PHYSICS 1408 LAMP

CHAPTER 2 NOTES

ONE-DIMENSIONAL MOTION:

>Kinematics Equation Symbols:

Acceleration: a

Velocity: v

Position: x

Time: t

*Initial and Final values are represented with subscripts, such as:

V_i and V_f X_i and X_f

>Kinematics Equations to Memorize:

$V_f = V_i + at$ *Does not need X

$V_{avg} = (V_i + V_f)/2$

$X_f = X_i + V_i t + (1/2)at^2$ *Does not need V_f

$V_f^2 = V_i^2 + 2a(X_f - X_i)$ *Does not need t

>Examples:

1. A car with initial velocity of 10 m/s accelerates. Its velocity after 5 seconds is 20 m/s. What was the car's acceleration?

Given: $V_i = 10$ m/s   Solving for: a

$V_f = 20$ m/s

T = 5 s

The kinematics equation with the variables given and needed is:

$V_f = V_i + at$ Now plug in givens and solve…

20 m/s = 10 m/s + a(5s)

10 m/s = (5s)a

2 m/s^2 = a

The car is accelerating at a rate of 2 m/s^2.

2. A car going 20 m/s comes to a stop in 30 m. What is the acceleration?

Given: $V_i = 20$ m/s Solving for: a

$\Delta X = 30$ m *($X_f - X_i$)

$V_f = 0$ m/s *Car came to a stop

The kinematics equation we need is:

$V_f^2 = V_i^2 + 2a(\Delta X)$ Plug and Chug...

$(0 \text{ m/s})^2 = (20 \text{ m/s})^2 + 2a(30 \text{ m})$

$0 = 400 \text{ m/s} + (60 \text{ s})a$

$-400 \text{ m/s} = (60 \text{ s})a$

$-6.66 \text{ m/s}^2 = a$ *The value is negative because the car is slowing down

The car is accelerating at a rate of -6.66 m/s^2.

3. A car is initially moving with a velocity of 10 m/s. It accelerates for 5 seconds at a rate of 2 m/s^2. If its final velocity is 20 m/s, over what distance was the car accelerating?

Given: $V_i = 10$ m/s Solving For: ΔX

$V_f = 20$ m/s

$A = 2 \text{ m/s}^2$

$T = 5$ s

The kinematics equation we need is:

$X_f = X_i + V_i t + (1/2)at^2$ Plug and Chug...

$X_f - X_i = (10 \text{ m/s})(5 \text{ s}) + (1/2)(2 \text{ m/s}^2)(5 \text{ s})^2$ *$X_f - X_i$ becomes ΔX

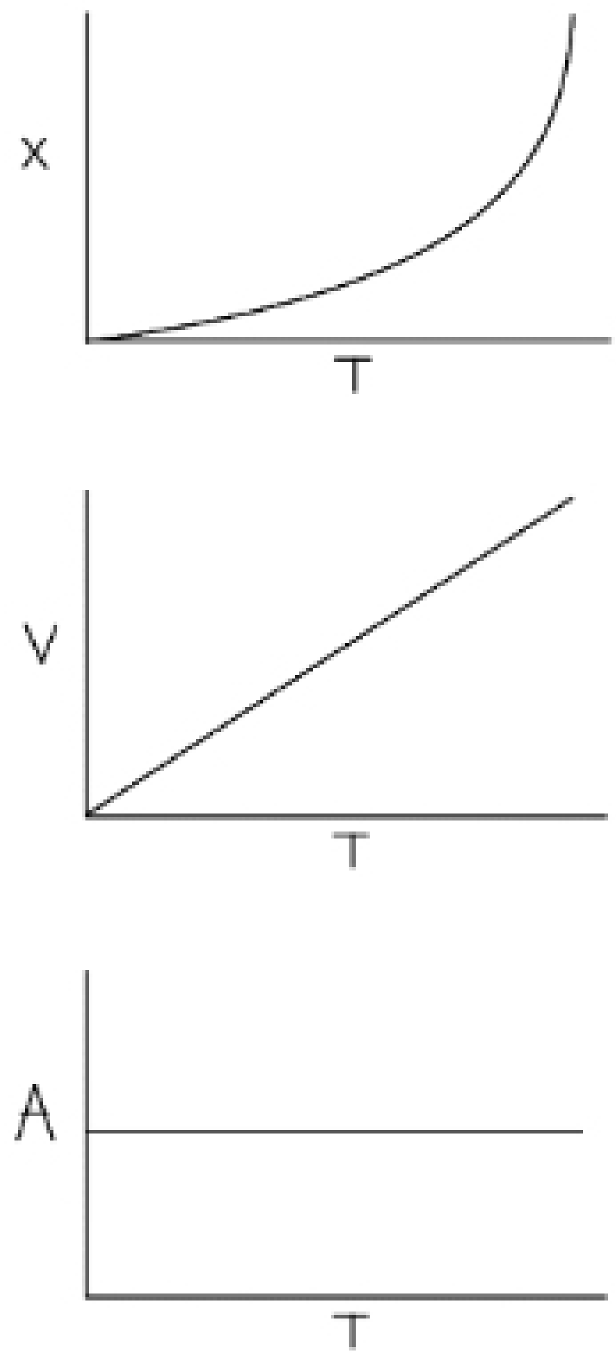
$\Delta X = (50 \text{ m}) + (25 \text{ m})$

$\Delta X = 75$ m

The car is accelerating over 75 meters.

>Position Velocity Acceleration Charts:

Position, velocity, and acceleration can be compared as graphs over time.



The three graphs represent the linear relationships of x, v, and a

Mathematically, $a = (d/dx)(v) = (d^2/dx)(x)$

Acceleration is the derivative of velocity which is the derivative of position

One graph can help determine the other two graphs, and show what is happening to each variable over the course of the problem.

<- These graphs represent a situation in which an object is moving at a positive velocity with a constant, positive acceleration.

As you can imagine, the graphs can vary quite a bit depending on the situation they're depicting.