Trayectorias de Móviles en exámenes BI-NS

Nov 01

A particle is moving along a straight line so that t seconds after passing through a fixed point O on the line, its velocity $v(t)\ \text{m s}^{-1}$ is given by $v(t) = t\sin\left(\frac{\pi}{3}t\right)$.

(a) Find the values of t for which $v(t) = 0$, given that $0 \le t \le 6$.

(b) (i) Write down a mathematical expression for the **total** distance travelled by the particle in the first six seconds after passing through O.

(ii) Find this distance.

Mayo 02

Se lanza una partícula según una trayectoria rectilínea. Pasados t segundos, su velocidad v en metros por segundo esta dada por $v = \frac{1}{2+t^2}$.

(a) Halle la distancia recorrida durante el primer segundo.

(b) Halle una expresión de la aceleración en el instante t.

Nov 02

Una partícula se mueve en línea recta con una velocidad dada en metros por segundo, a los t segundos, por

$$v(t) = 6t^2 - 6t,\ t \ge 0$$

Calcule la distancia total recorrida por la partícula en los primeros dos segundos de movimiento.

Mayo 03

Una partícula se desplaza en línea recta. Su velocidad $v\ \text{ms}^{-1}$ pasados t segundos, está dada por $v = \text{e}^{-\sqrt{t}}\text{sen}\,t$.

Halle la distancia total recorrida en el intervalo de tiempo $[0, 2\pi]$.

Mayo 06

Particle A moves in a straight line, starting from O_A, such that its velocity in metres per second for $0 \le t \le 9$ is given by

$$v_A = -\frac{1}{2}t^2 + 3t + \frac{3}{2}.$$

Particle B moves in a straight line, starting from O_B, such that its velocity in metres per second for $0 \le t \le 9$ is given by

$$v_B = \text{e}^{0.2t}.$$

(a) Find the maximum value of v_A, justifying that it is a maximum.

(b) Find the acceleration of B when $t = 4$.

The displacements of A and B from O_A and O_B respectively, at time t are s_A metres and s_B metres. When $t = 0$, $s_A = 0$, and $s_B = 5$.

(c) Find an expression for s_A and for s_B, giving your answers in terms of t.

(d) (i) Sketch the curves of s_A and s_B on the same diagram.

(ii) Find the values of t at which $s_A = s_B$.

Mayo 07

Una partícula se mueve en línea recta. Transcurrido un tiempo t segundos, su desplazamiento respecto a un punto fijo O es igual a s metros, y su velocidad v en metros por segundo viene dada por la expresión $v = 3t^2 - 4t + 2$, con $t \geq 0$. Cuando $t = 0$, $s = -3$. Halle el valor de t para el cual la partícula se encuentra en O.

Nov 07

The acceleration in m s^{-2} of a particle moving in a straight line at time t seconds, $t > 0$, is given by the formula $a = -\dfrac{1}{(1+t)^2}$. When $t = 1$, the velocity is $8\ \text{m s}^{-1}$.

(a) Find the velocity when $t = 3$.

(b) Find the limit of the velocity as $t \to \infty$.

(c) Find the exact distance travelled between $t = 1$ and $t = 3$.

Mayo 08

A particle moves in a straight line in a positive direction from a fixed point O.

The velocity $v\ \text{m s}^{-1}$, at time t seconds, where $t \geq 0$, satisfies the differential equation

$$\frac{dv}{dt} = \frac{-v(1+v^2)}{50}.$$

The particle starts from O with an initial velocity of $10\ \text{m s}^{-1}$.

(a) (i) Express as a definite integral, the time taken for the particle's velocity to decrease from $10\ \text{m s}^{-1}$ to $5\ \text{m s}^{-1}$.

(ii) **Hence** calculate the time taken for the particle's velocity to decrease from $10\ \text{m s}^{-1}$ to $5\ \text{m s}^{-1}$.

(b) (i) Show that, when $v > 0$, the motion of this particle can also be described by the differential equation $\dfrac{dv}{dx} = \dfrac{-(1+v^2)}{50}$ where x metres is the displacement from O.

(ii) Given that $v = 10$ when $x = 0$, solve the differential equation expressing x in terms of v.

(iii) **Hence** show that $v = \dfrac{10 - \tan\dfrac{x}{50}}{1 + 10\tan\dfrac{x}{50}}$.

Muestra 08

The acceleration of a body is given in terms of the displacement s metres as $a = \frac{2s}{s^2+1}$.

(a) Give a formula for the velocity as a function of the displacement given that when $s = 1$ metre, $v = 2\ \text{ms}^{-1}$.

(b) Hence find the velocity when the body has travelled 5 metres.

Mayo 09 TZ2 P2#6

La aceleración, en m s^{-2}, de una partícula que se mueve en línea recta en el instante t segundos, con $t \geq 0$, viene dada por la fórmula $a = -\frac{1}{2}v$. Para $t = 0$, la velocidad es igual a $40\ \text{m s}^{-1}$.

Halle una expresión para v en función de t.

Mayo 11 TZ2 P2#3

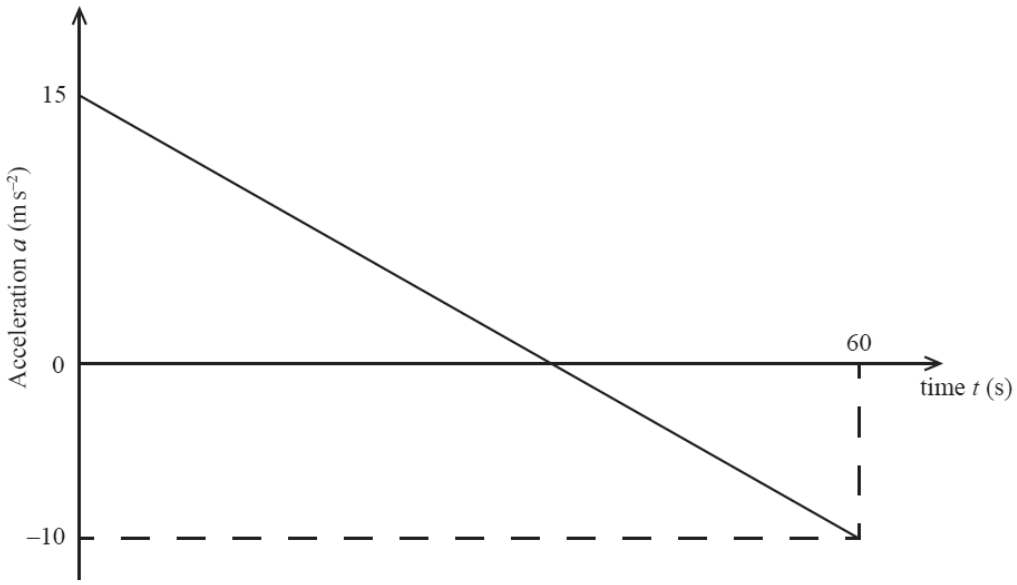
A skydiver jumps from a stationary balloon at a height of 2000 m above the ground. Her velocity, $v\ \text{m s}^{-1}$, t seconds after jumping, is given by $v = 50(1 - e^{-0.2t})$.

(a) Find her acceleration 10 seconds after jumping.

(b) How far above the ground is she 10 seconds after jumping?

Mayo 11 TZ1 P2#8

A jet plane travels horizontally along a straight path for one minute, starting at time $t = 0$, where t is measured in seconds. The acceleration, a, measured in m s^{-2}, of the jet plane is given by the straight line graph below.



(a) Find an expression for the acceleration of the jet plane during this time, in terms of t.

(b) Given that when $t = 0$ the jet plane is travelling at $125\ \text{m s}^{-1}$, find its maximum velocity in m s^{-1} during the minute that follows.

(c) Given that the jet plane breaks the sound barrier at $295\ \text{m s}^{-1}$, find out for how long the jet plane is travelling greater than this speed.

Mayo 13 TZ1 P2#12

A particle, A, is moving along a straight line. The velocity, v_A ms^{-1}, of A t seconds after its motion begins is given by

$$v_A = t^3 - 5t^2 + 6t.$$

(a) Sketch the graph of $v_A = t^3 - 5t^2 + 6t$ for $t \geq 0$, with v_A on the vertical axis and t on the horizontal. Show on your sketch the local maximum and minimum points, and the intercepts with the t-axis.

(b) Write down the times for which the velocity of the particle is increasing.

(c) Write down the times for which the magnitude of the velocity of the particle is increasing.

At $t = 0$ the particle is at point O on the line.

(d) Find an expression for the particle's displacement, x_A m, from O at time t.

A second particle, B, moving along the same line, has position x_B m, velocity v_B ms^{-1} and acceleration, a_B ms^{-2}, where $a_B = -2v_B$ for $t \geq 0$. At $t = 0$, $x_B = 20$ and $v_B = -20$.

(e) Find an expression for v_B in terms of t.

(f) Find the value of t when the two particles meet.

Mayo 13 TZ2 P2#10

La aceleración de un coche es igual a $\frac{1}{40}(60 - v)$ ms^{-2}, siendo v su velocidad en v ms^{-1}. Sabiendo que el coche parte de la posición de reposo, halle la velocidad del coche al cabo de 30 segundos.