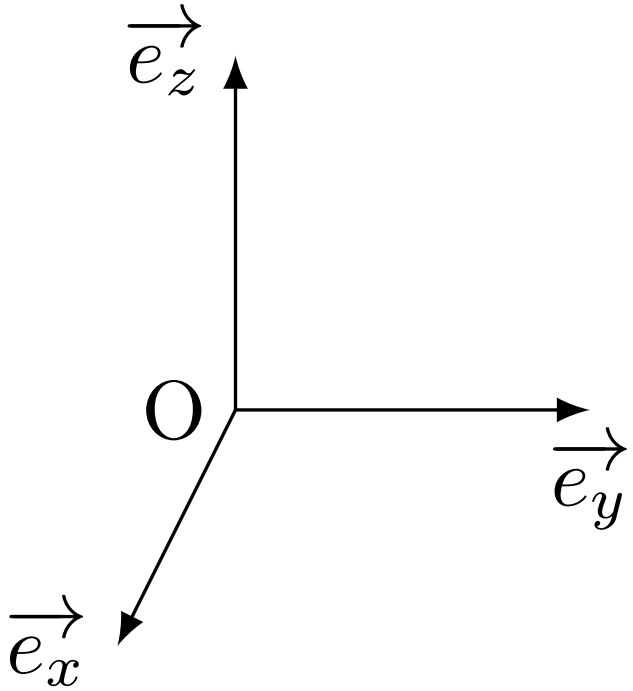
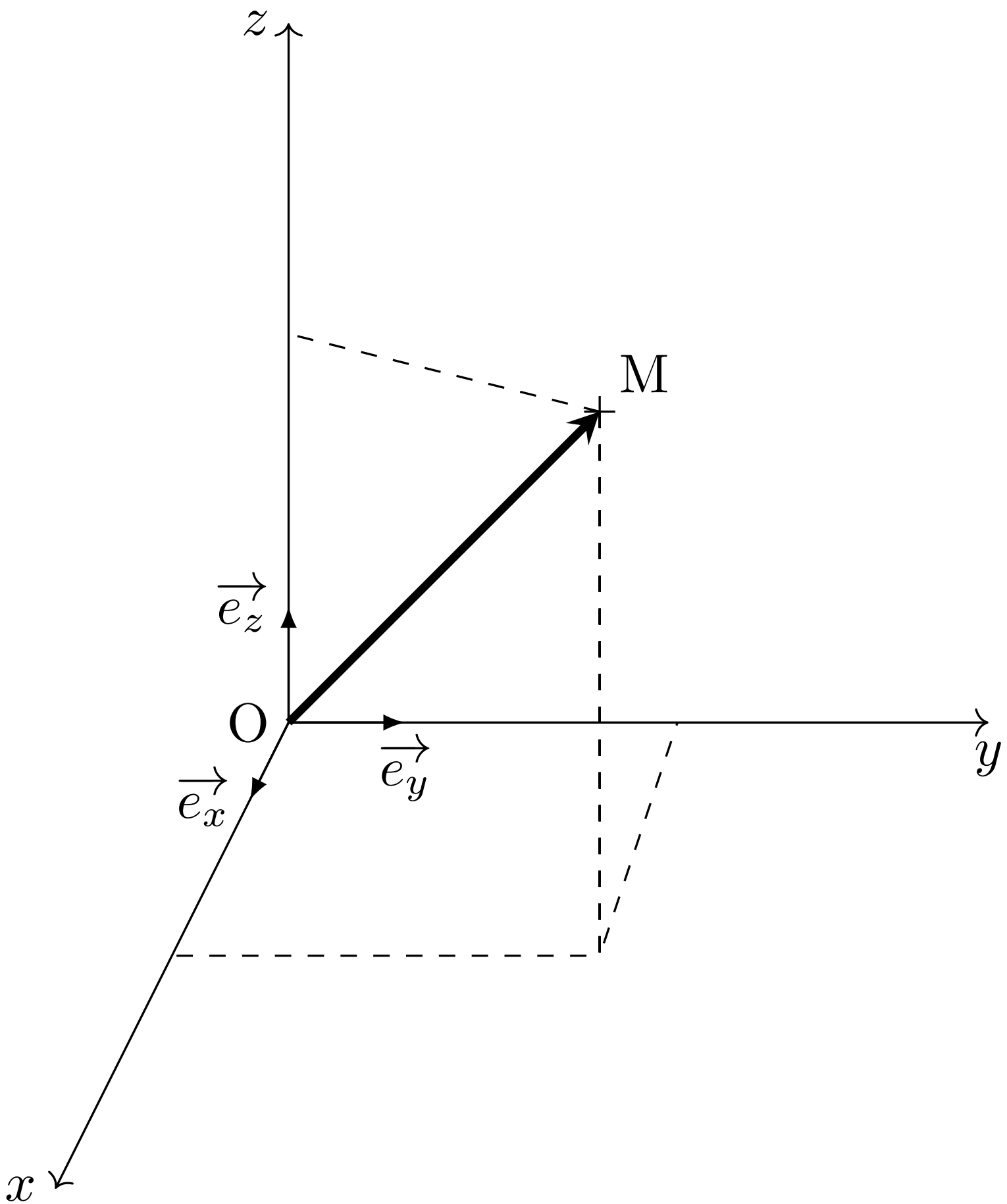
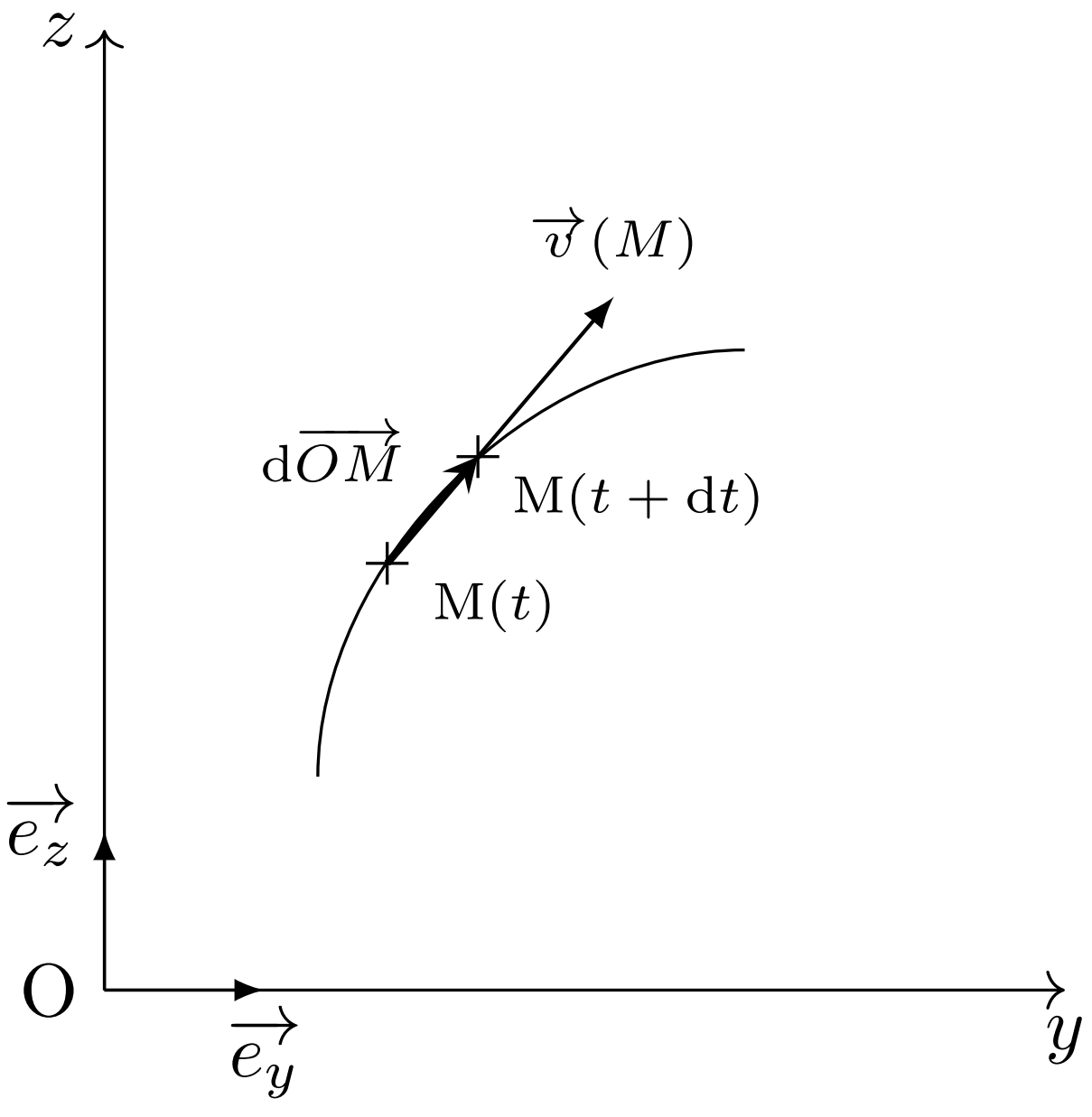
Mécanique

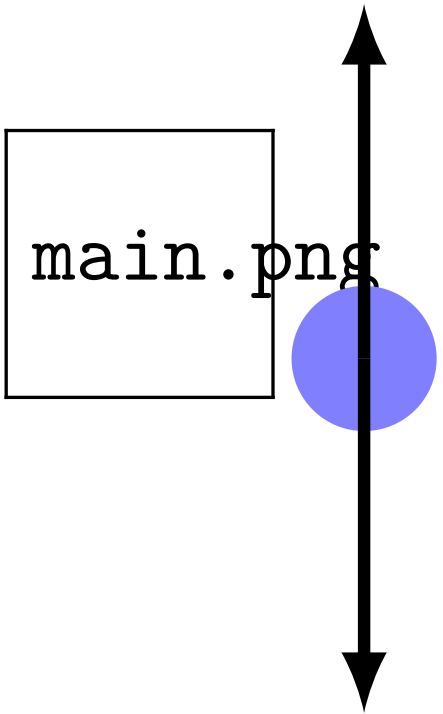


$$||\overrightarrow{e_x}|| = 1 \; ; \; ||\overrightarrow{e_y}|| = 1 \; ; \; ||\overrightarrow{e_z}|| = 1$$

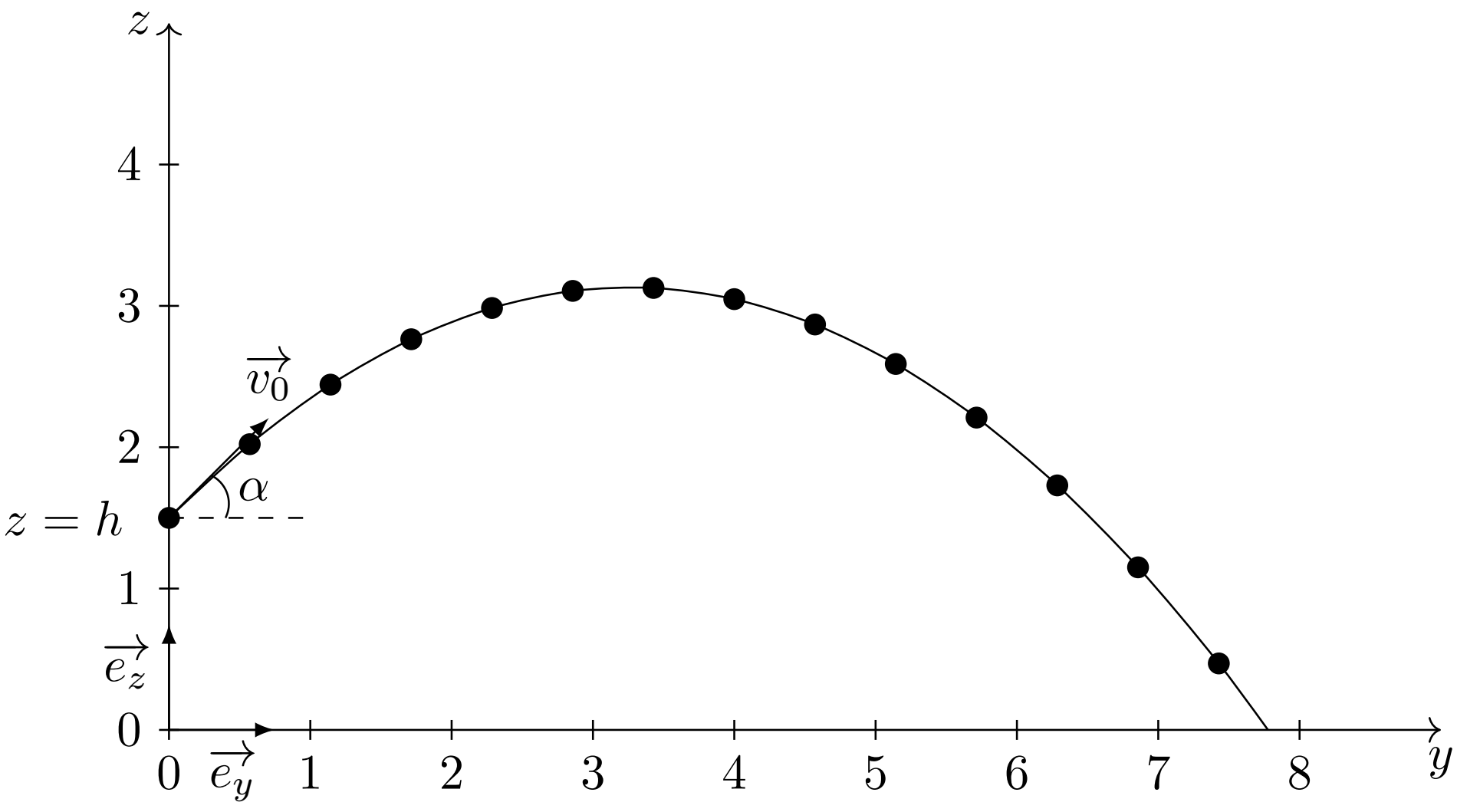

z
M
$\overrightarrow{e_z}$
O
$\overrightarrow{e_y}$
y
$\overrightarrow{e_x}$
x

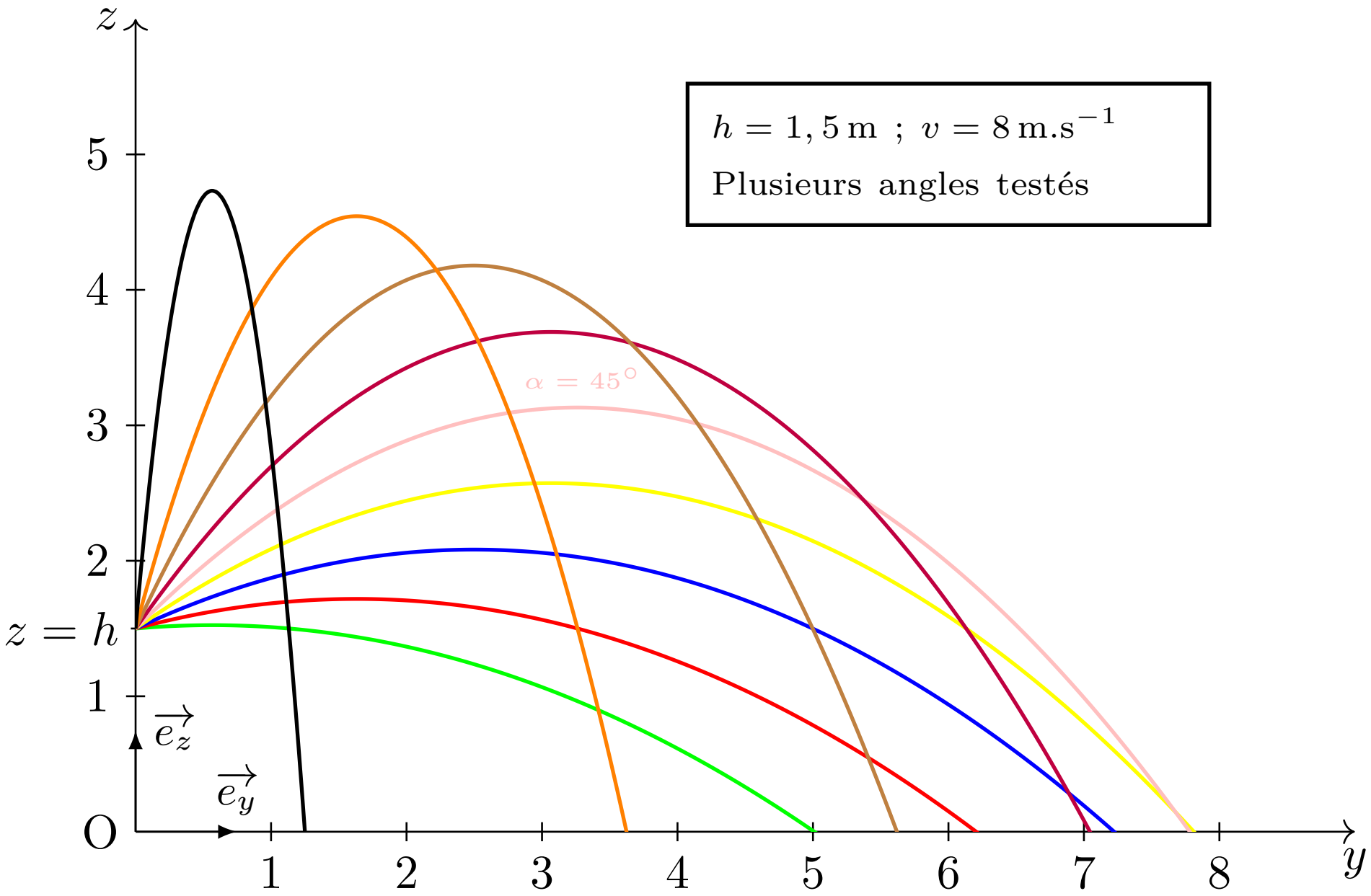

z
$\overrightarrow{v}(M)$
$\mathrm{d}\overrightarrow{OM}$
$\mathrm{M}(t+\mathrm{d}t)$
$\mathrm{M}(t)$
$\overrightarrow{e_z}$
O
$\overrightarrow{e_y}$
y

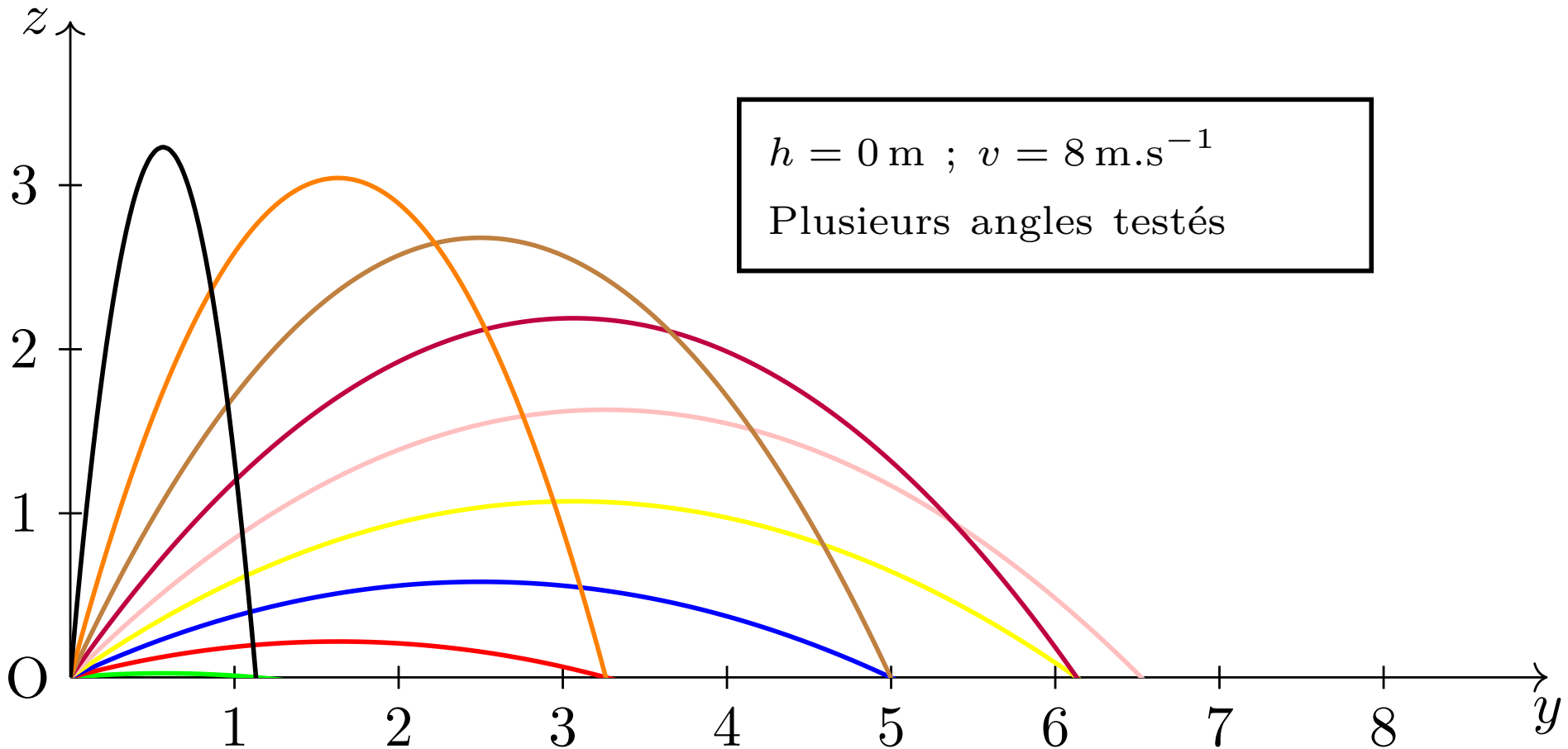
$$\overrightarrow{R} = \overrightarrow{F}_{M/O}$$

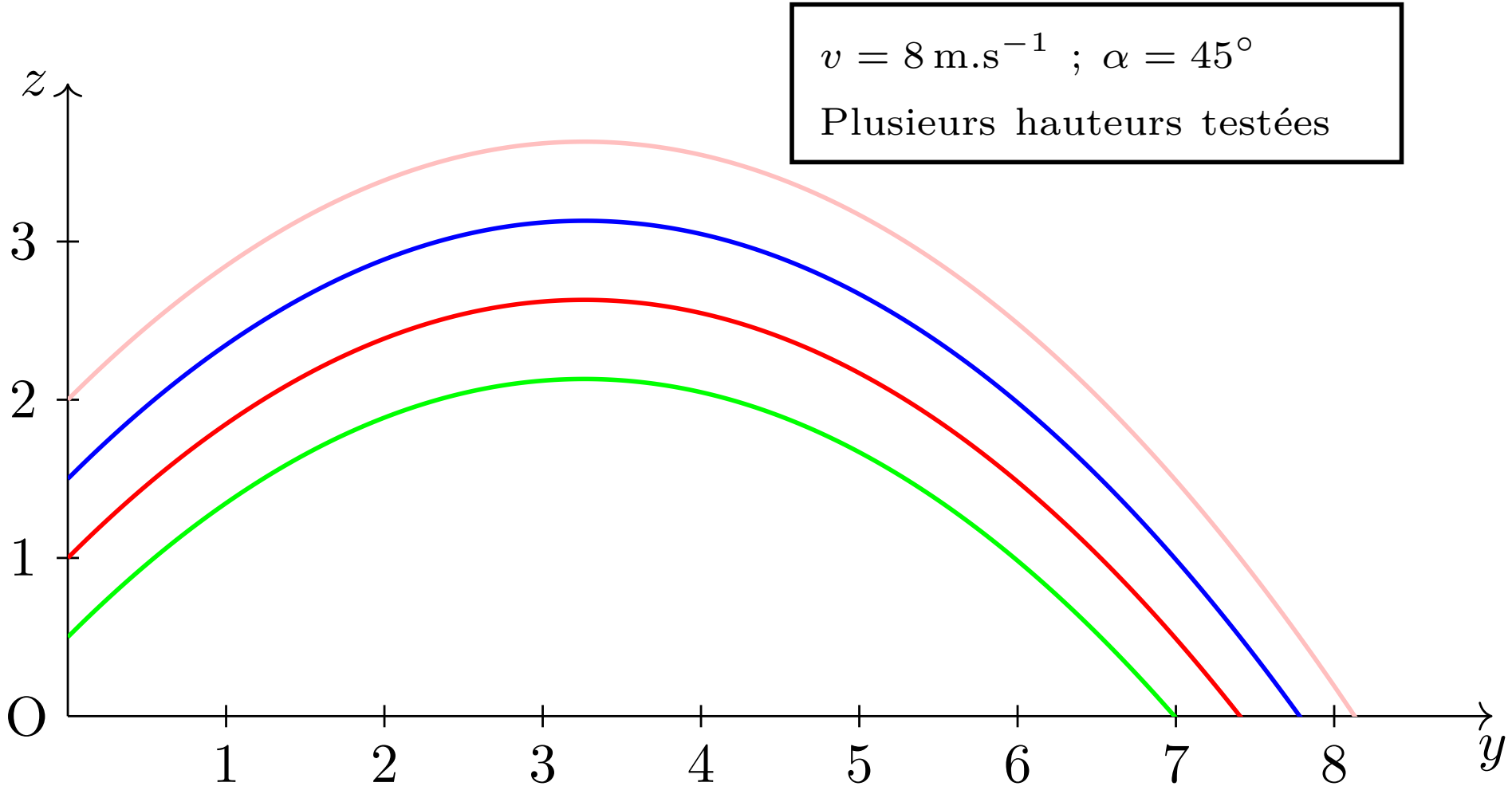


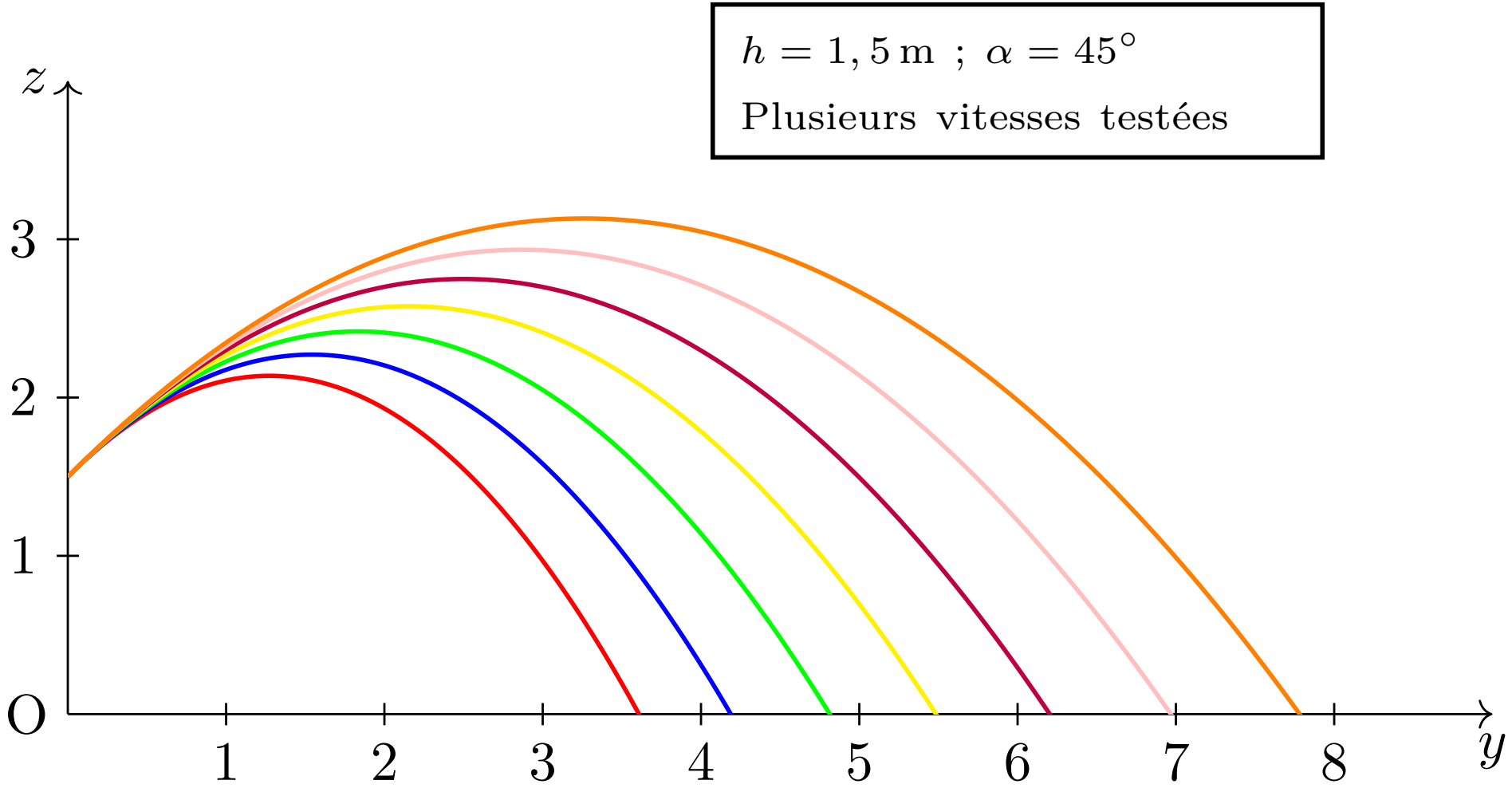
$$\overrightarrow{P} = \overrightarrow{F}_{T/O}$$

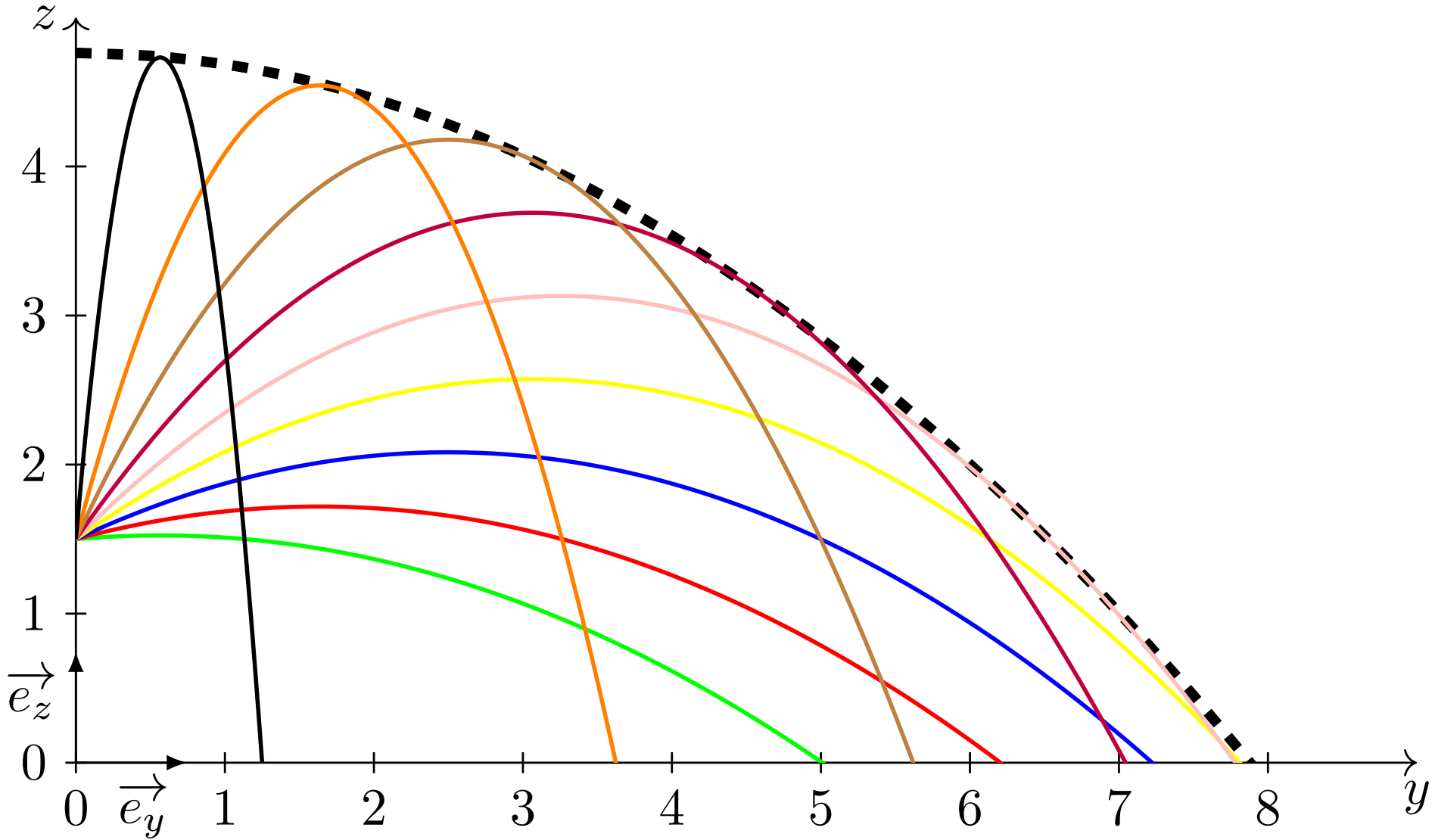

z
4
3
2
1
0
$\overrightarrow{v_0}$
α
$z = h$
$\overrightarrow{e_z}$
0
$\overrightarrow{e_y}$
1
2
3
4
5
6
7
8
y

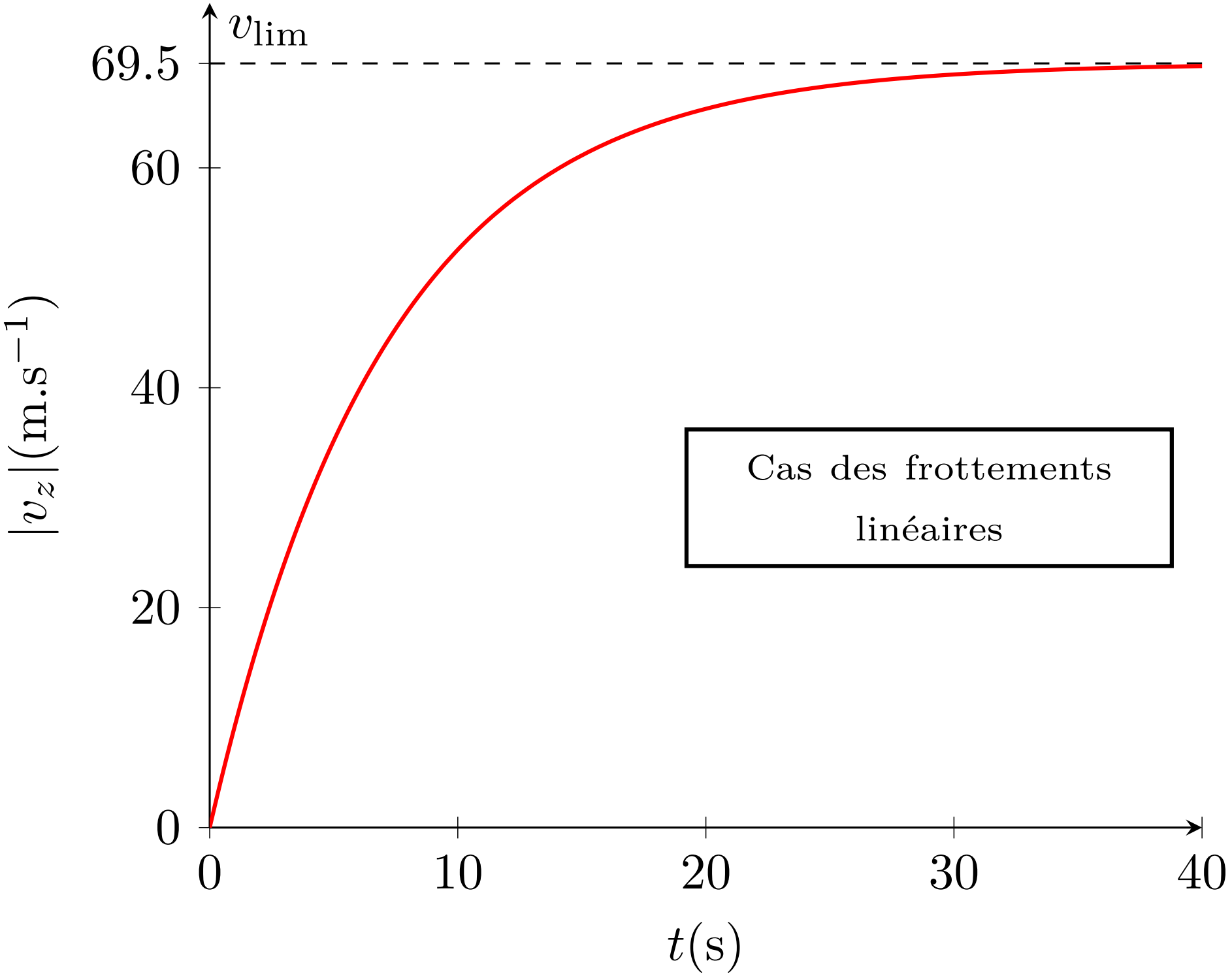

$h = 1,5\,\text{m}$; $v = 8\,\text{m.s}^{-1}$
Plusieurs angles testés
z
y
O
$z = h$
$\overrightarrow{e_z}$
$\overrightarrow{e_y}$
$\alpha = 45°$
1
2
3
4
5
6
7
8

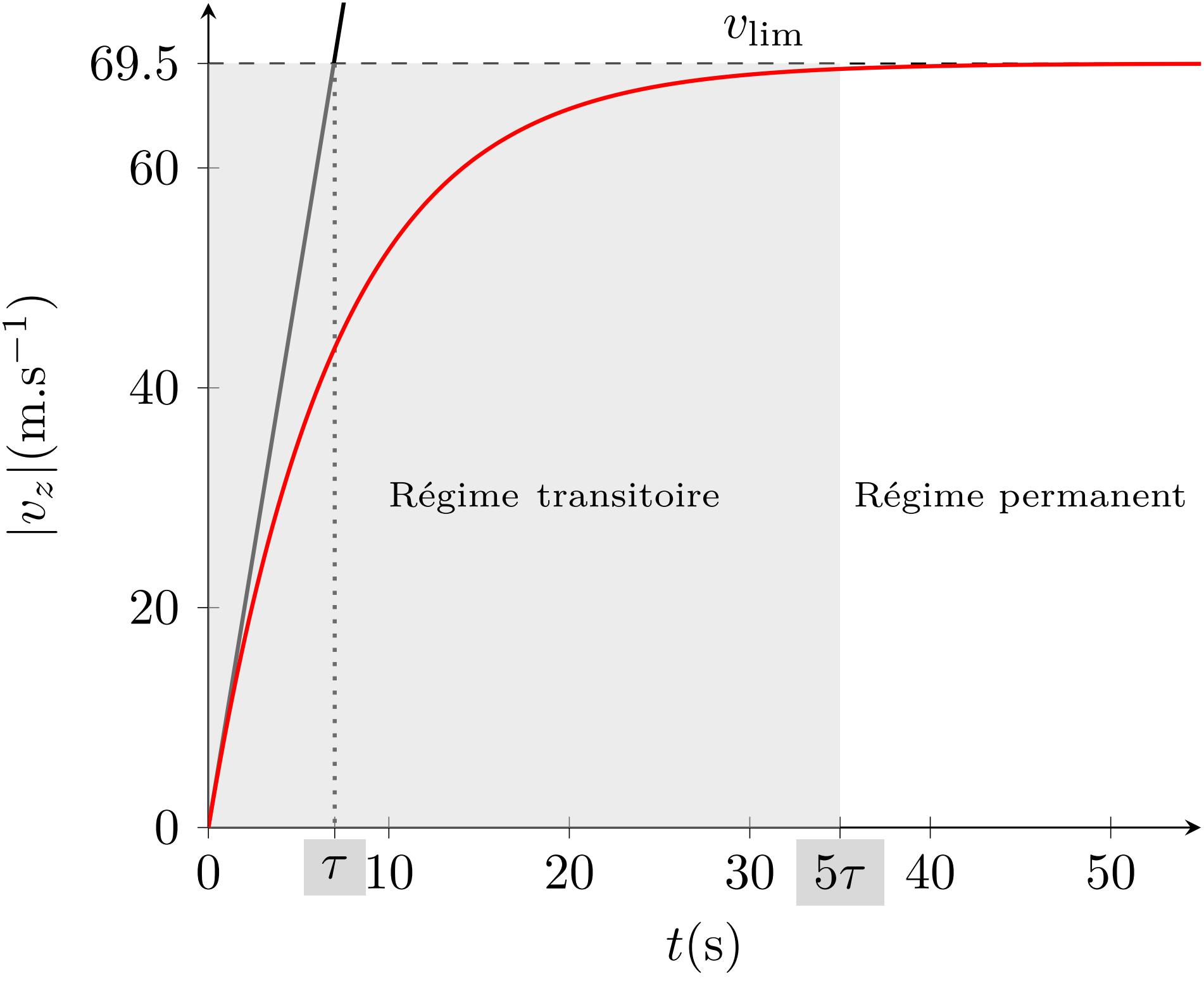

z
3
2
1
O
1
2
3
4
5
6
7
8
y
$h = 0\,\mathrm{m}$; $v = 8\,\mathrm{m.s^{-1}}$
Plusieurs angles testés

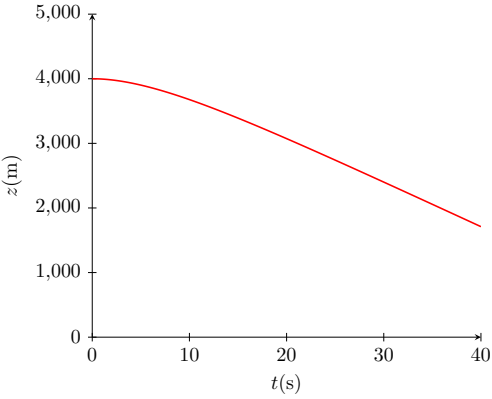

$v = 8\,\mathrm{m.s^{-1}}$; $\alpha = 45°$
Plusieurs hauteurs testées
z
3
2
1
O
1
2
3
4
5
6
7
8
y

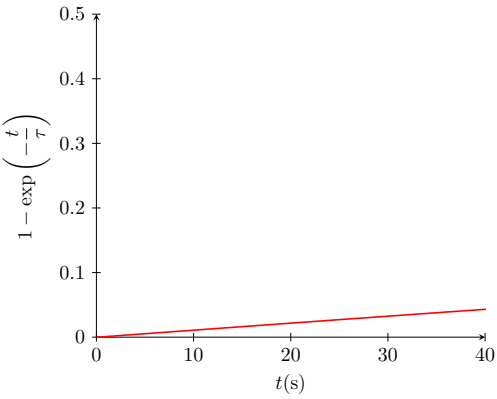

$h = 1,5\,\text{m}$; $\alpha = 45°$
Plusieurs vitesses testées
z
3
2
1
O
1
2
3
4
5
6
7
8
y

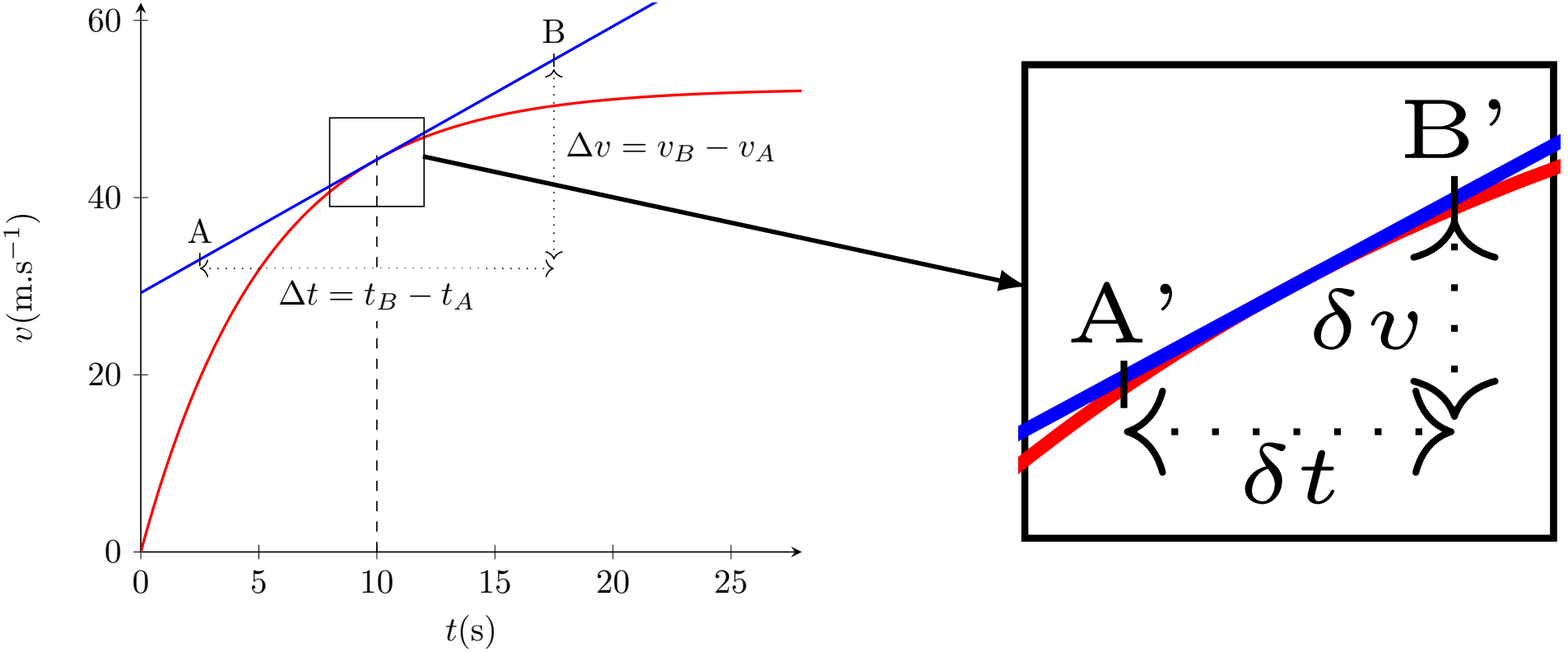

z
4
3
2
1
0
$\overrightarrow{e_z}$
0
$\overrightarrow{e_y}$
1
2
3
4
5
6
7
8
y

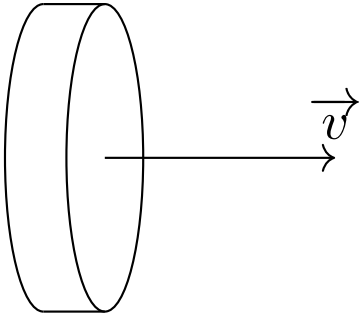

v_{lim}
69.5
60
40
20
0
$|v_z|(\text{m.s}^{-1})$
0
10
20
30
40
$t(\text{s})$
Cas des frottements linéaires


v_{lim}
69.5
60
40
20
0
$|v_z|(\text{m.s}^{-1})$
Régime transitoire
Régime permanent
0
τ
10
20
30
5τ
40
50
$t(\text{s})$

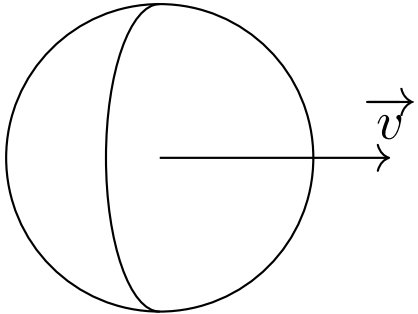

5,000
4,000
3,000
2,000
1,000
0
z(m)
0
10
20
30
40
t(s)


0.5
0.4
0.3
0.2
0.1
0
$1 - \exp\left(-\frac{t}{\tau}\right)$
0
10
20
30
40
t(s)

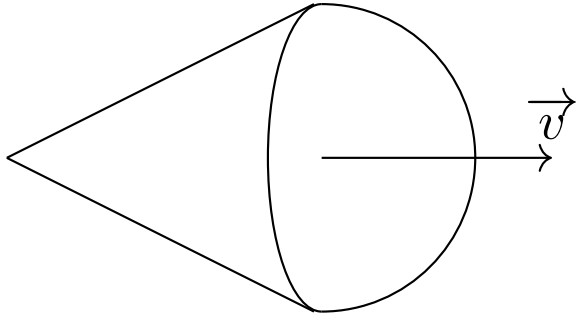

60
40
20
0
0
5
10
15
20
25
$v(\mathrm{m.s^{-1}})$
$t(\mathrm{s})$
A
B
$\Delta v = v_B - v_A$
$\Delta t = t_B - t_A$
A'
B'
δv
δt



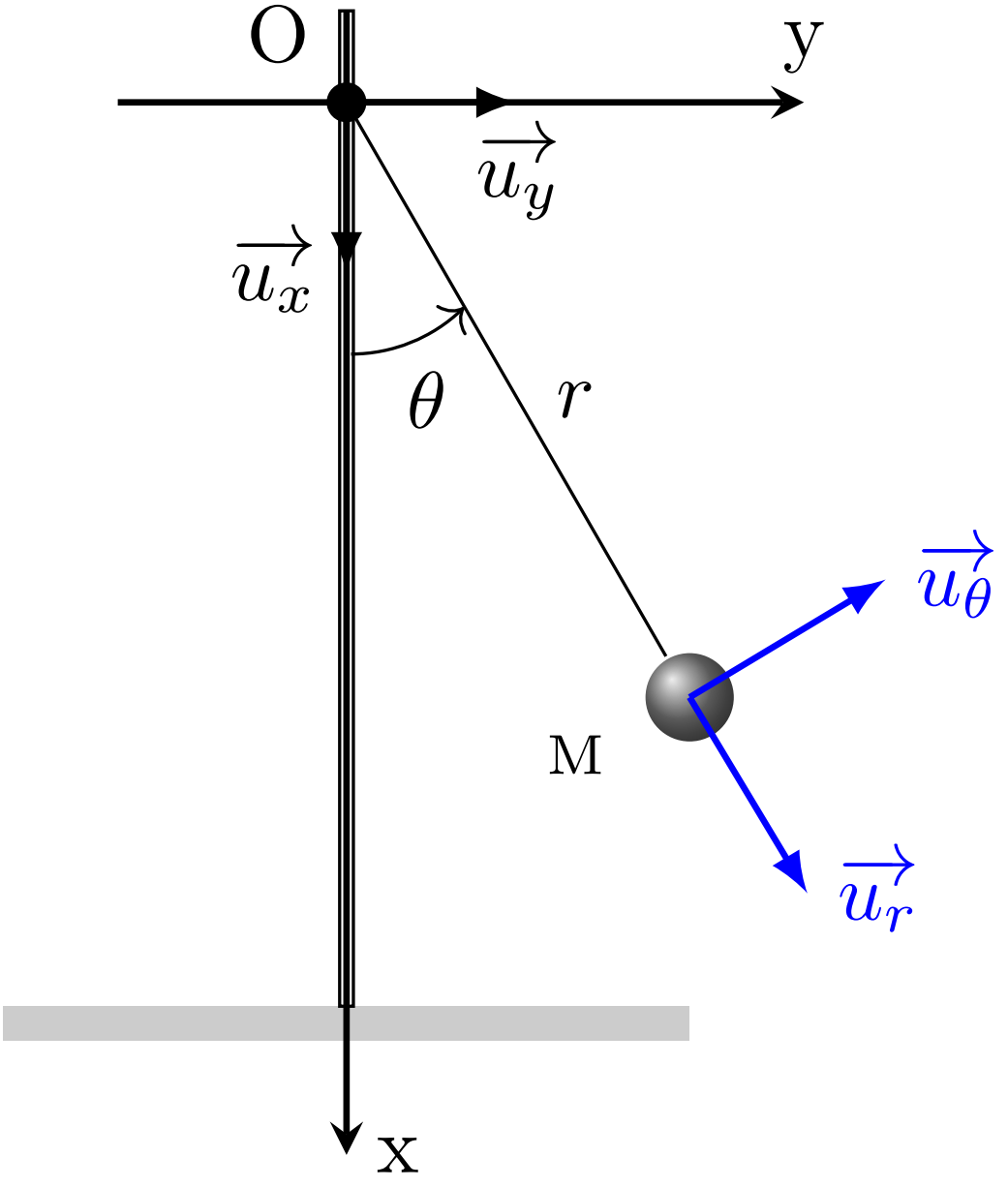
$C_x = 1.32$

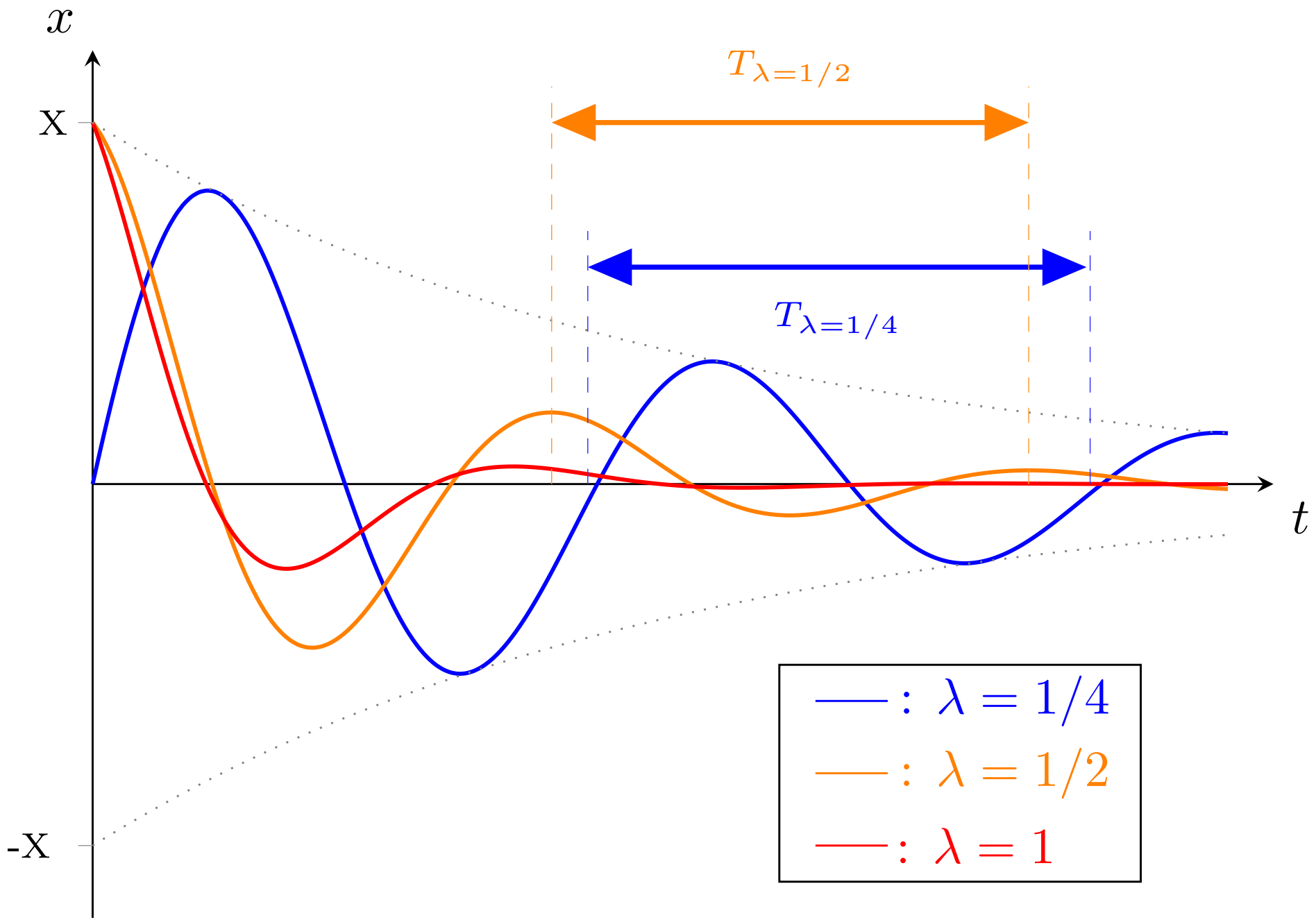


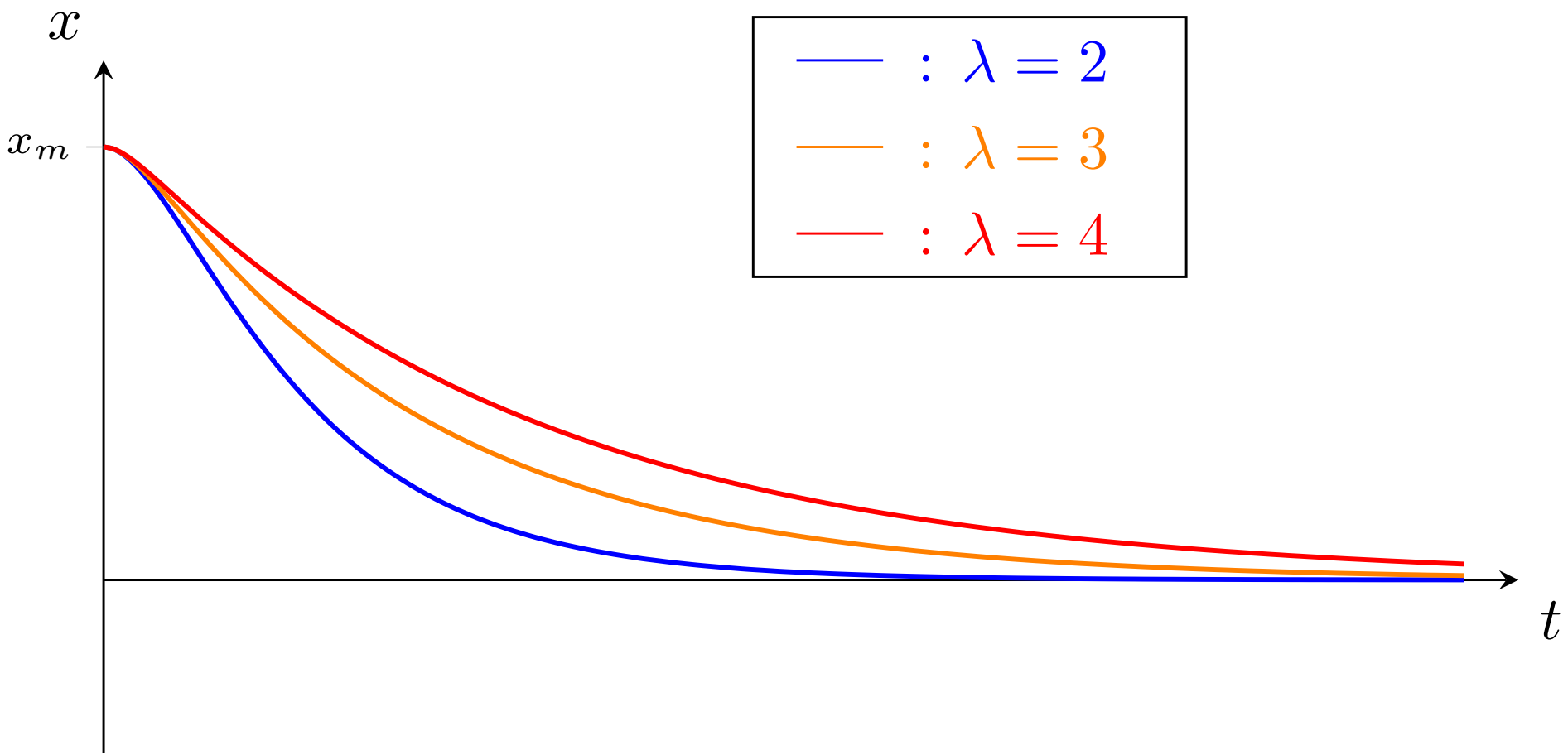
$C_x = 0.45$

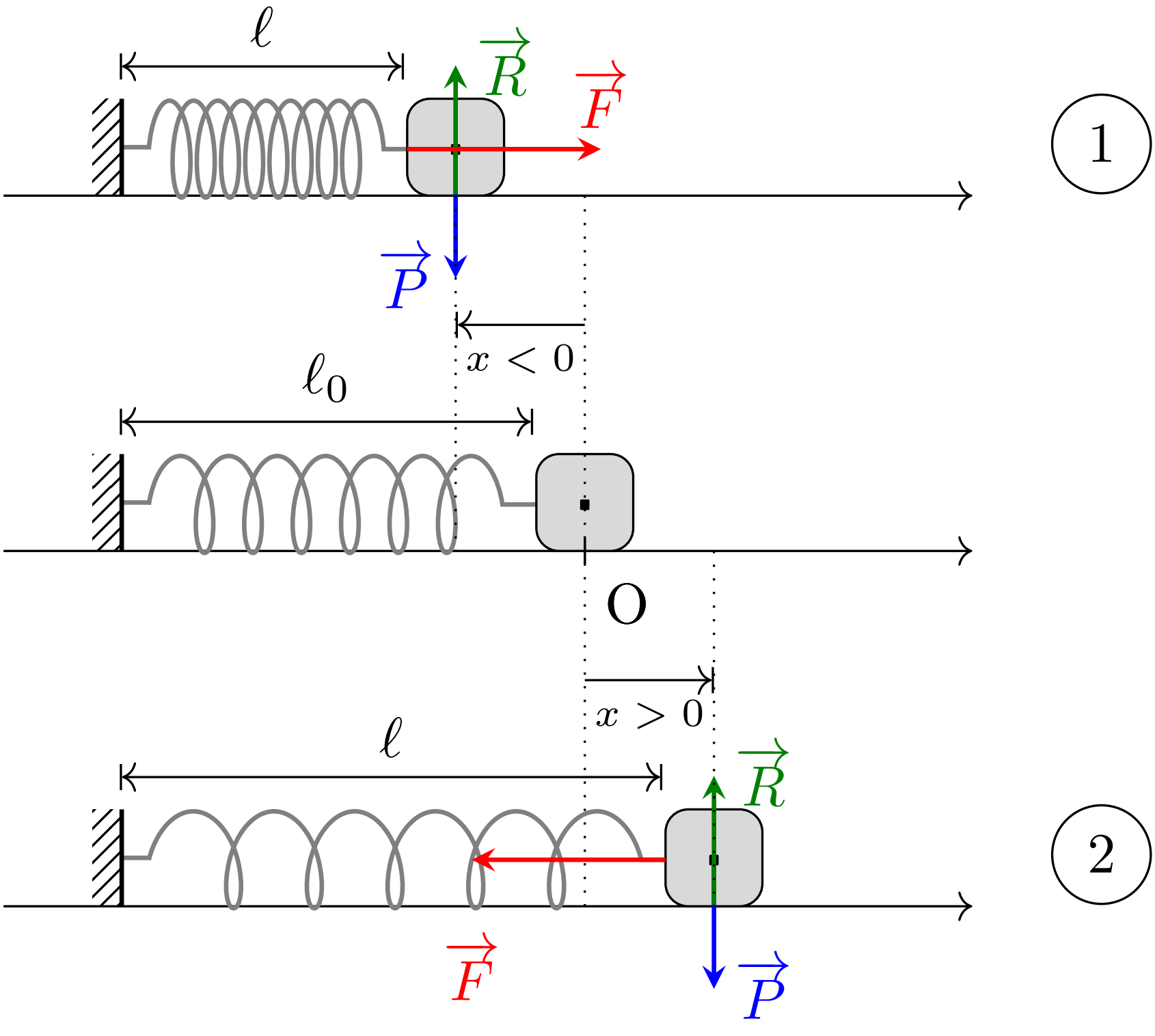


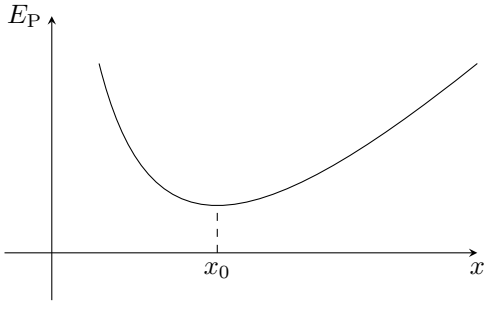
$C_x = 0.04$

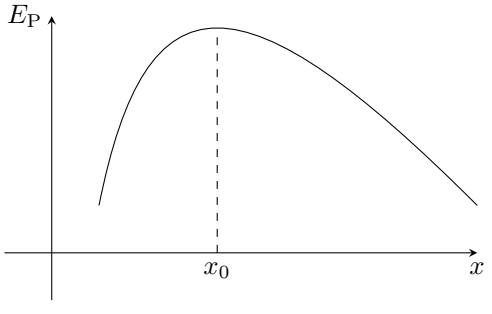

O
y
$\overrightarrow{u_y}$
$\overrightarrow{u_x}$
θ
r
$\overrightarrow{u_\theta}$
M
$\overrightarrow{u_r}$
x

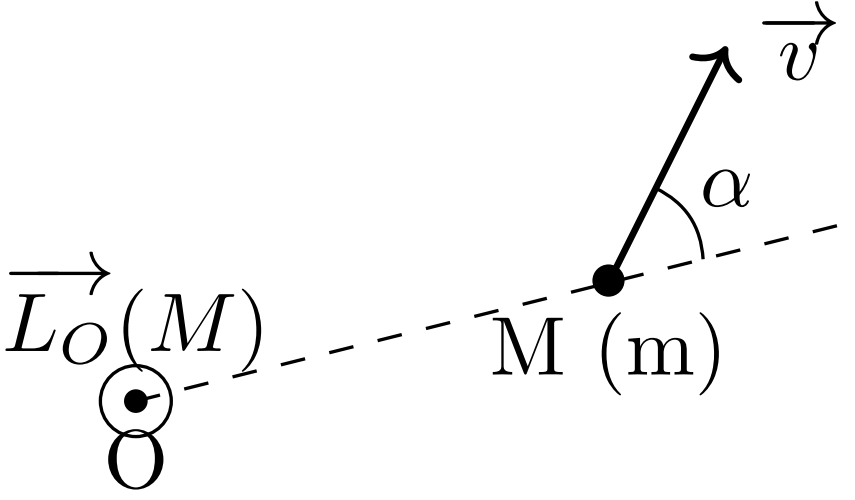

x
X
-X
t
$T_{\lambda=1/2}$
$T_{\lambda=1/4}$
—— : $\lambda = 1/4$
—— : $\lambda = 1/2$
—— : $\lambda = 1$

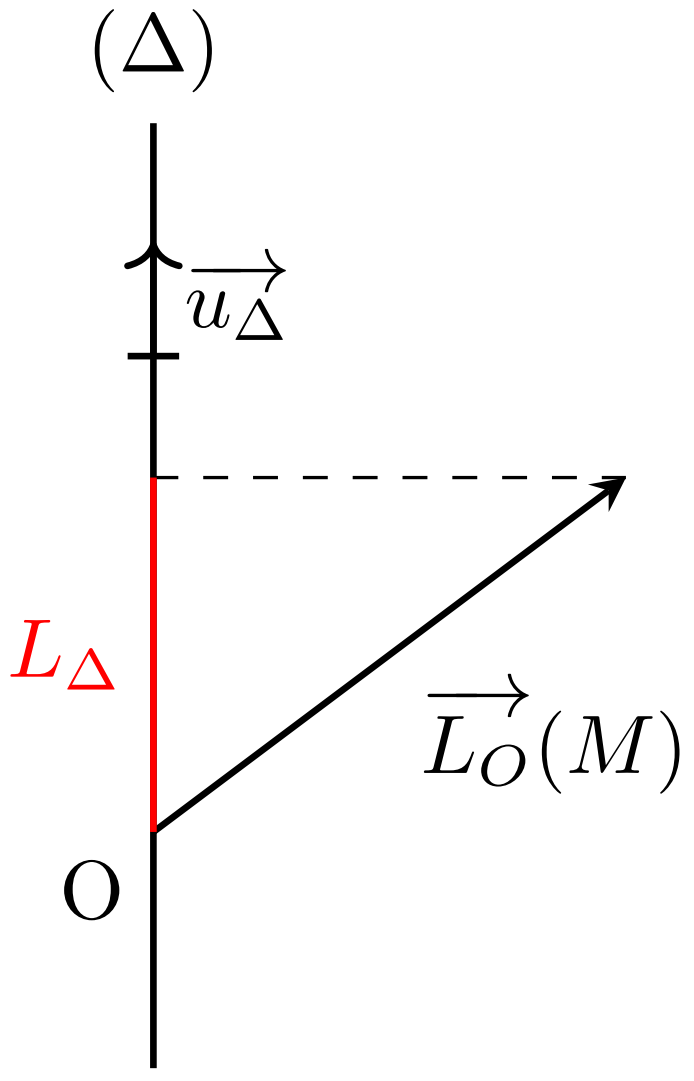

x
x_m
t
— : $\lambda = 2$
— : $\lambda = 3$
— : $\lambda = 4$

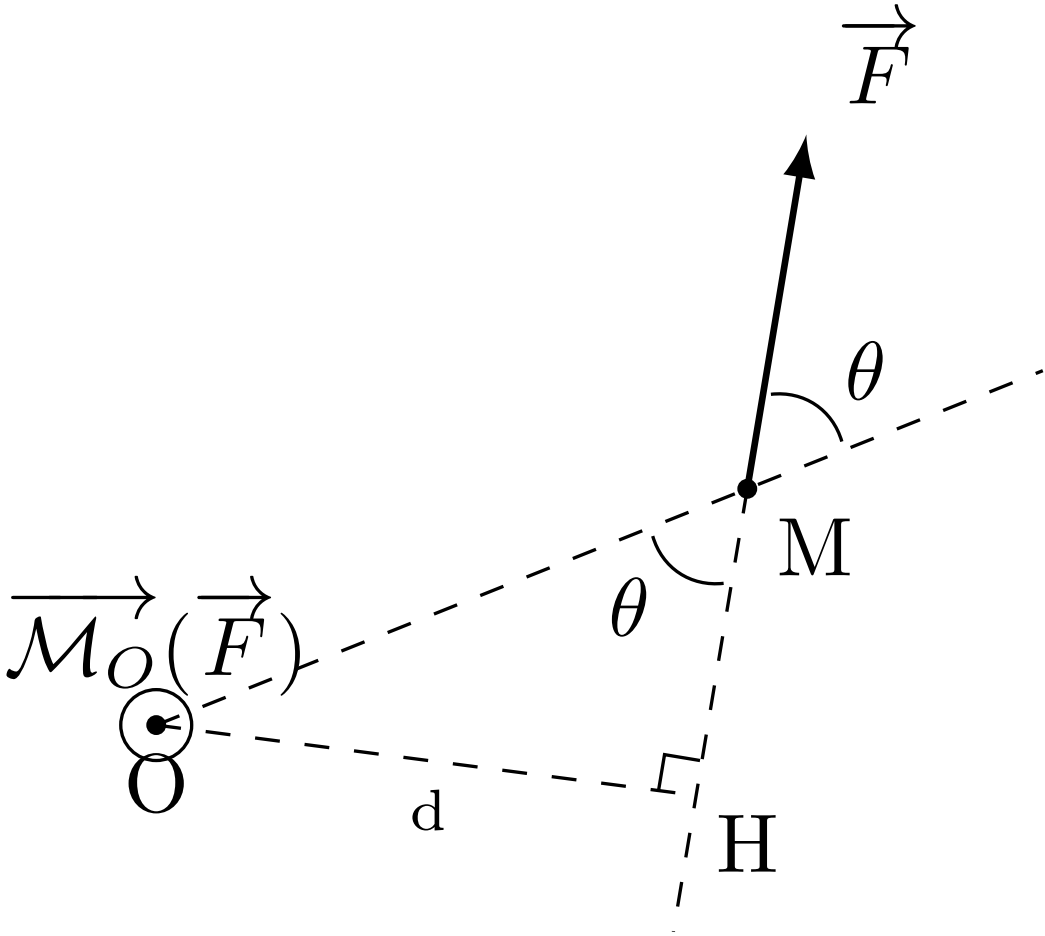

ℓ
$\vec{R}$
$\vec{F}$
1
$\vec{P}$
$x < 0$
ℓ_0
O
$x > 0$
ℓ
$\vec{R}$
2
$\vec{F}$
$\vec{P}$

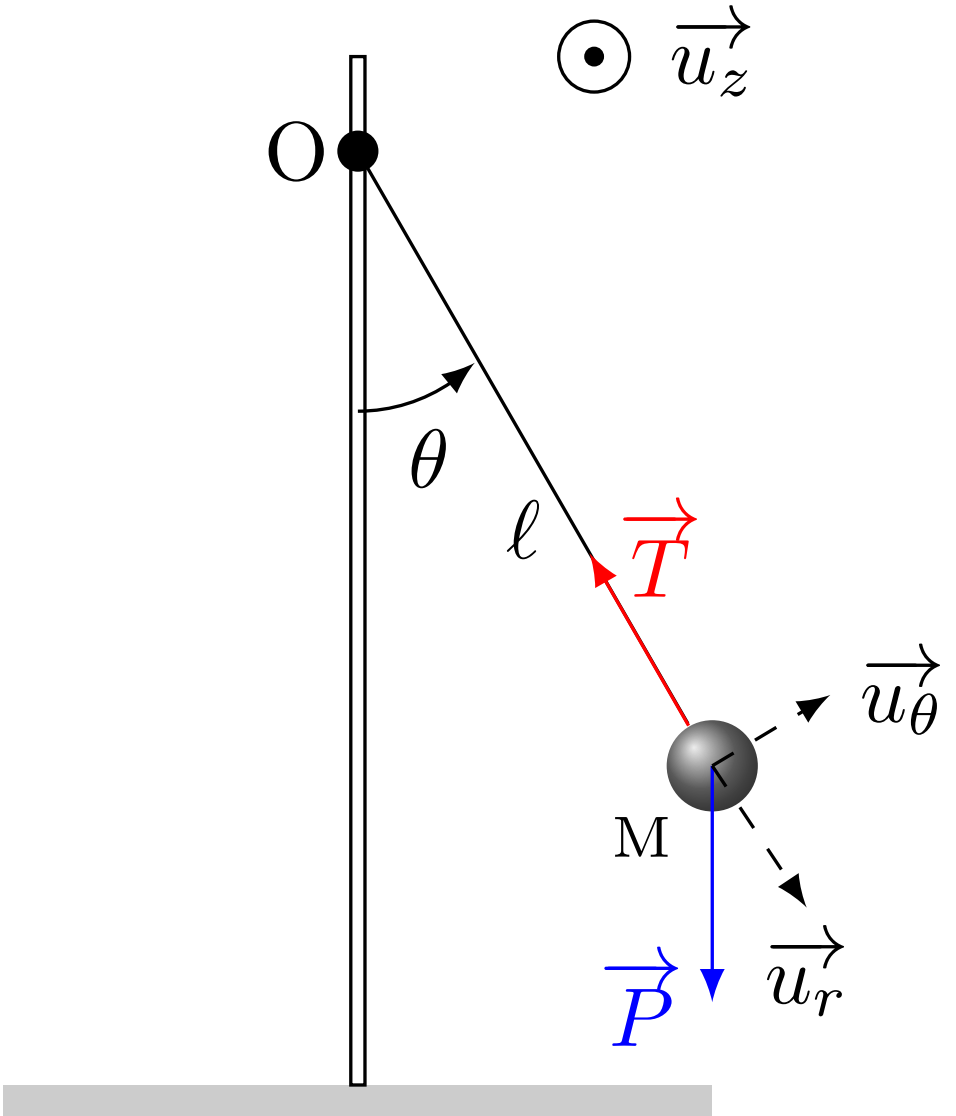

E_P
x_0
x

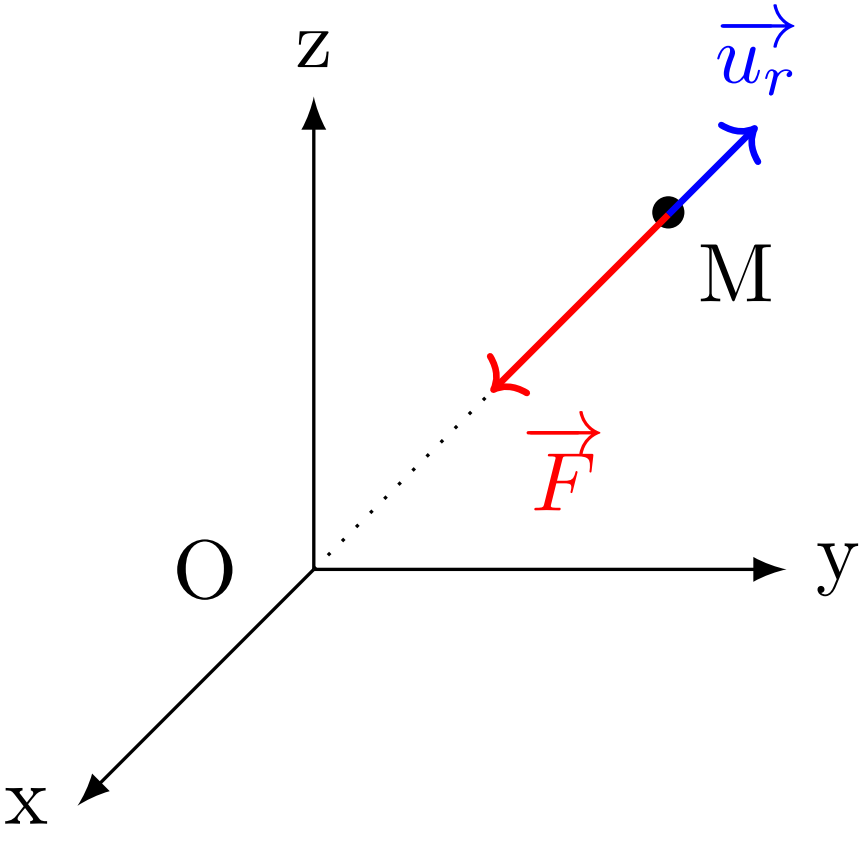

E_P
x_0
x

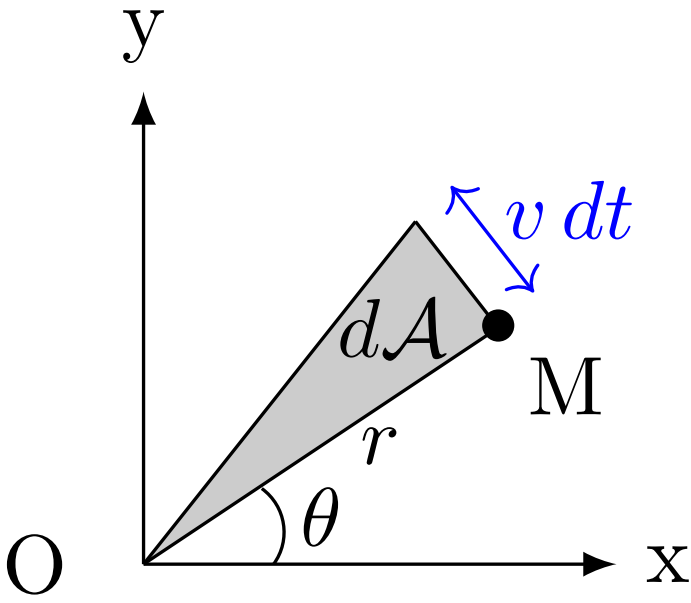

$\overrightarrow{v}$
α
$\overrightarrow{L_O(M)}$
M (m)
O

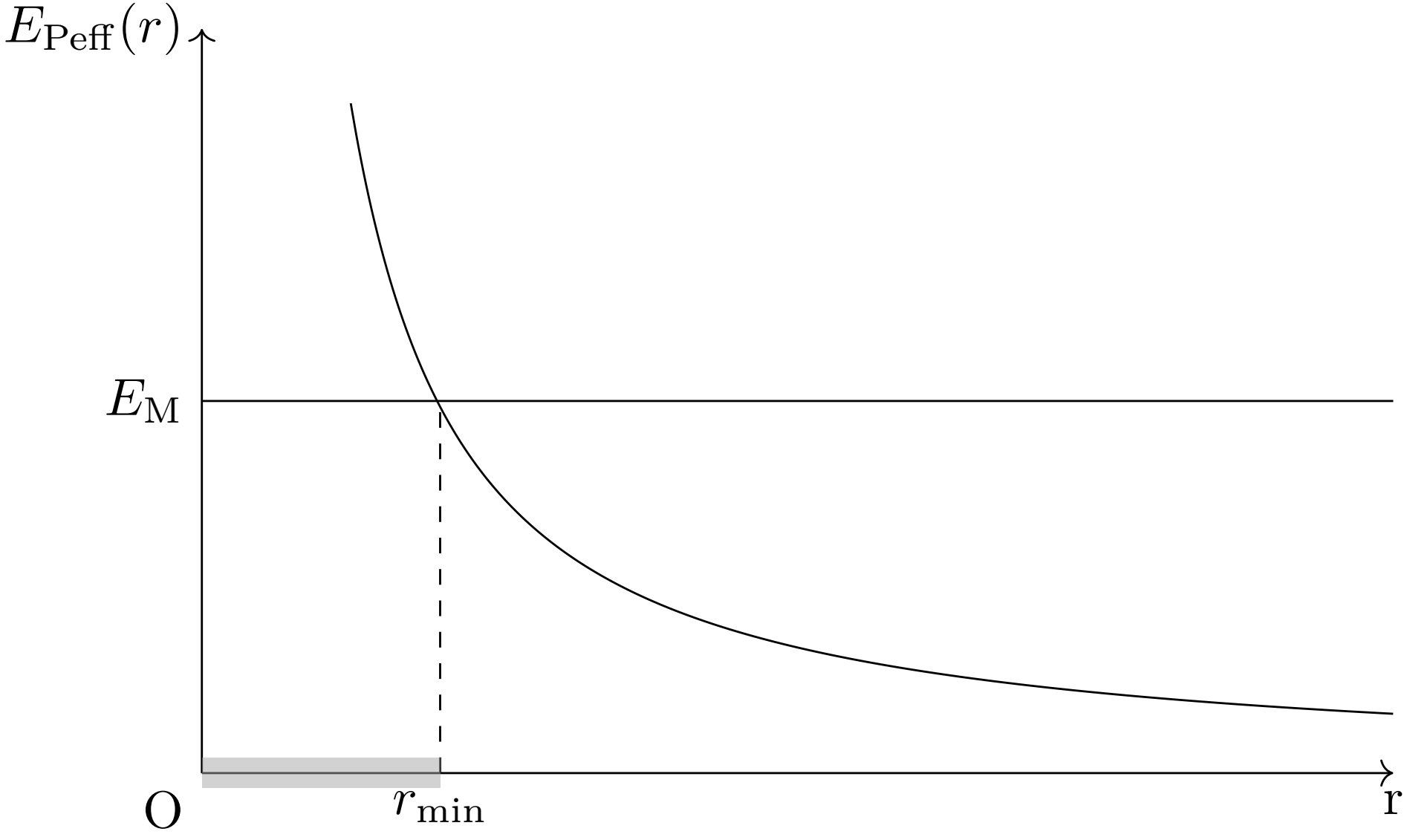

(Δ)
$\overrightarrow{u_\Delta}$
L_Δ
$\overrightarrow{L_O(M)}$
O

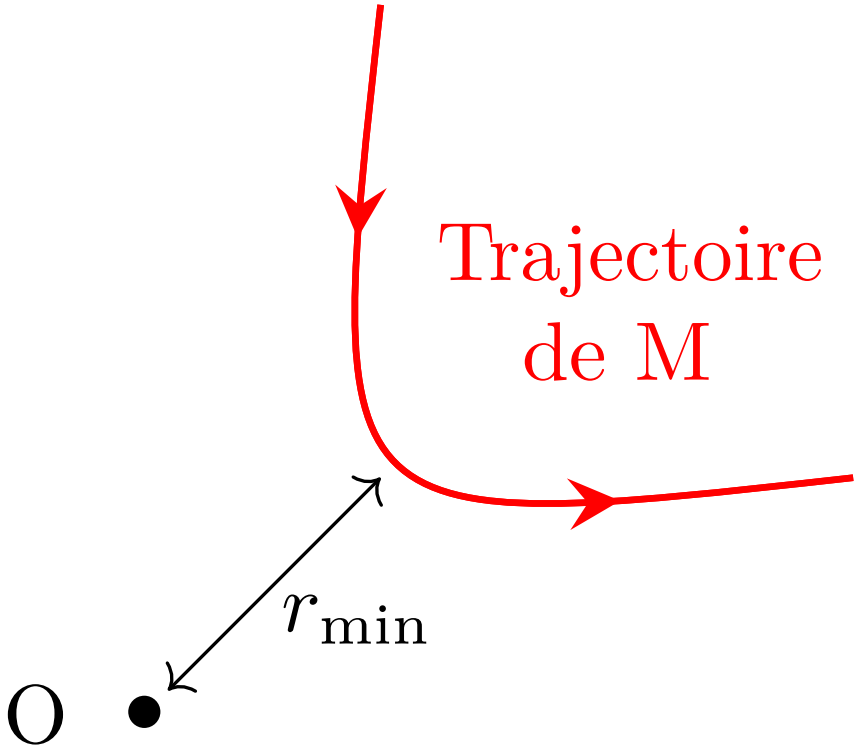

$\overrightarrow{F}$
θ
M
θ
$\overrightarrow{\mathcal{M}_O(\overrightarrow{F})}$
O
d
H

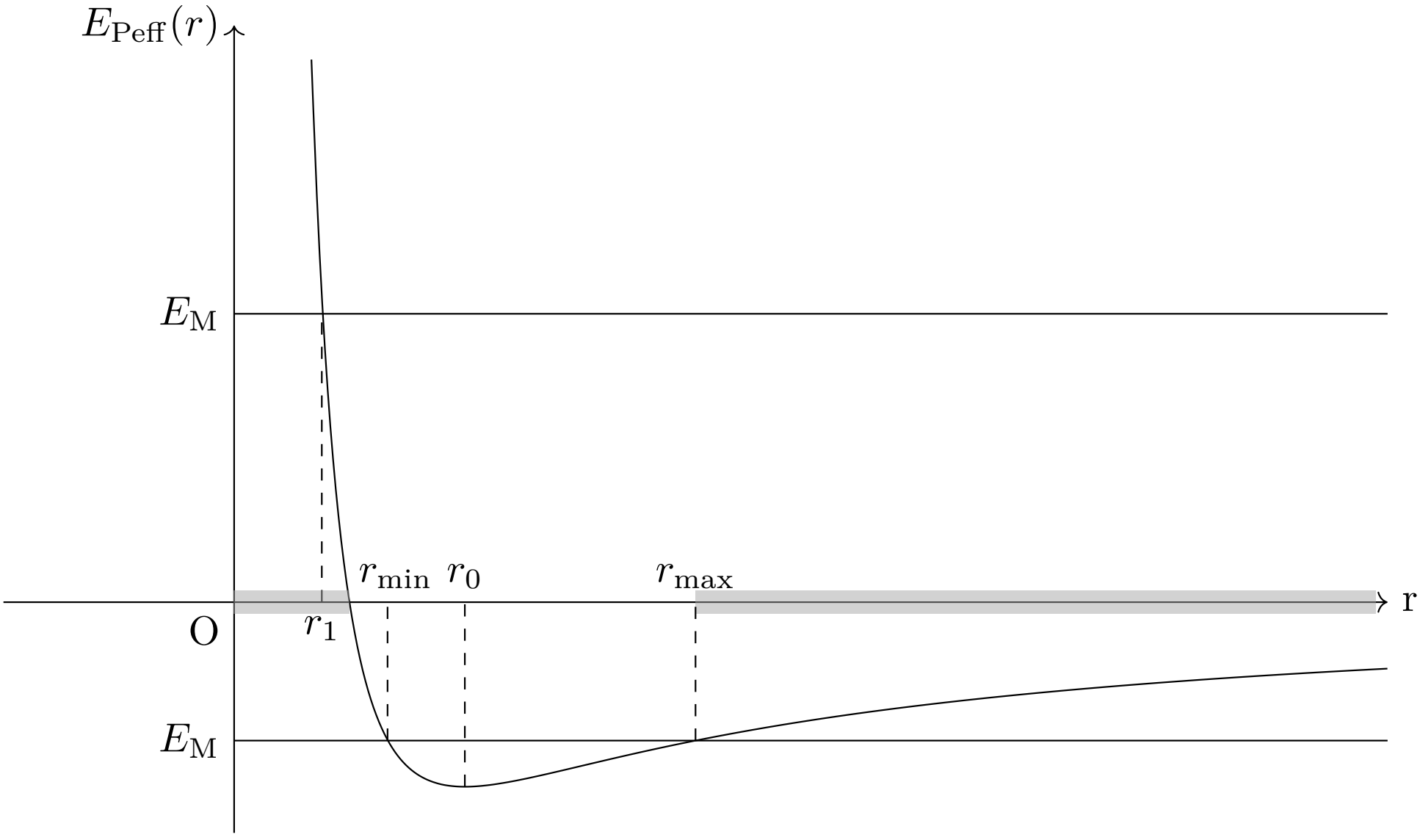

$\overrightarrow{u_z}$
O
θ
ℓ
$\overrightarrow{T}$
$\overrightarrow{u_\theta}$
M
$\overrightarrow{P}$
$\overrightarrow{u_r}$

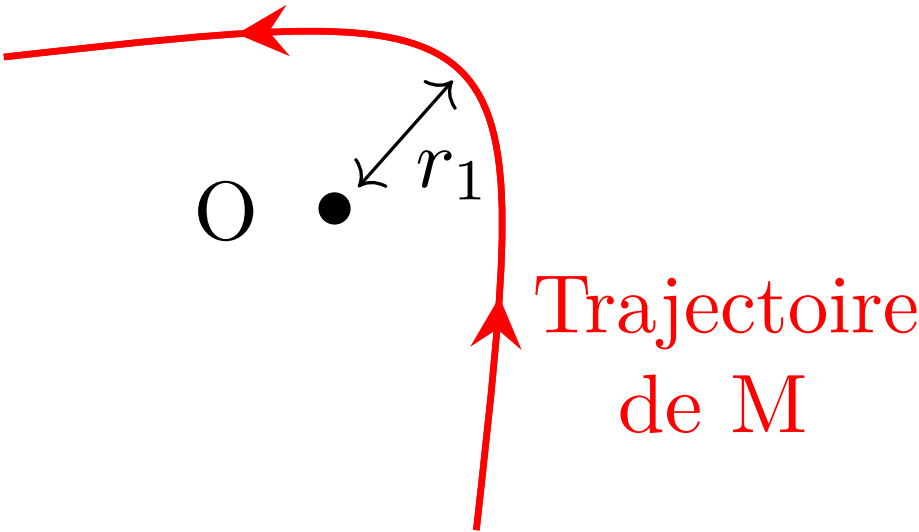

z
$\overrightarrow{u_r}$
M
$\overrightarrow{F}$
O
y
x

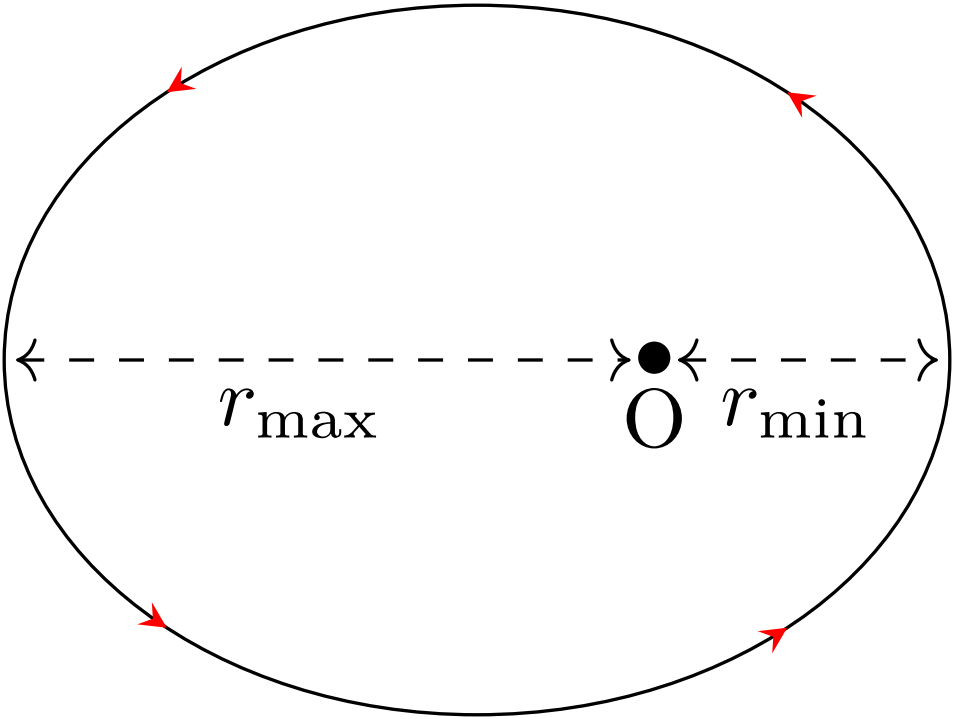

y
$v\,dt$
$d\mathcal{A}$
M
r
θ
O
x

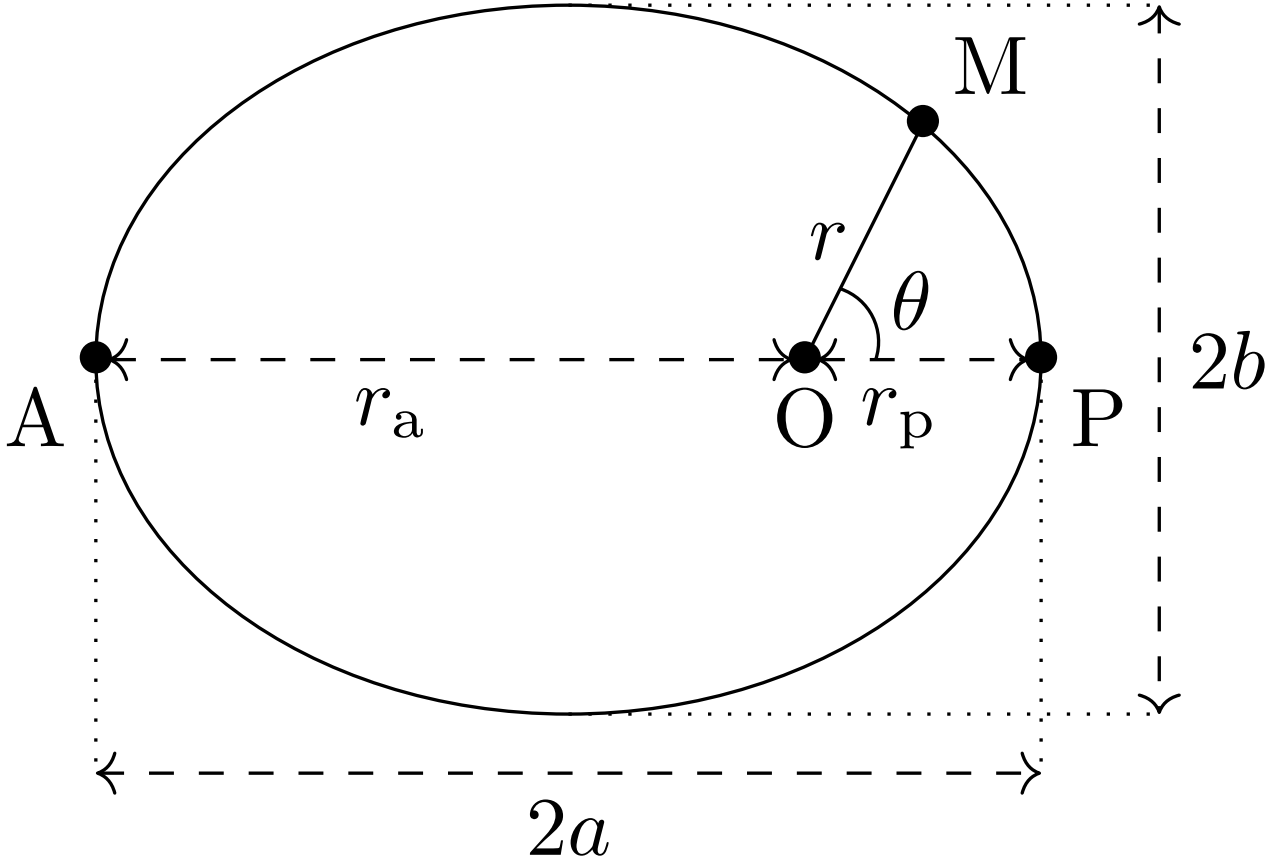

$E_{\mathrm{Peff}}(r)$
E_{M}
O
r_{min}
r

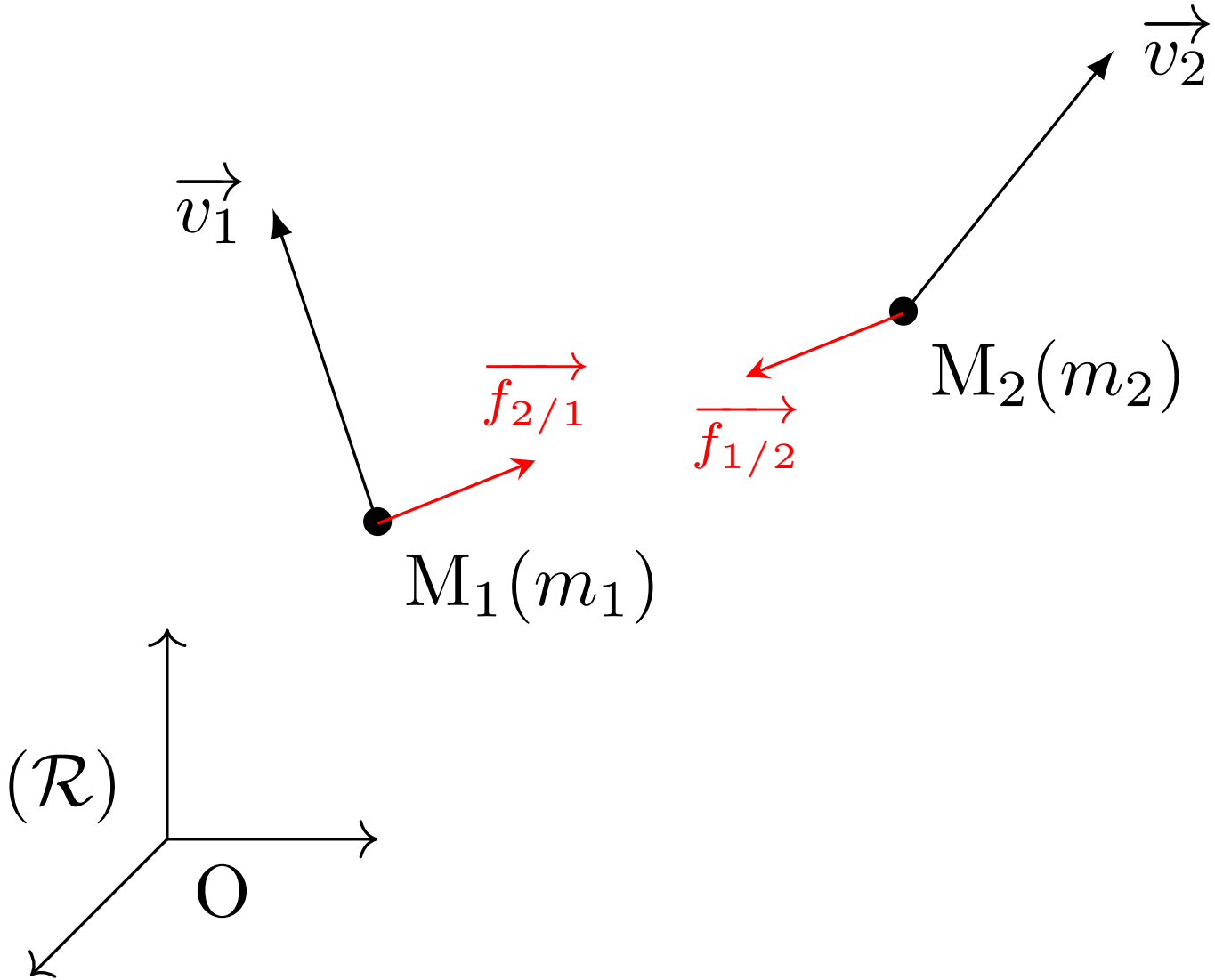

Trajectoire
de M
$r_{\min}$
O

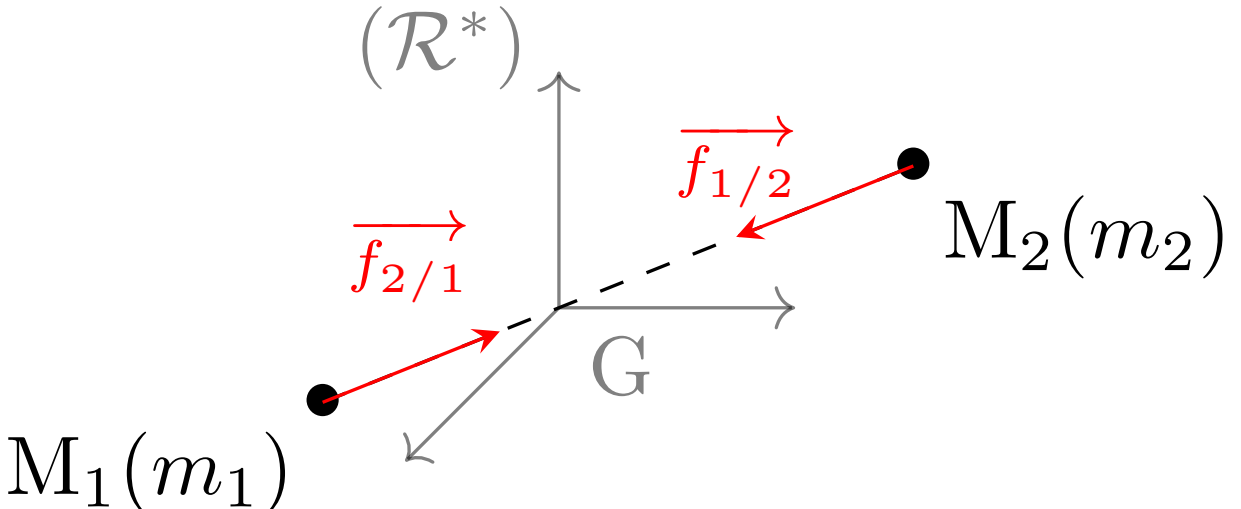

$E_{\mathrm{Peff}}(r)$
E_{M}
r_{min}
r_0
r_{max}
r
O
r_1
E_{M}

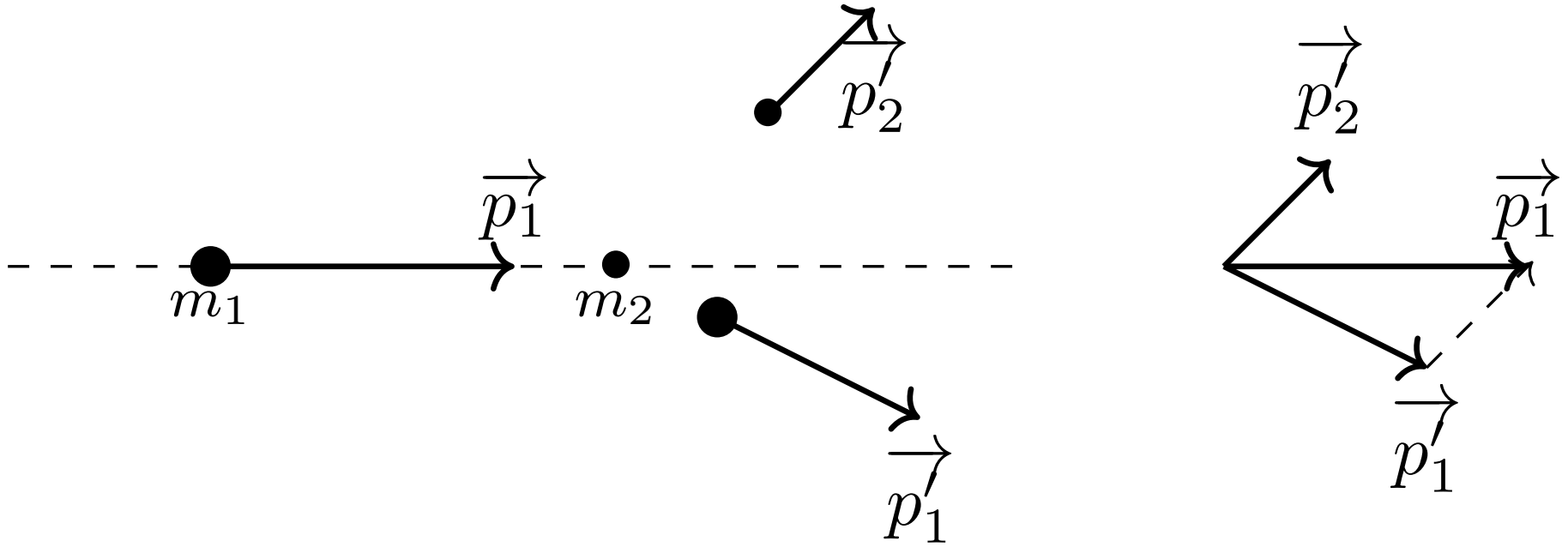

O
r_1
Trajectoire
de M

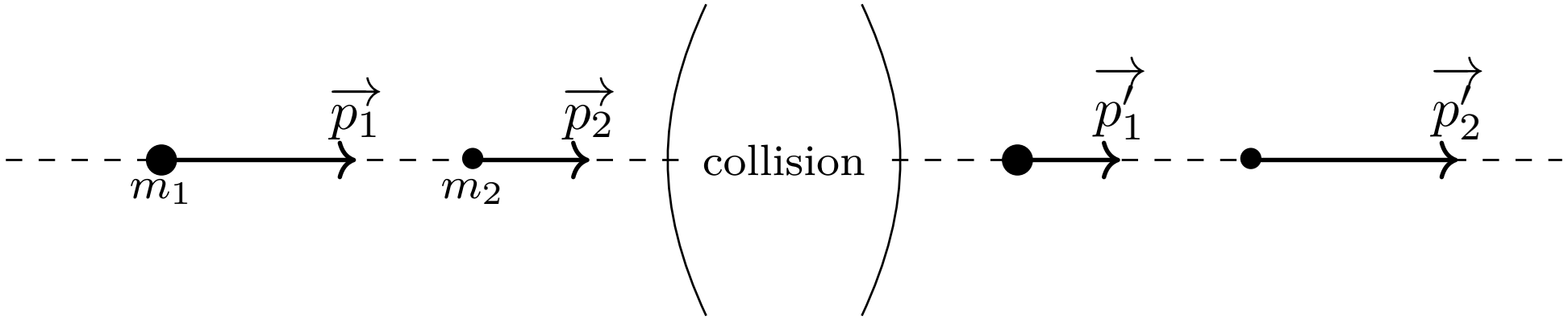

$r_{\max}$
O
$r_{\min}$

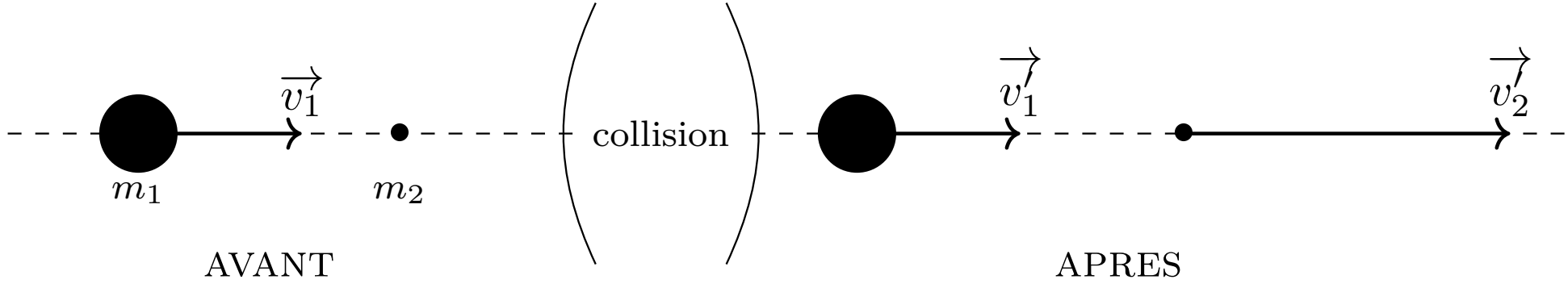

M
r
θ
A
r_a
O
r_p
P
2b
2a

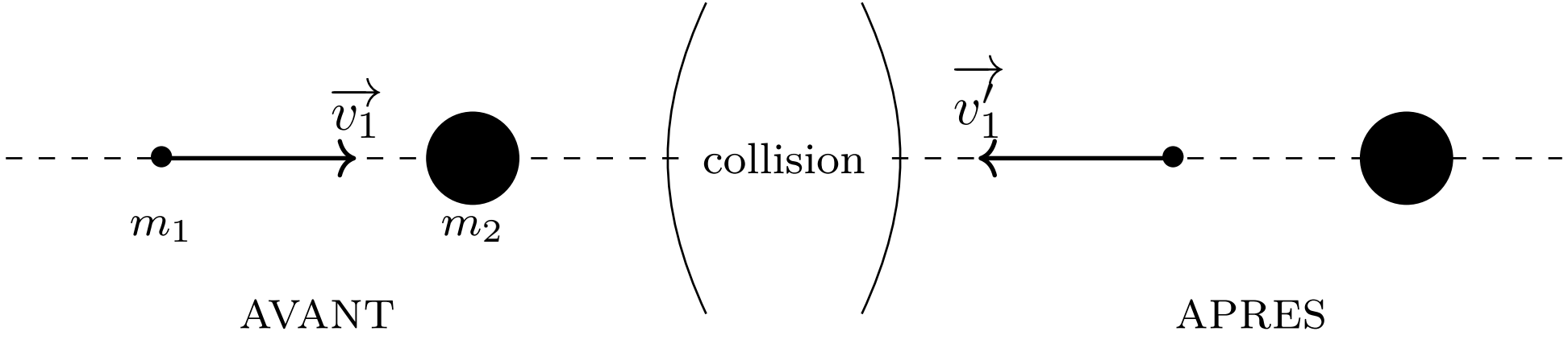

$\overrightarrow{v_2}$
$\overrightarrow{v_1}$
$\overrightarrow{f_{2/1}}$
$\overrightarrow{f_{1/2}}$
$\mathrm{M}_2(m_2)$
$\mathrm{M}_1(m_1)$
$(\mathcal{R})$
O

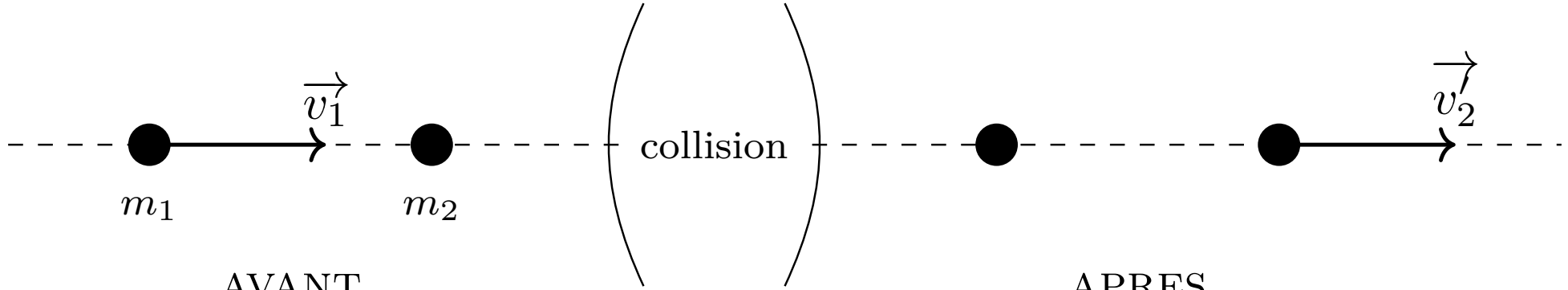

$(\mathcal{R}^*)$
$\overrightarrow{f_{1/2}}$
$\overrightarrow{f_{2/1}}$
$\mathrm{M}_2(m_2)$
G
$\mathrm{M}_1(m_1)$

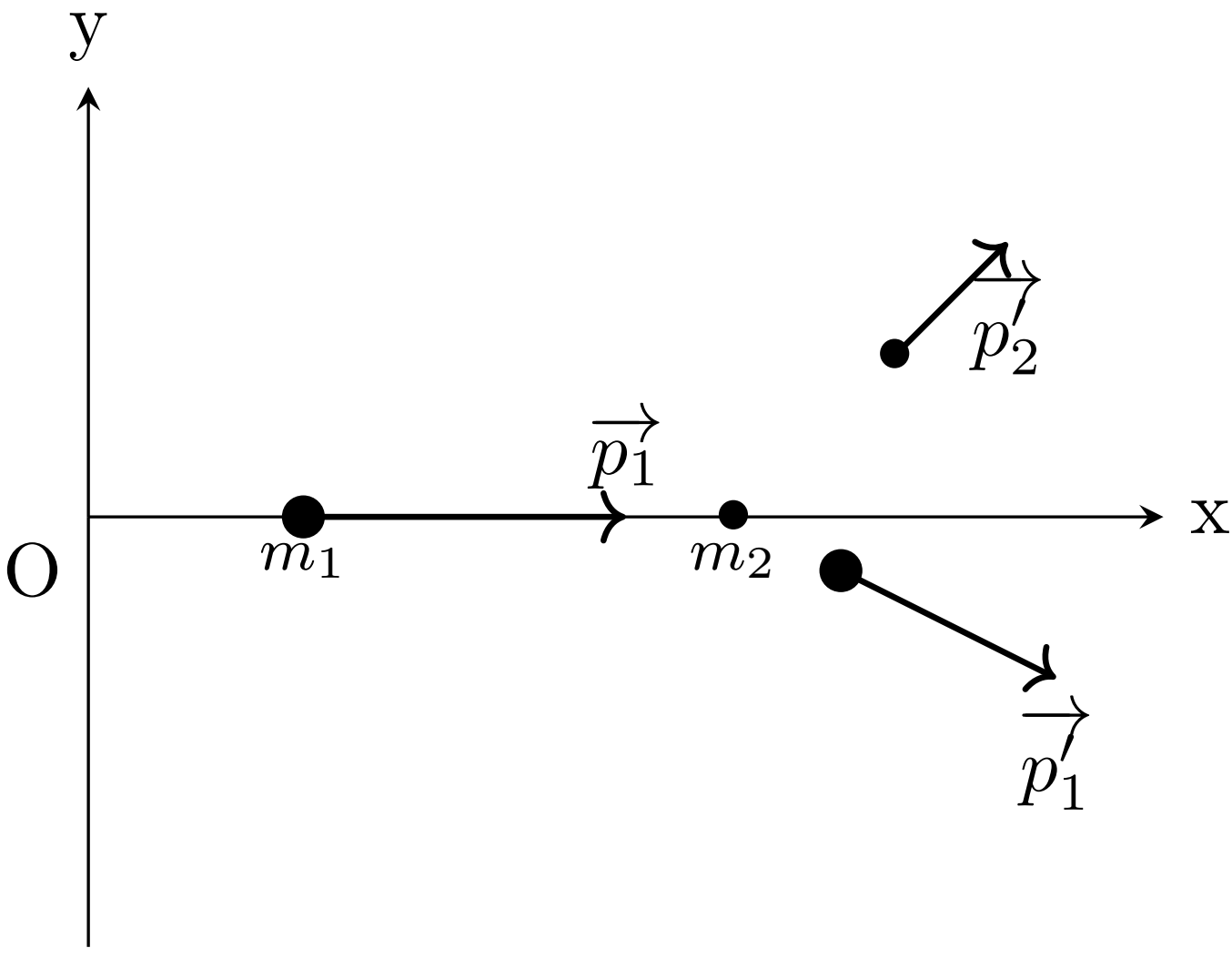

$\overrightarrow{p_2'}$
$\overrightarrow{p_1}$
m_1
m_2
$\overrightarrow{p_1'}$
$\overrightarrow{p_2}$
$\overrightarrow{p_1}$
$\overrightarrow{p_1'}$

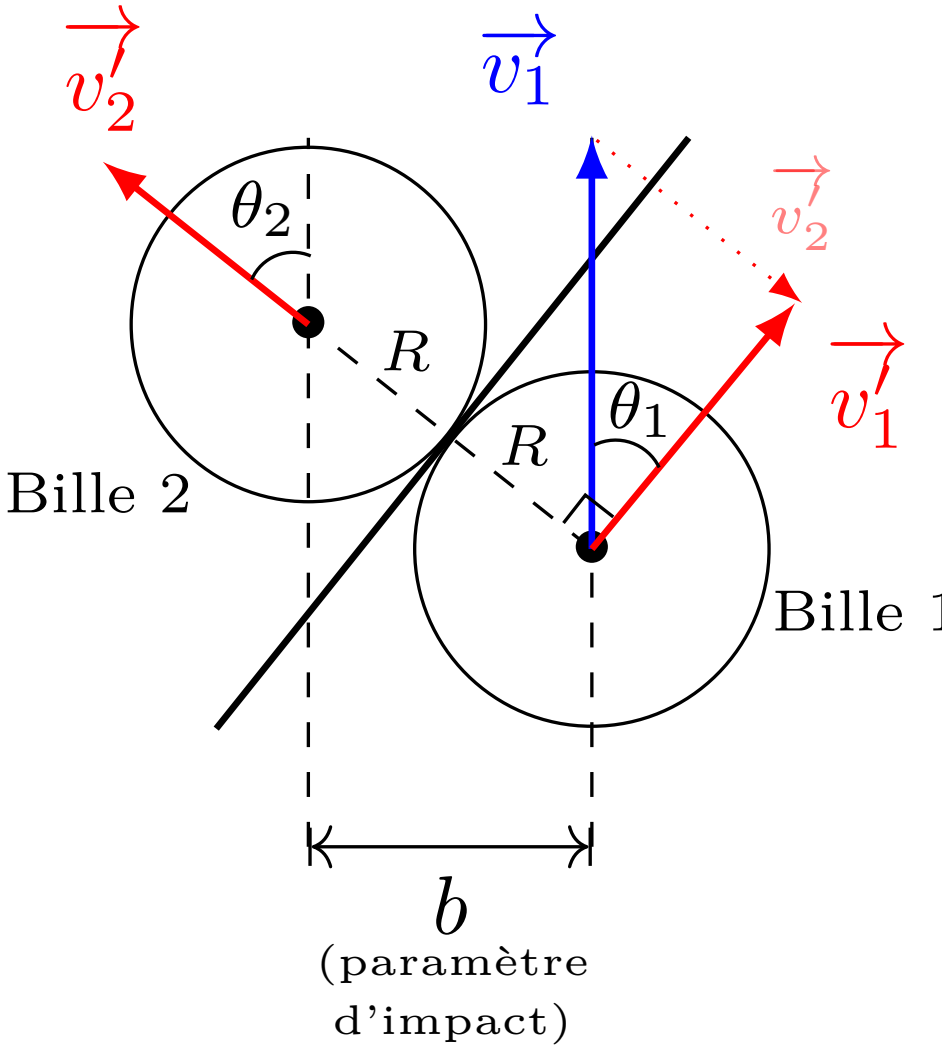

$\overrightarrow{p_1}$
$\overrightarrow{p_2}$
collision
$\overrightarrow{p_1'}$
$\overrightarrow{p_2'}$
m_1
m_2

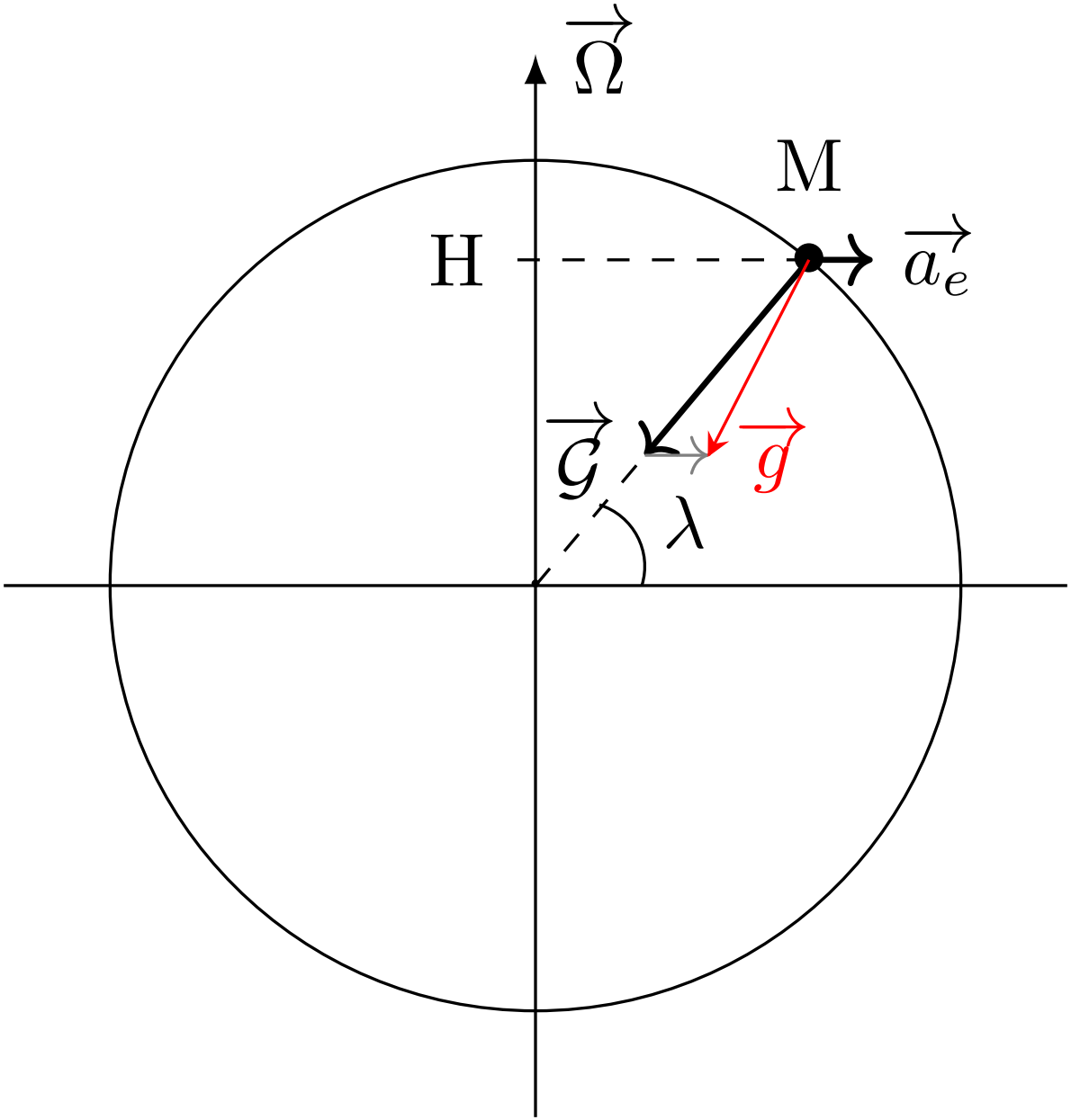

$\overrightarrow{v_1}$
collision
$\overrightarrow{v_1'}$
$\overrightarrow{v_2'}$
m_1
m_2
AVANT
APRES

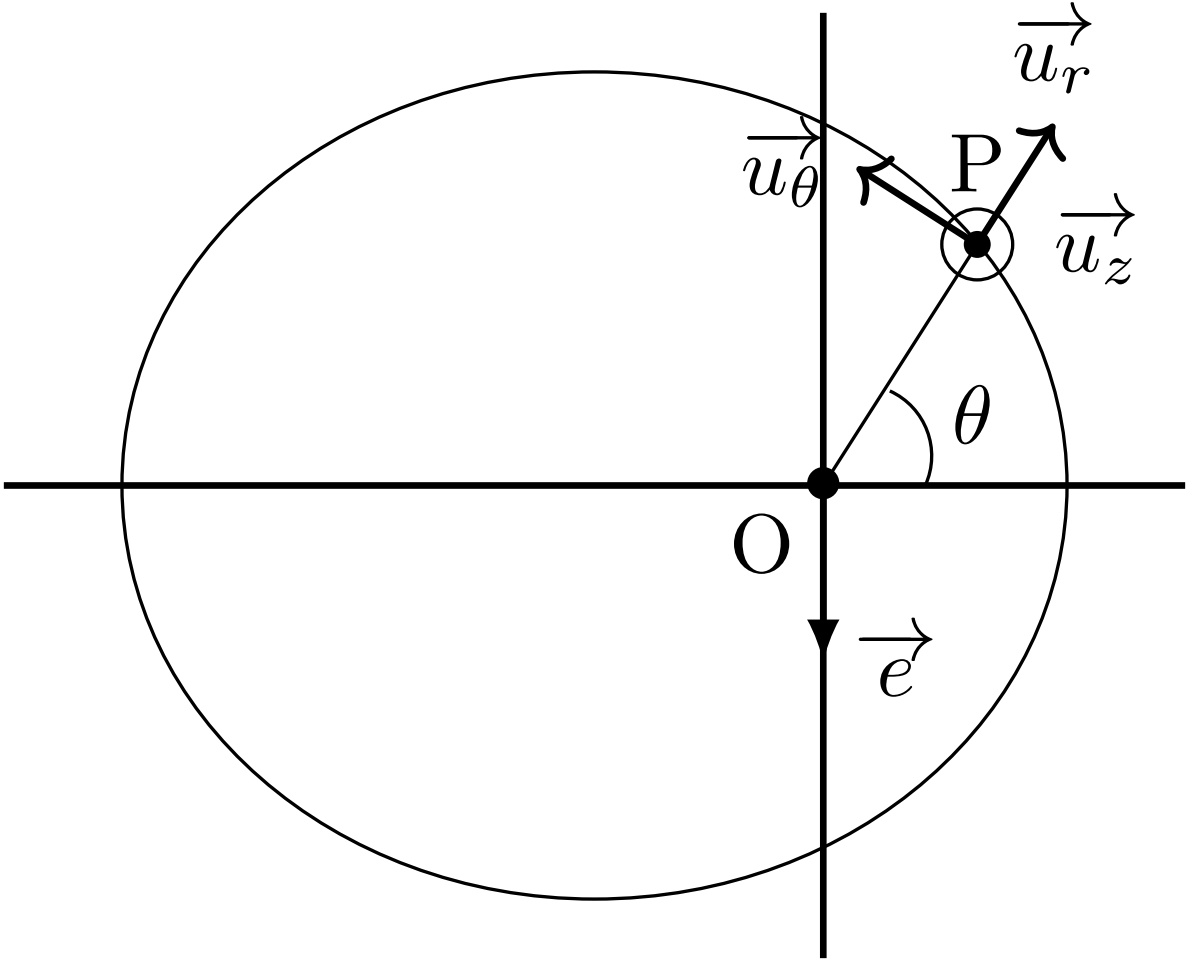

$\overrightarrow{v_1}$
$\overrightarrow{v_1'}$
collision
m_1
m_2
AVANT
APRES

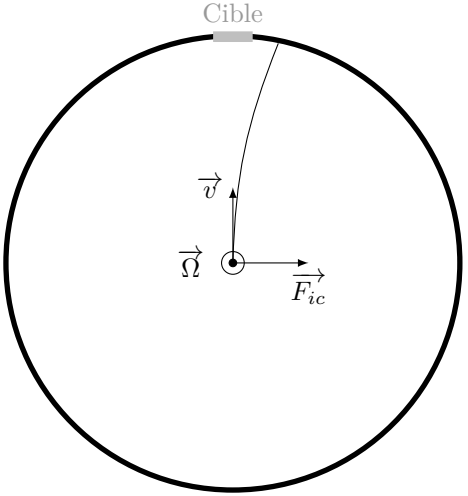

$\overrightarrow{v_1}$
collision
$\overrightarrow{v_2'}$
m_1
m_2
AVANT
APRES

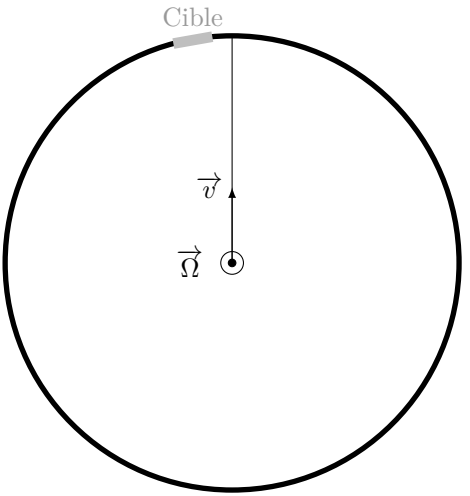

y
x
O
m_1
m_2
$\overrightarrow{p_1}$
$\overrightarrow{p_2}$
$\overrightarrow{p_1}$

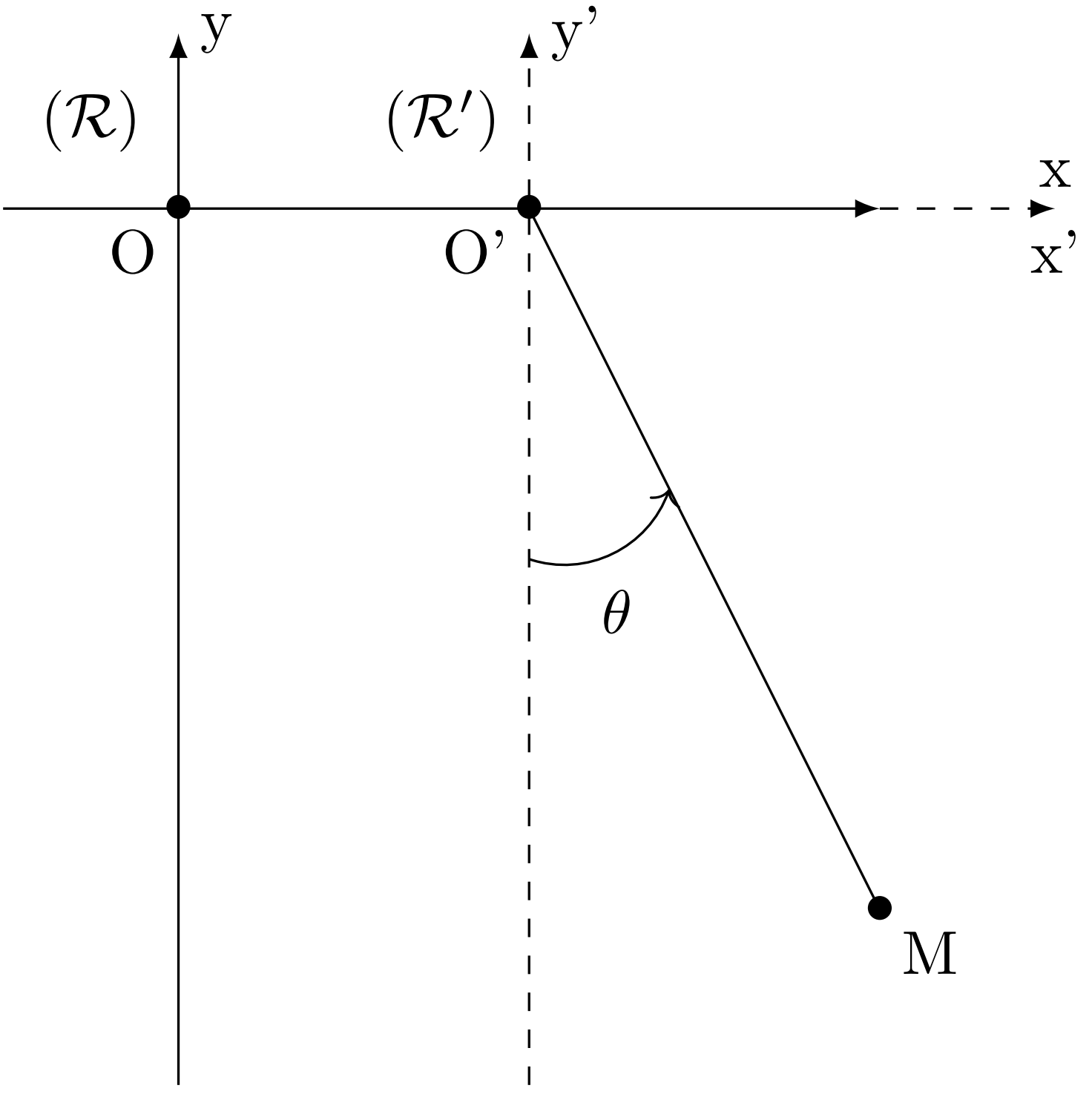

$\overrightarrow{v_2'}$
$\overrightarrow{v_1}$
θ_2
R
$\overrightarrow{v_2'}$
$\overrightarrow{v_1'}$
θ_1
R
Bille 2
Bille 1
b
(paramètre
d'impact)

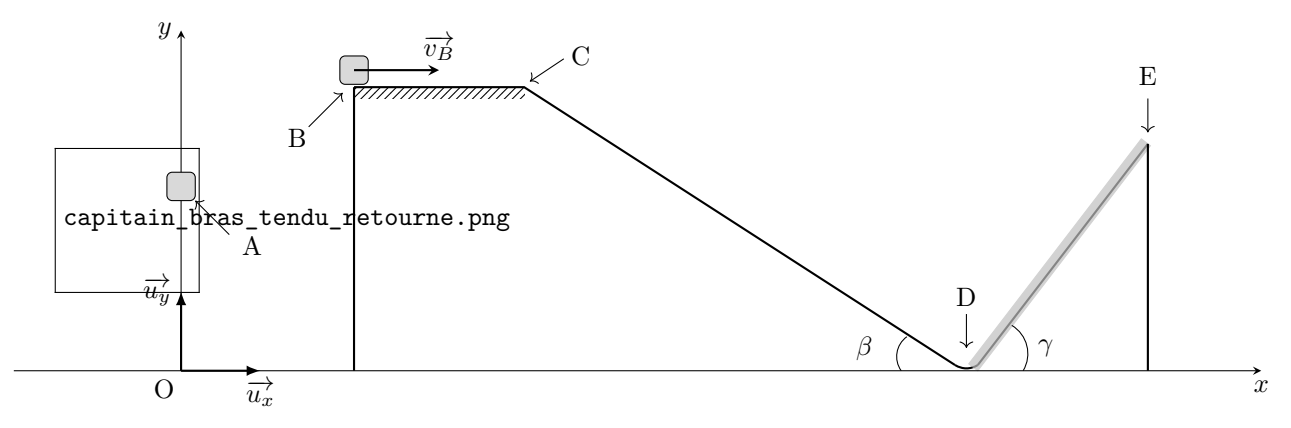

$\overrightarrow{\Omega}$
M
H
$\overrightarrow{a_e}$
$\overrightarrow{\mathcal{G}}$
$\overrightarrow{g}$
λ

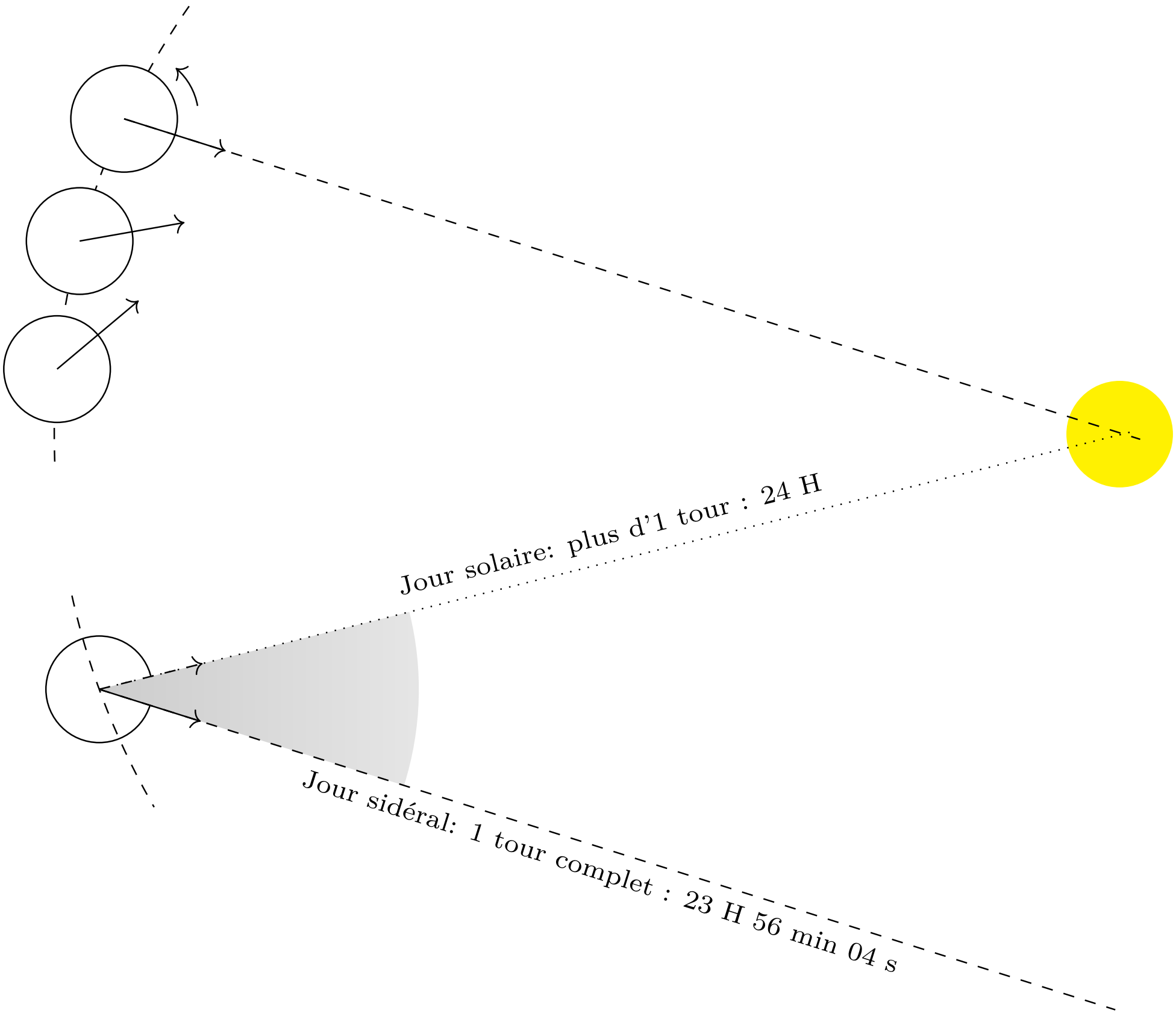

$\overrightarrow{u_r}$
$\overrightarrow{u_\theta}$
P
$\overrightarrow{u_z}$
θ
O
$\overrightarrow{e}$

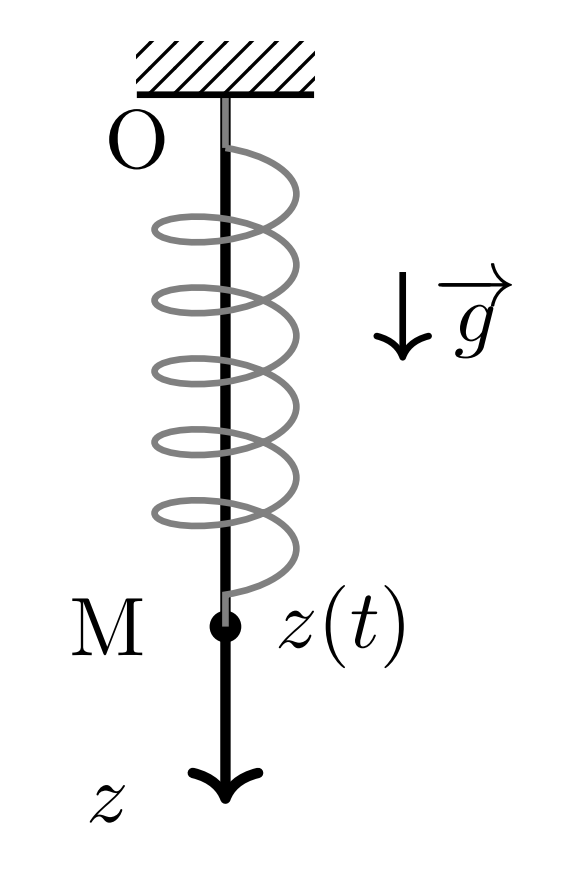

Cible
$\overrightarrow{v}$
$\overrightarrow{\Omega}$
$\overrightarrow{F_{ic}}$

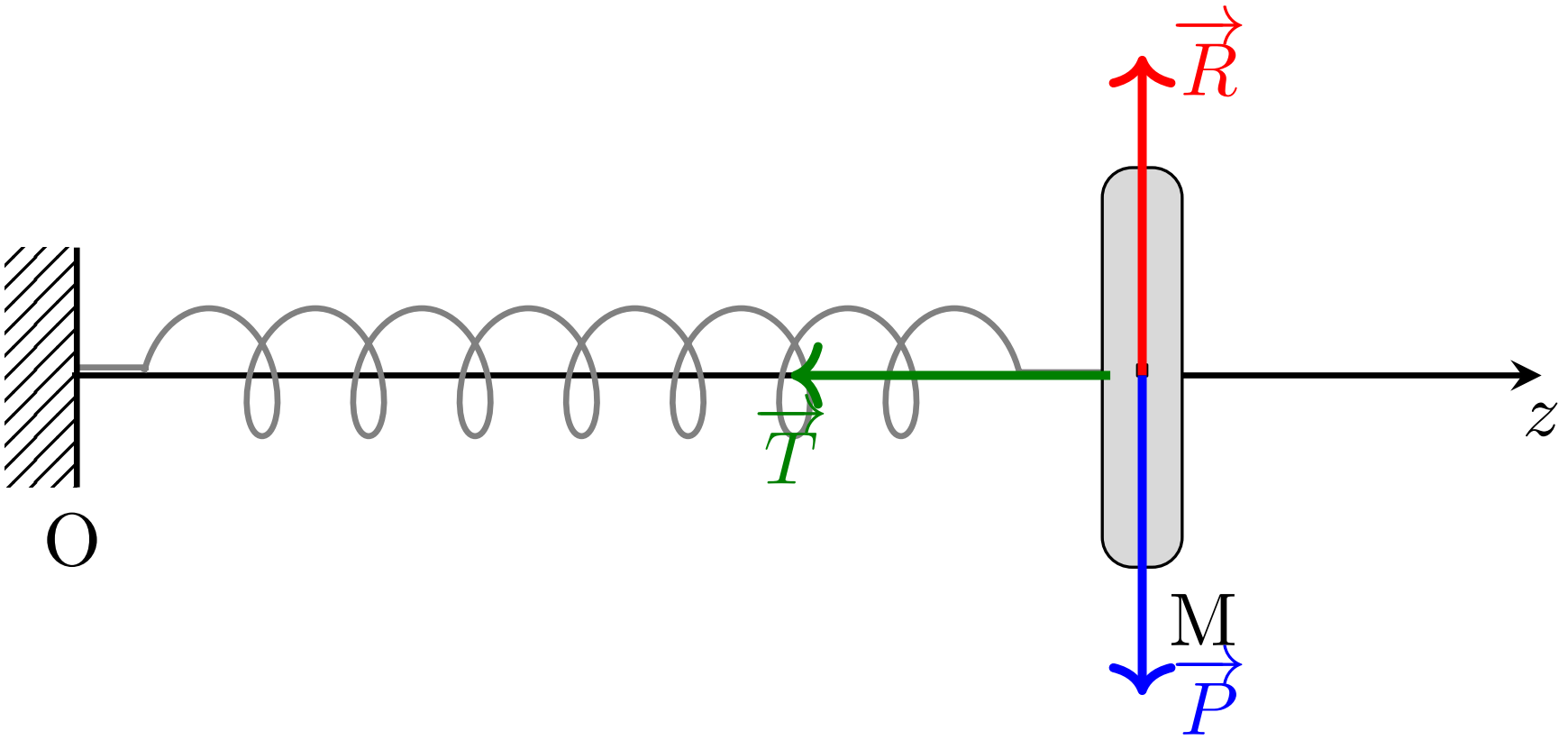

Cible
$\overrightarrow{v}$
$\overrightarrow{\Omega}$

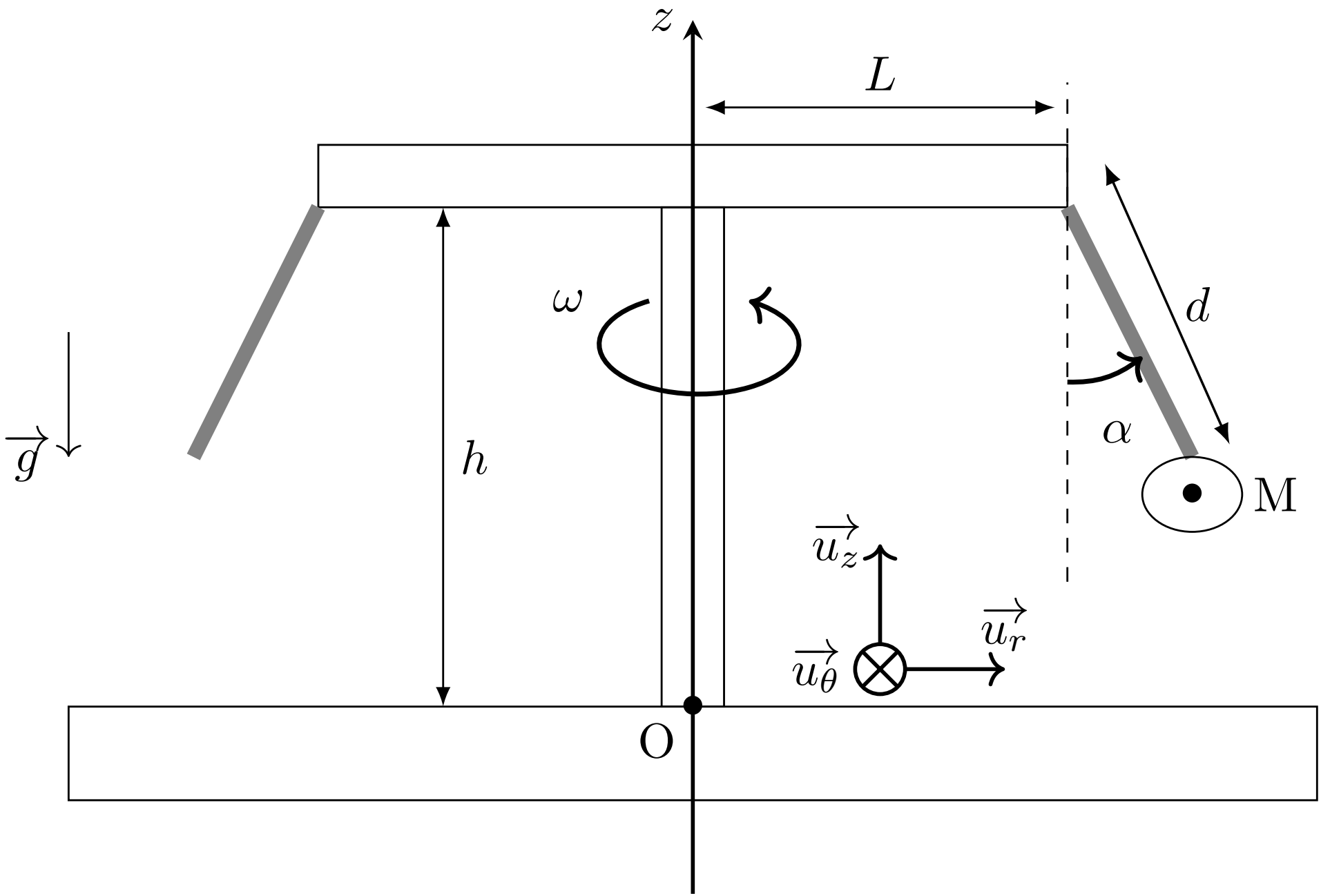

y
y'
$(\mathcal{R})$
$(\mathcal{R}')$
x
O
O'
x'
θ
M


y
$\overrightarrow{v_B}$
C
B
E
capitain_bras_tendu_retourne.png
A
$\overrightarrow{u_y}$
D
β
γ
O
$\overrightarrow{u_x}$
x

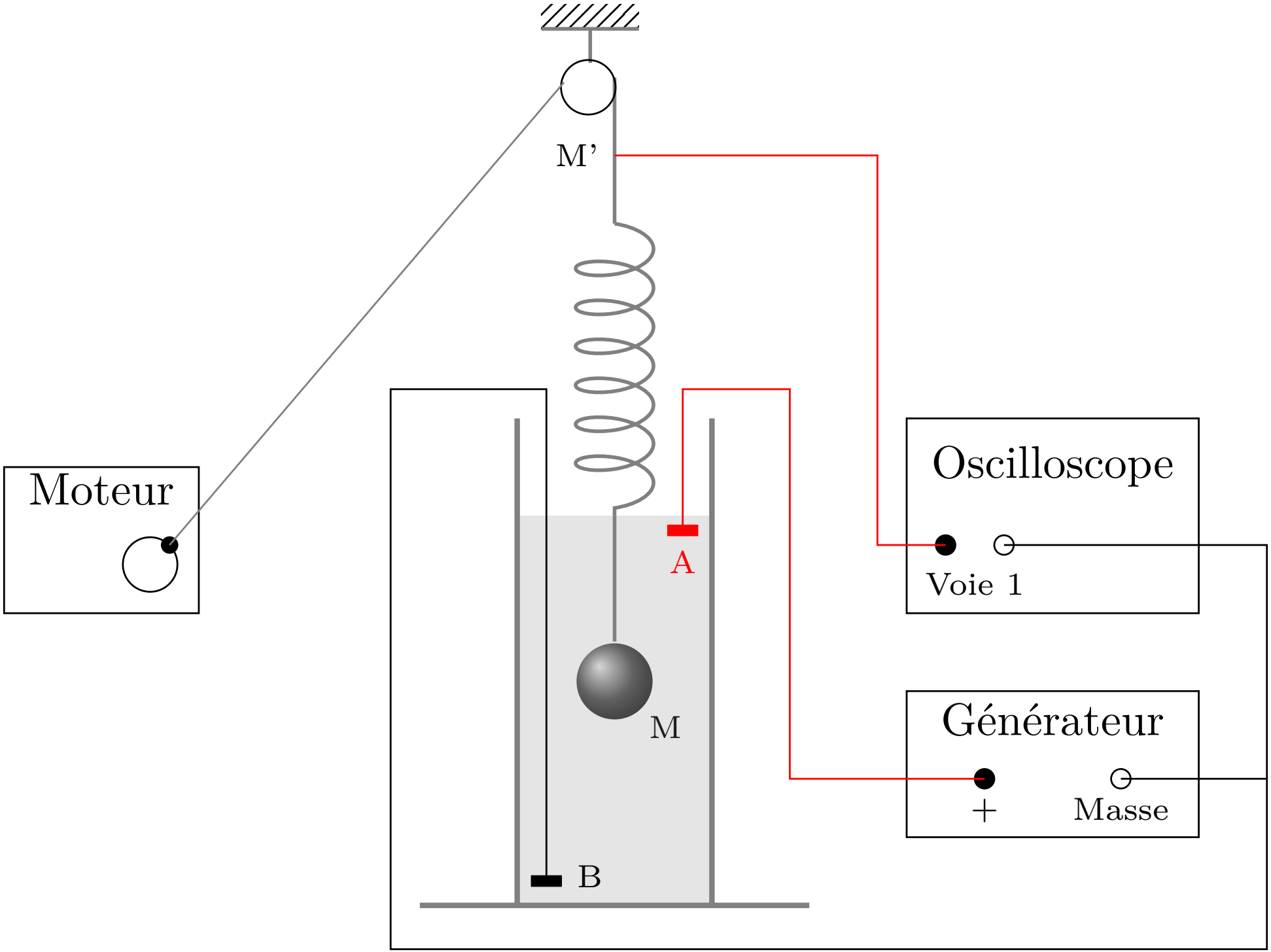

Jour solaire: plus d'1 tour : 24 H
Jour sidéral: 1 tour complet : 23 H 56 min 04 s


O
$\vec{g}$
M
$z(t)$
z


$\vec{R}$
$\vec{T}$
z
O
M
$\vec{P}$



z
L
ω
d
α
$\overrightarrow{g}$
h
M
$\overrightarrow{u_z}$
$\overrightarrow{u_r}$
$\overrightarrow{u_\theta}$
O


Moteur
M'
A
M
B
Oscilloscope
Voie 1
Générateur
+
Masse