NOTE: This is NOT a Sample Exam… (30,000 points) *Multiple-Guess-Fill-In-The-Bubbles*

mph	sec
25	144.0
30	120.0
35	102.9
40	90.0
45	80.0
50	72.0
55	65.5
60	60.0
65	55.4
70	51.4
75	48.0
80	45.0
85	42.4
90	40.0
95	37.9
100	36.0
105	34.3
110	32.7
115	31.3
120	30.0
125	28.8
130	27.7
135	26.7
225	16.0

1.)(a) Jerry drives his car for 2.00 miles at 40.0 mph. How many minutes does it take to travel this distance? *The handy chart at left may be useful.* *90.0 sec/mile × 2 miles = 180 sec = 3 min.*

A = 2.00 min B = 3.00 min C = 4.00 min D = 5.00 min
E = 6.00 min F = None of these

Ⓐ **Ⓑ** Ⓒ Ⓓ Ⓔ Ⓕ

(b) Janet drives her car for 4.00 miles accelerating from rest to 80.0 mph. How many minutes does it take to travel this distance? *Average speed = 40 mph, so 4 miles in 6 min.*

A = 2.00 min B = 3.00 min C = 4.00 min D = 5.00 min
E = 6.00 min F = None of these

Ⓐ Ⓑ Ⓒ Ⓓ **Ⓔ** Ⓕ

(c) Juan drove 1.00 mile accelerating from rest to 80.0 mph and then 1.00 mile decelerating from 80.0 mph back down to zero. How many minutes does it take? *Average speed = 40 mph, so 2 miles in 3 min.*

A = 2.00 min B = 3.00 min C = 4.00 min D = 5.00 min
E = 6.00 min F = None of these

Ⓐ **Ⓑ** Ⓒ Ⓓ Ⓔ Ⓕ

(d) Joanne drives 2.00 miles at 40.0 mph, 3.00 miles at 90.0 mph and 2.00 miles at 120. mph How many minutes does it take? *(2 × 90.0 sec) + (3× 40.0 sec) + (2×30.0 sec) = 360 sec = 6.00 min.*

A = 2.00 min B = 3.00 min C = 4.00 min D = 5.00 min
E = 6.00 min F = None of these

Ⓐ Ⓑ Ⓒ Ⓓ **Ⓔ** Ⓕ

For each of the following, select the answer A-D that BEST represents the motion.

(e) Diane is waiting for the elevator to arrive. This is an example of _____ Motion.

A = No B = Uniform C = Constant Acceleration
D = None of these

Ⓐ Ⓑ Ⓒ Ⓓ

(f) Diane is standing in the elevator when it starts from rest. This is an example of _____ Motion.

A = No B = Uniform C = Constant Acceleration
D = None of these

Ⓐ Ⓑ **Ⓒ** Ⓓ

(g) Diane walks to her class. This is an example of _____ Motion.

A = No B = Uniform C = Constant Acceleration
D = None of these

Ⓐ **Ⓑ** Ⓒ Ⓓ

For each of the following, select the answer A-F that BEST represents the quantity.

(h) Darryl tosses a football in a ballistic arc with $v_{0x} = 9.81$ m/s. While it is going up, the **acceleration** of the football in the **x-direction** is _____.

A = +9.81 m/s B = +9.81 m/s² C = 0
D = -9.81 m/s E = -9.81 m/s² F = None of these.

Ⓐ Ⓑ **Ⓒ** Ⓓ Ⓔ Ⓕ

(i) The **acceleration** of the football in the **x-direction** at the turning point is _____.

A = +9.81 m/s B = +9.81 m/s² C = 0
D = -9.81 m/s E = -9.81 m/s² F = None of these.

Ⓐ Ⓑ **Ⓒ** Ⓓ Ⓔ Ⓕ

(j) When the football comes back down to Darryl's twin Larry, the **x-component of the velocity** is _____ .

A = +9.81 m/s B = +9.81 m/s² C = 0
D = -9.81 m/s E = -9.81 m/s² F = None of these.

Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓕ

***"This is a Real Duzy!"* (35,000 points)**

2.) (a) The Model J Duesenberg, built from 1929 to 1936, was a powerful and expensive luxury car capable of going 116 mph (51.8 m/s). If the Duesenberg accelerates from rest to 51.8 m/s in 16.2 seconds, find the acceleration, *a*.

$$v = v_0 + a\,t = a\,t \quad or \quad a = \frac{\Delta v}{\Delta t}$$
$$a = \frac{v}{t} = \frac{51.8 m/s}{16.2\,\text{sec}} = 3.200 m/s^2$$

(b) How far does the Duesenberg travel in this time? *This can be found with or without the answer to (a).*

$$x = x_0 + v_0 t + \tfrac{1}{2} a\,t^2$$
$$x = \tfrac{1}{2} a\,t^2 = \tfrac{1}{2}\left(3.200 m/s^2\right)\left(16.2\,\text{sec}\right)^2$$
$$= 419.9 m$$

OR

$$v^2 = v_0^2 + 2a(x - x_0)$$
$$v^2 = 2ax$$
$$x = \frac{v^2}{2a} = \frac{\left(51.8 m/s\right)^2}{2\left(3.200 m/s^2\right)} = 419.3 m$$

OR use average speed d = v t = (25.90 m/s) (16.2sec) = 419.6m

(c) What is the average speed of the Duesenberg while it is accelerating?

$$v = \frac{d}{t} = \frac{419.9 m}{16.2\,\text{sec}}$$
$$= 25.92 m/s$$

OR

$$v_{ave} = \frac{v_0 + v}{2} = \frac{v}{2} = \frac{51.8 m/s}{2}$$
$$= 25.90 m/s$$

(d) It is 204 km (204,000 meters) from here to Detroit. If you could drive your Duesenberg at 116 mph (51.8 m/s) without stopping, how long would it take you?

$$v = \frac{d}{t}$$
$$t = \frac{d}{v} = \frac{204{,}000 m}{51.8 m/s}$$
$$= 3938\,\text{sec} \quad \left(= 1\,hour\ 5\,\text{min}\ 38\,\text{sec}\right)$$

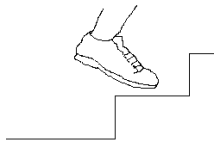
(e) Halfway to Detroit, however, you stop at Burger King to pick up a double cheeseburger off the Dollar Menu. The stop adds 8.00 minutes to your trip. What is your average speed for the whole trip, including this stop?

$$v = \frac{d}{t} = \frac{204{,}000 m}{\left(3938\,\text{sec} + 480.\,\text{sec}\right)}$$
$$= 46.16 m/s$$

It's still 103.3 mph, though. (grin)

Travel Into The Mysterious *Second Dimension!* (35,000 points)

3.) Sandra is out running and goes up a flight of stairs. The stairs go up a height of 2.00 meters and over a horizontal distance of 3.35 meters. If she takes 1.11 seconds to go up the stairs, find (a) the *x*-component of her velocity, v_x , …



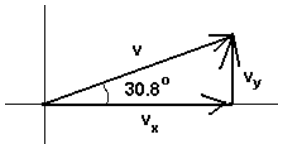
$$v = \frac{d}{t} = \frac{3.35m}{1.11\sec} = 3.018m/s$$

(b) the *y*-component of her velocity, v_y , …

$$v = \frac{d}{t} = \frac{2.00m}{1.11\sec} = 1.802m/s$$

and (c) her vector velocity $\vec{v}$ in Standard Form .

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(3.018m/s)^2 + (1.802m/s)^2}$$
$$= 3.515m/s$$
$$\theta = \tan^{-1}\left(\frac{v_y}{v_x}\right) = \tan^{-1}\left(\frac{1.802m/s}{3.018m/s}\right) = 30.8°$$
$$\vec{v} = 3.515m/s \,@\, 30.8°$$



Running along the upper level at $v_{0x} = 6.00$ *m/s*, Sandra leaps straight out and lands on the ground 2.00 meters below. (d) How much time does it take for her to fall to the ground?

$$y = y_0 + v_{0y}t - \tfrac{1}{2}gt^2$$
$$0 = y_0 - \tfrac{1}{2}gt^2$$
$$y_0 = \tfrac{1}{2}gt^2$$
$$t^2 = \frac{2y_0}{g}$$
$$t = \sqrt{\frac{2y_0}{g}} = \sqrt{\frac{2(2.00m)}{9.81m/s^2}} = 0.6386\sec$$

(e) What is her final v_y just before she lands on the ground? *This can be found with or without the answer to (d).*

$$v_y = v_{0y} - gt = -gt$$
$$= -(9.81m/s^2)(0.6386\sec)$$
$$= -6.265m/s$$

OR

$$v_y^2 = v_{0y}^2 - 2g(y - y_0)$$
$$= -2g(0 - y_0) = 2gy_0$$
$$v_y = \sqrt{2gy_0} = \sqrt{2(9.81m/s^2)(2.00m)}$$
$$= \pm 6.264m/s = -6.264m/s$$