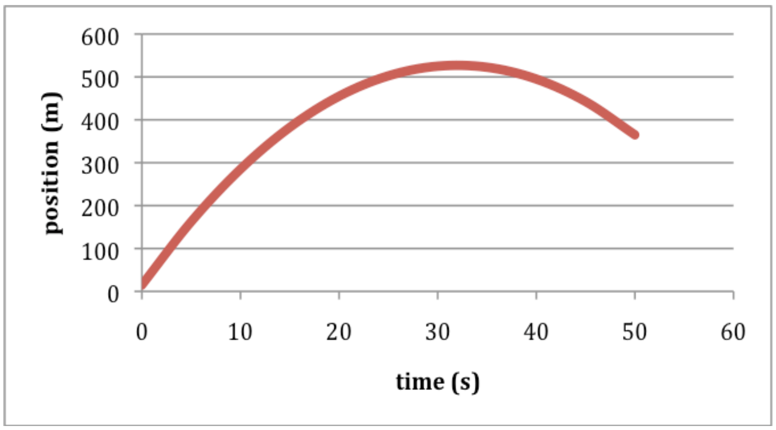
Name____________________________________
Physics 110 Quiz #1, April 2, 2010

Please show all work, thoughts and/or reasoning in order to receive partial credit. The quiz is worth 10 points total.

Suppose that you are given the position-time data and graph shown below.

t(s)	x(m)
0	15
5	162.5
10	285
15	382.5
20	455
25	502.5
30	525
35	522.5
40	495
45	442.5
50	365



1. In the graph above, the sign of the acceleration of the object is

   a. positive.
   b. negative.
   c. zero.
   d. unable to be determined from the information given.

2. Based on the table and graph above solve the following problems.

   a. What are the displacements of the object during the time intervals $t_{0\to 10}$ and $t_{40\to 50}$?

   $$\Delta x_{0\to 10} = 285m - 15m = 270m$$
   $$\Delta x_{40\to 50} = 365m - 495m = -130m$$

   b. What are the average velocities of the object during the time intervals $t_{10\to 30}$ and $t_{20\to 30}$?

   $$v_{10\to 30} = \frac{\Delta x_{10\to 30}}{\Delta t} = \frac{525m - 285m}{20s} = 12\,\tfrac{m}{s}$$
   $$v_{20\to 30} = \frac{\Delta x_{20\to 30}}{\Delta t} = \frac{525m - 455m}{10s} = 7\,\tfrac{m}{s}$$

Useful formulas:

Motion in the r = x, y or z-directions

$$r_f = r_0 + v_{0r}t + \tfrac{1}{2}a_r t^2$$

$$v_{fr} = v_{0r} + a_r t$$

$$v_{fr}^{\,2} = v_{0r}^{\,2} + 2a_r\Delta r$$

Uniform Circular Motion

$$a_r = \frac{v^2}{r}$$

$$F_r = ma_r = m\frac{v^2}{r}$$

$$v = \frac{2\pi r}{T}$$

$$F_G = G\frac{m_1 m_2}{r^2}$$

Geometry /Algebra

Circles	*Triangles*	*Spheres*
$C = 2\pi r$	$A = \frac{1}{2}bh$	$A = 4\pi r^2$
$A = \pi r^2$		$V = \frac{4}{3}\pi r^3$

Quadratic equation: $ax^2 + bx + c = 0,$

whose solutions are given by: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Vectors

$$\textit{magnitude of a vector} = \sqrt{v_x^{\,2} + v_y^{\,2}}$$

$$\textit{direction of a vector} \rightarrow \phi = \tan^{-1}\left(\frac{v_y}{v_x}\right)$$

Useful Constants

$g = 9.8\,{}^{m}/{}_{s^2}$ $\quad G = 6.67\times10^{-11}\,{}^{Nm^2}/{}_{kg^2}$

$N_A = 6.02\times10^{23}\,{}^{atoms}/{}_{mole}$ $\quad k_B = 1.38\times10^{-23}\,{}^{J}/{}_{K}$

$\sigma = 5.67\times10^{-8}\,{}^{W}/{}_{m^2K^4}$ $\quad v_{sound} = 343\,{}^{m}/{}_{s}$

Linear Momentum/Forces

$$\vec{p} = m\vec{v}$$

$$\vec{p}_f = \vec{p}_i + \vec{F}\Delta t$$

$$\vec{F} = m\vec{a}$$

$$\vec{F}_s = -k\vec{x}$$

$$F_f = \mu F_N$$

Work/Energy

$$K_t = \tfrac{1}{2}mv^2$$

$$K_r = \tfrac{1}{2}I\omega^2$$

$$U_g = mgh$$

$$U_S = \tfrac{1}{2}kx^2$$

$$W_T = FdCos\theta = \Delta E_T$$

$$W_R = \tau\theta = \Delta E_R$$

$$W_{net} = W_R + W_T = \Delta E_R + \Delta E_T$$

$$\Delta KE + \Delta U_g + \Delta U_S = 0$$

$$\Delta KE + \Delta U_g + \Delta U_S = -\Delta E_{diss}$$

Heat

$$T_C = \tfrac{5}{9}\left[T_F - 32\right]$$

$$T_F = \tfrac{9}{5}T_C + 32$$

$$L_{new} = L_{old}(1 + \alpha\Delta T)$$

$$A_{new} = A_{old}(1 + 2\alpha\Delta T)$$

$$V_{new} = V_{old}(1 + \beta\Delta T):\ \beta = 3\alpha$$

$$PV = Nk_BT$$

$$\tfrac{3}{2}k_BT = \tfrac{1}{2}mv^2$$

$$\Delta Q = mc\Delta T$$

$$P_C = \frac{\Delta Q}{\Delta t} = \frac{kA}{L}\Delta T$$

$$P_R = \frac{\Delta Q}{\Delta T} = \varepsilon\sigma A\Delta T^4$$

$$\Delta U = \Delta Q - \Delta W$$

Rotational Motion

$$\theta_f = \theta_i + \omega_i t \tfrac{1}{2}\alpha t^2$$

$$\omega_f = \omega_i + \alpha t$$

$$\omega^2{}_f = \omega^2{}_i + 2\alpha\Delta\theta$$

$$\tau = I\alpha = rF$$

$$L = I\omega$$

$$\Delta s = r\Delta\theta:\ v = r\omega:\ a_t = r\alpha$$

$$a_r = r\omega^2$$

Fluids

$$\rho = \frac{M}{V}$$

$$P = \frac{F}{A}$$

$$P_d = P_0 + \rho gd$$

$$F_B = \rho gV$$

$$P_1 + \tfrac{1}{2}\rho v^2{}_1 + \rho gh_1 = P_2 + \tfrac{1}{2}\rho v^2{}_2 + \rho gh_2$$

Simple Harmonic Motion/Waves

$$\omega = 2\pi f = \frac{2\pi}{T}$$

$$T_S = 2\pi\sqrt{\frac{m}{k}}$$

$$T_P = 2\pi\sqrt{\frac{l}{g}}$$

$$v = \pm v_{\max}\left(\sqrt{1 - \frac{x^2}{A^2}}\right)$$

$$v_{\max} = \omega A$$

$$a_{\max} = \omega^2 A$$

$$v = f\lambda$$

$$v = \sqrt{\frac{F_T}{\mu}}$$

$$f_n = nf_1 = n\frac{v}{2L}$$