TD2 _ Physique 1

Corrigés

Exercice 1

1) a) v = constante

$$x_J = \int v\,dt = v.t + \cancel{x_0}^{\,0}$$

$$t = \frac{x}{v} = \frac{100}{30} = 3{,}33\,s$$

b) Alex : $a = 3\,m/s^2$

$$v = \int a\,dt = \int 3\,dt = 3t + \cancel{v_0}^{\,0}$$

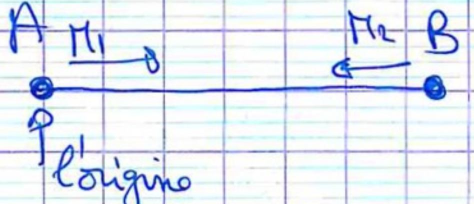
$$x_A = \int 3t\,dt = \frac{3}{2}t^2 + \cancel{x_0}^{\,0}$$

$$x_A(\text{à } t = 3{,}33\,s) = \frac{3}{2} \times (3{,}33)^2 = 16{,}67\,m.$$

2) a)
$$x_J = x_A$$
$$v.t = \frac{1}{2}a t^2$$
$$v = \frac{1}{2}a.t \Rightarrow t = \frac{2.v}{a} = \frac{2.30}{3} = 20\,s$$

b) à $t = 20\,s$
$$x_J = 30 \times 20 = 600\,m$$
$$x_A = \frac{1}{2}.3.(20)^2 = 600\,m$$

Exercice 2 :



1) M_1 : $a = 3\ m/s^2$

$x_1 = ?$ $\quad v = \int a\,dt = \int 3\,dt = 3t + \cancel{v_0}^{0}$

$$x_1 = \int 3t\,dt = \frac{3}{2}t^2 + \cancel{x_0}^{0}$$

$$\boxed{x_1 = \frac{3}{2}t^2}$$

M_2 : $a = 0$, $v = 5\ m/s$.

$$x_2 = -\int v\,dt = -\int 5\,dt = -5t + x_0 = -5t + 100$$

2) $x_1 = x_2$

$$\frac{3}{2}t^2 = -5t + 100$$

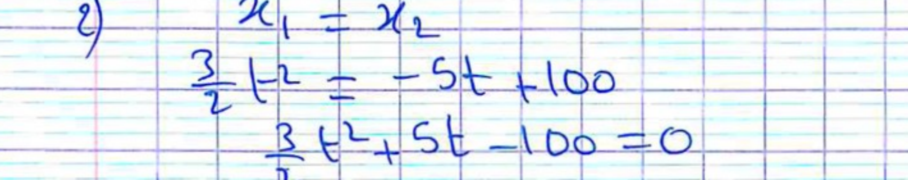
$$\frac{3}{2}t^2 + 5t - 100 = 0$$

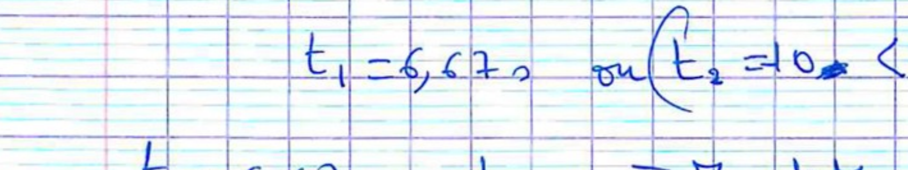
$t_1 = 6,67\ s$ ou ($t_2 = -10 < 0$ non acceptable)

$t = 6,67\ s$ temps où M_1 et M_2 se rejoignent.

3) à $t = 6,67\ s$: $x_1 = \frac{3}{2}(6,67)^2 = 66,67\ m$.

Exercice 3 :





Alice :

$d_1 = \frac{1}{2} a t^2 + \cancel{v_0}^{\,0}$

$a = \frac{v}{t} = \frac{8}{2} = 4 \ m/s^2 \Rightarrow \boxed{d_1 = 2t^2}$

$d_1 = 2 \times 2^2 = 8 m$

$d_{restante} = 150 - 8 = 142 m$

$t_{restant} = \frac{d}{v} = \frac{142}{8} = 17,75 s$

$t_{totale_{Alice}} = 2 + 17,75 s = 19,75$

Bob :

$d_1 = \frac{1}{2} a t^2 + \cancel{v_0}^{\,0}$

$a = \frac{v}{t} = \frac{9,2}{1,5} = 6,13 m/s^2 \Rightarrow \boxed{d_1 = \frac{6,13}{2} t^2}$

$d_1 = \frac{1}{2} . 6,13 . (1,5)^2 = 6,9 m$

$d_{restant} = 150 - 6,9 = 143,1 m$

$t_{restant} = \frac{d}{v} = \frac{143,1}{9,2} = 15,55 s$

$t_{totale_{Bob}} = 1,5 + 15,55 = 17,05 s$

$t_{Bob} < t_{Alice}$ c'est lui qui gagne

Exercice 4 :

a) $x_t = 5t \Rightarrow v = \frac{dx}{dt} = 5\ m/s$; $a = \frac{dv}{dt} = 0$

b) $x_t = 2t^2 - t + 4 \Rightarrow v = \frac{dx}{dt} = 4t - 1$; $a = 4\ m/s^2$.

c) $x_t = \frac{1}{3}t^2 + 12 \Rightarrow v = \frac{dx}{dt} = \frac{2}{3}t$; $a = \frac{2}{3}\ m/s^2$

d) $x_t = 4t - \frac{2}{5} \Rightarrow v = \frac{dx}{dt} = 4\ m/s$; $a = 0$

Exercice 5 :

$M \begin{cases} x = 1 + \cos t \\ y = \sin t \end{cases}$ $\qquad N \begin{cases} x = -4t \\ y = t^2 + 2 \end{cases}$

1) $M \begin{cases} (x-1)^2 = \cos^2 t \\ y^2 = \sin^2 t \end{cases}$ (+) $\Rightarrow (x-1)^2 + y^2 = \cos^2 t + \sin^2 t$

$\boxed{(x-1)^2 + y^2 = 1}$ équation de la trajectoi

$N \begin{cases} -\frac{x}{4} = t \\ y = t^2 + 2 \end{cases}$ on remplace t dans l'équation de y

$y = \left(-\frac{x}{4}\right)^2 + 2 \Rightarrow \boxed{y = \frac{x^2}{16} + 2}$ équation de trajectoire de N

2) $\vec{OM} = (1 + \cos t)\,\vec{e}_x + \sin t\,\vec{e}_y$

$\vec{v}_M = \frac{d\vec{OM}}{dt} = -\sin t\,\vec{e}_x + \cos t\,\vec{e}_y$

$\vec{a}_M = \frac{d\vec{v}}{dt} = -\cos t\,\vec{e}_x - \sin t\,\vec{e}_y$

$$\vec{ON} = -4\,\vec{e}_x + (t^2+2)\,\vec{e}_y$$

$$\vec{v}_N = \frac{d\vec{ON}}{dt} = 0 + 2t\,\vec{e}_y = 2t\,\vec{e}_y$$

$$\vec{a}_N = \frac{d\vec{v}_N}{dt} = 2\,\vec{e}_y.$$

Exercice 6 :

a) Entre 0 et 20 s.

$x = \int v\,dt$ = Aire ou la surface sous la courbe de v

= A trapèze

$$d = \frac{(B+b)h}{2} = \frac{(4+2).20}{2} = 60\,m.$$

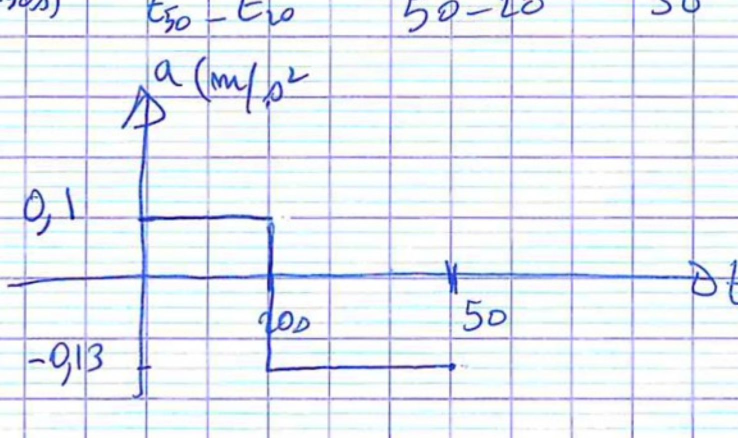
Entre 20 et 50 s :

x = Aire du triangle $= \frac{B \times h}{2} = \frac{4 \times 30}{2} = 60\,m.$

distance totale $= 60 + 60 = 120\,m.$

b) $a_{(0-20s)} = \frac{v_{20} - v_0}{t_{20} - 0} = \frac{4-2}{20-0} = 0{,}1\,m/s^2.$

$$a_{(20-50s)} = \frac{v_{50} - v_{20}}{t_{50} - t_{20}} = \frac{0-4}{50-20} = \frac{-4}{30} = -0{,}13\,m/s^2$$



Exercice 7 :

Pour $A\left(2, \frac{\pi}{3}; 5\right)$ $\begin{cases} \rho = 2 \\ \theta = \frac{\pi}{3} \\ z = 5 \end{cases}$

$x = \rho \cos\theta$
$y = \rho \sin\theta$ $\Rightarrow$ $\begin{cases} x = 2\cos\frac{\pi}{3} = 1 \\ y = 2\sin\frac{\pi}{3} = \sqrt{3} \\ z = 5 = 5 \end{cases}$ $A(1; \sqrt{3}; 5)$
$z = z$

Pour $B\left(4, \frac{3\pi}{2}; -2\right)$

$x = 4\cos\frac{3\pi}{2} = 0$
$y = 4\sin\frac{3\pi}{2} = -4$ $\rightarrow$ $B(0, -4, -2)$
$z = -2$