NAME _____ PERIOD _____ DATE _____

Linear Motion Graph WS2

Practice#1: Motion Graphs & Calculations

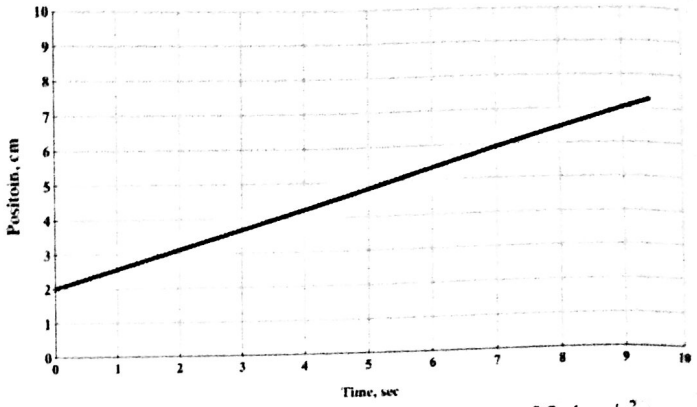
1. The position of a wind-up toy is shown over several seconds.

a. 2cm Estimate the initial position the toy.

b. 5cm / 9s Calculate the average velocity of the toy for the motion shown.

c. $y = b + mx$; $x_f = x_i + v\Delta t$; $x_f = 2 + \frac{5cm}{9s}\Delta t$ Write a position equation for the toy's motion

d. 13 cm If the toy were to continue moving in this way, where would it be at 20.0 seconds?



2. A cart rolls down the ramp. Its **initial position** is 0.55 m and its **initial velocity** is 0.20 m/s. It **accelerates** at a rate of 2.4 m/s^2.

a. $x_f = 0.55m + 0.20m/s(t) + \frac{1}{2}(2.4m/s^2)(t^2)$; $x_f = x_i + v_i t + \frac{1}{2}at^2$ Write the position equation for the cart's motion using these values.

b. 0.822 Calculate its **position** at 0.40 second.

$v_f = v_i + at$; $= 0.2 + 2.4(3)$

c. 7.4 m/s Calculate its **velocity** at 3.0 seconds.

d. Sketch a position-time, velocity-time and an acceleration-time plot for the cart's motion. Mark any known values on the graphs (such as x_0, v_0 and a)

3. The position-time graph of a car is shown over several seconds.

a. Describe the type of motion that created this graph.

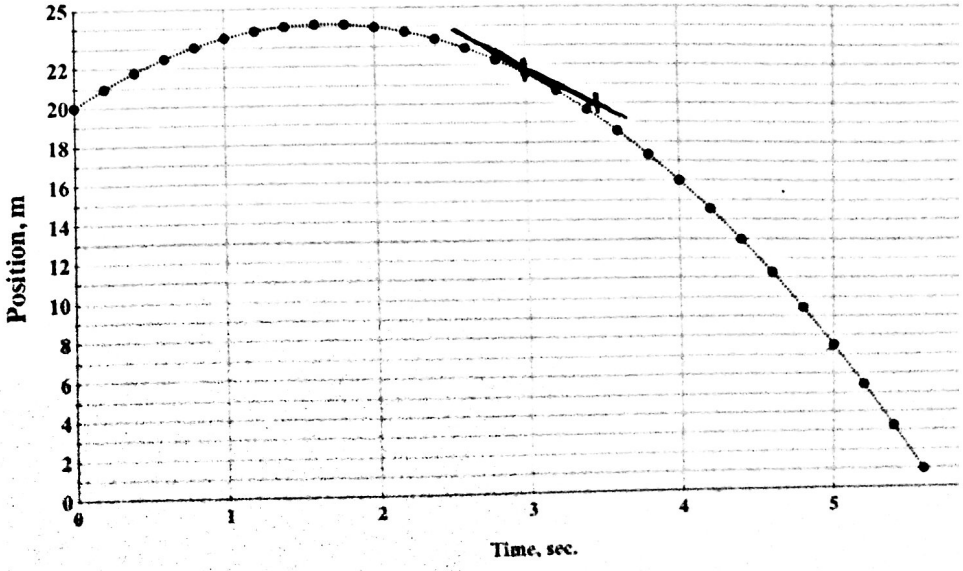
b. 20 m What was the car's **initial position**?

c. Yes positive slope Did the car have an **initial velocity**? How can you tell?

-20 d. -12.5 m What is the **displacement** of the car over the first five seconds?

e. -2.5 m/s Calculate the car's **average velocity** over the first five seconds.

f. -0.4 m/s Calculate the approximate **instantaneous velocity** of the car at 3.0 seconds. ~20-22 m / 0.5sec



g. Why doesn't the *average* velocity for the entire trip equal the *instantaneous* velocity of the car at 2.6 seconds?

h. ~2.75 s Estimate when the instantaneous velocity is approximately zero.

4. The graph shows the velocity vs. time for a rolling ball.

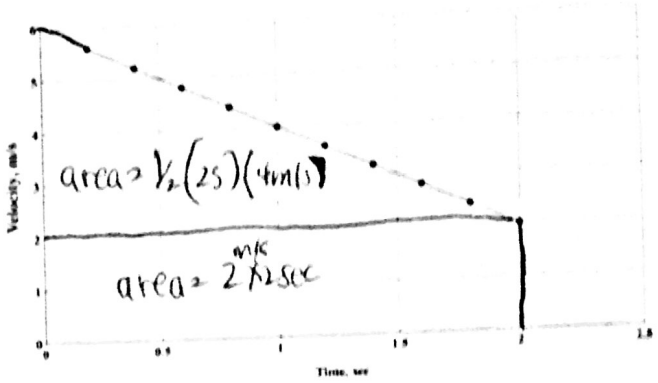
a. Describe how the ball is moving

b. $-2 m/s^2$ What is the ball's **acceleration**?

c. 6 m/s What is the ball's **initial velocity**?

d. $v_f = v_i + a\Delta t$ Write a general equation for the ball's velocity using the starting velocity and acceleration.

$y = b + mx \rightarrow v_f = 6 + (-2)\Delta t$



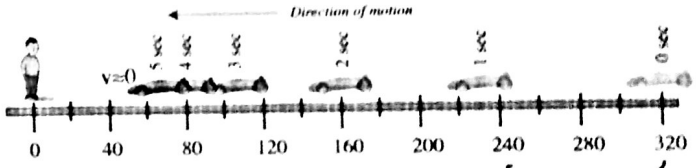
e. 2 m/s How fast would the ball be moving at the 2.0 seconds?

f. 3 sec Calculate the time when the ball will stop. $0 = 6 + (-2)(t)$

g. 8 m Calculate the ball's total **displacement** for the data shown.

5. The changing positions of a car shown in the picture.

a. $v_i = 0$ $x_i = 320m$ *Identify* the values that are given. $\Delta t = 5 sec$ $x_f = 60m$



b. Describe the motion shown.
car moving toward the left + decelerating

c. $-260m$ Estimate the car's displacement.

$v_i = \frac{240-320m}{1s}$

$v_i = -80 m/s$

$\frac{-260m}{5s}$

d. $-52 m/s$ Calculate the average velocity of the car from 0 to 5 seconds.

$a = \frac{\Delta v}{\Delta t} = \frac{0-(-80 m/s)}{5s} = -16 m/s^2$

e. $-16 m/s^2$ Calculate the acceleration of the car.

6. A pumpkin is thrown directly upward with an **initial velocity** of 19.6 m/s.

a. $v_i = 19.6 m/s, x_i = 0, a = -9.81 m/s^2$ Identify the known values for this situation. (x, x_0, v, v_0, a, t)

b. 2.00 s How much **time** will it take for the pumpkin to reach its maximum height? $v_f = 0$

c. 19.6 m How **high** will the pumpkin get?

$v_f = v_i + a\Delta t$

$0 = 19.6 m/s + 9.81 m/s^2(\Delta t)$

$\frac{+19.6 m/s}{-9.81 m/s^2} = \frac{-9.81 m/s^2(\Delta t)}{-9.81 m/s^2}$

$\Delta t = 2 sec$

either use: $v_f^2 = v_i^2 + 2a\Delta x$

or $x_f = x_i + v_i t + \frac{1}{2}at^2$