KINEMATICS

FT KINEMATICS (21 S2)

Directions: Solve the following problems. Your work will be graded, not just the answer. Each question is worth 5 points. The test is worth 50 points.

1) Niagara Falls, NY is 315 miles away. If we assume a realistic speed average of 50 mi/hr including stops, how long will it take to drive there?

$X = 315 \, mi$

$v = 50 \, mi/hr$

$a = zero$

$t \sim ?$

$x = v_0 t + \frac{1}{2} a t^2$

$x = v_0 t$

$\frac{x}{v_0} = t$

$\frac{315 \, mi}{50 \frac{mi}{hr}} = 6.3 \, hr$

$6 \, hr \; \& \; 18 \, min$

2) Determine the acceleration of a car that starts from rest and obtains a speed of 50 mi/hr in a
time of 6.5 seconds. Express in mi/hr/s

$v_0 = Zero$

$v = 50 mi/hr$

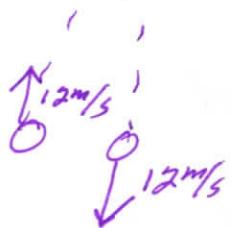$t = .5s$

$a = ?$

$v = v_0 + at$

$$\frac{v - v_0}{t} = a$$

$$\frac{50 \frac{mi}{hr} - 0}{6.5s} = a$$

$$\frac{50 \frac{mi}{hr}}{s}$$

$$7.7 \frac{mi}{hr}/s$$

3) A ball is thrown up in the air with an initial speed of 12m/s. How long will the ball be in the air?

$v_0 = 12 \text{ m/s}$
$v = -12 \text{ m/s}$
$a = -9.8 \text{ m/s}^2$
$t = ?$

$v = v_0 + at$

$\dfrac{v - v_0}{a} = t$

$\dfrac{-12\frac{m}{s} - 12\frac{m}{s}}{-9.8 \text{ m/s}^2} = t$

$\boxed{2.4s = t}$

4) A ball is thrown upward at 12 m/s. How long will it take the ball to reach its highest point?

$v_0 = 12 \text{ m/s}$

$v = \text{Zero}$

$a = -9.8 \text{ m/s}^2$

$t = ?$

$v = v_0 + at$

$\dfrac{v - v_0}{a} = t$

$\dfrac{\text{Zero} - 12 \text{ m/s}}{-9.8 \text{ m/s}^2} = 1.22 s$

5) A phone is dropped from a table in class. The table is 74cm tall. How long do you have to try to catch it before it hits the floor (In other words, how long will it take to hit the floor?)

$$y = -.74m$$
$$a = -9.8 \, m/s^2$$
$$t = ?$$
$$v_0 = Zero$$

$$x = v_0 t + \frac{1}{2}at^2$$

$$x = \frac{1}{2}at^2$$

$$\sqrt{\frac{2x}{a}} = t$$

$$\sqrt{\frac{(2)(-.74m)}{-9.8 \frac{m}{s^2}}} = t$$

$$\cancel{.15s} = t$$

$$\boxed{.39s = t}$$

6) Short essay question.... A person stands still and jumps straight up. How could you determine how fast (the speed they were traveling) they were traveling when they left the floor?

7) A ball is rolling along at 0.5 m/s. The ball then comes to a downhill that results in the ball accelerating at 3 m/s². How fast will the ball be traveling if the ramp is 1.2 m long?

$v_0 = .5 \, m/s$

$a = 3 \, m/s^2$

$x = 1.2 \, m$

$v = ?$

$v^2 = v_0^2 + 2ax$

$v = \sqrt{v_0^2 + 2ax}$

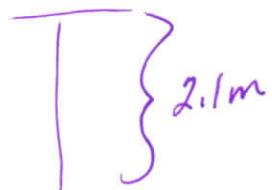$v = \sqrt{(.5 \tfrac{m}{s})^2 + (2)(3\tfrac{m}{s^2})(1.2m)}$

$v = 2.73 \, m/s$

8) A friend of yours is up in the bleachers while you are on the ground. You have a burger for them that you wish to throw up for them to catch. Assuming they are able to get directly above you, 2.1 m above you, how fast would you need to throw the burger so they can catch it?

$v_0 = ?$

$v = Zero$

$y = 2.1m$

$v = Zero$

2.1m

$v^2 = v_0^2 + 2ax$

$\dfrac{v^2 - v_0^2}{2a} = x$

Zero

$\sqrt{v^2 - 2ax} = v_0$

$\sqrt{0 - (2)(-9.8\frac{m}{s^2})(2.1m)} = v_0$

$6.4\frac{m}{s} = v_0$