

key Pd 1

Kinematics Test

AT kinematics (08)

Solve the following problems. Each is worth 5 points. Be sure to show all work, and circle your answer. This test is worth 50 points.

- 1) During a trip, you notice a road sign while on the highway stating there are 18 miles until "Your Exit." If you are driving with the cruise set to 72 mi/hr, how long will it take you to get to the exit?

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

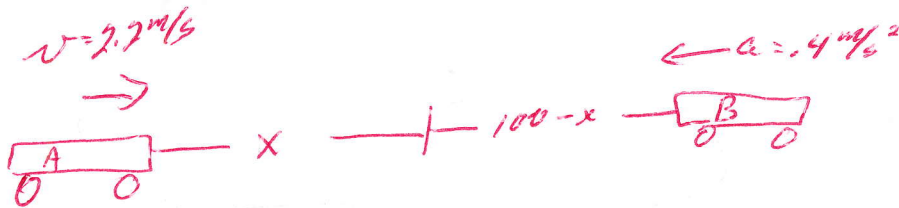
$$t = \frac{x}{v} = \frac{18 \text{ mi}}{72 \text{ mi/hr}} = 0.25 \text{ hr} = 15 \text{ min}$$

- 2) Two carts are 100 m apart. Cart "A" goes into motion (at $t=0$) with a constant speed of 2.2 m/s. Cart B has an initial speed of zero at $t=0$ and accelerates at a rate of 0.4m/s^2 . If the two carts are moving toward each other, determine where they meet.

A
 $a_A = 2.2\text{m/s}$
 $x_A = x$
 $v_A = 2.2\text{m/s}$
 $t_A = t$

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

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



B
 $a_B = 0.4\text{m/s}^2$
 $v_{0B} = 0$
 $t_B = t$

$$x_B = \frac{1}{2} a_B t^2$$

$$(100 - x) = \frac{1}{2} (0.4\text{m/s}^2) t^2 \quad x_B = 100 - x$$

$$(100 - x) = (0.2\text{m/s}^2) \frac{x^2}{v_A^2}$$

$$(100 - x) = \frac{(0.2\text{m/s}^2) x^2}{(2.2\text{m/s})^2}$$

$$(100 - x) = \frac{(0.2\text{m/s}^2) x^2}{4.84\text{m}^2/\text{s}^2}$$

$$(100 - x) = (0.0413\text{m}) x^2$$

$$0 = (0.0413\text{m}) x^2 + x - 100\text{m}$$

$x = 38\text{m}$ From A's Starting Point

- 3) If a car is moving at 12 m/s (27 mi/hr), determine how far the car will travel if it accelerates at 3.2 m/s^2 to 25 m/s (56 mi/hr).

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

$$v = 25 \text{ m/s}$$

$$a = 3.2 \text{ m/s}^2$$

$$x = ?$$

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

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

$$\frac{(25 \text{ m/s})^2 - (12 \text{ m/s})^2}{2(3.2 \text{ m/s}^2)} = 75 \text{ m}$$

- 4) On November 11, 2006, Tony Schumacher drove his NHRA Top Fuel Dragster to a record holding 4.428s, 1/4 mile (400m) pass. In drag racing, the cars start at rest and "go" when the light turns green. Determine the average acceleration Tony endured during this pass.

$$v_0 = \text{Zero}$$

$$a = ?$$

$$t = 4.428 \text{ s}$$

$$x = 400 \text{ m}$$

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

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

$$\frac{2x}{t^2} = a = \frac{(2)400 \text{ m}}{(4.428 \text{ s})^2} = 40.5 \text{ m/s}^2$$

$$4.16 \text{ g's}$$

- 5) While doing some roof repairs your friend (who is on the roof) asks you (who is on the ground) to throw up his hammer. If your friend is standing 8 m above you, determine how fast the hammer would need to leave your hand so that it stops just in front of him (or her).

$$v_0 = ?$$

$$v = 0 \text{ m/s}$$

$$x = 8 \text{ m}$$

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

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

$$v_0 = 12.5 \text{ m/s}$$

- 6) A ball is thrown up in the air with a speed of 21 m/s. Determine where the ball is 2.4 seconds after being thrown.

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

$$x = (21 \text{ m/s})(2.4 \text{ s}) + \left(\frac{1}{2}\right)(-9.8 \text{ m/s}^2)(2.4 \text{ s})^2$$

$$x = 27 \text{ m Above ground}$$

- 8) A ball is thrown up in the air. Determine the acceleration of the ball at the top of its path.

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