Physics 5A Sample Extra Solutions Midterm I
These are the problems I didn’t have a chance to do in the review session.

Problem 6

Since you have a speed of 3 m/s up the stairs, you will move 12 m in 4 seconds. This distance is along the stairs, so the $x$ and $y$ components can be found by multiplying by the cosine and sine of the angle, respectively. Therefore, the amount of height gained in that time is $12 \sin 40^\circ \approx 7.7$ m. The horizontal distance traveled is $12 \cos 40^\circ \approx 9.2$ m.
Problem 7

a) The average speed can be found using the equation

\[ s_{\text{avg}} = \frac{s_1 \Delta t_1 + s_2 \Delta t_2 + \ldots}{\Delta t_1 + \Delta t_2 + \ldots}. \]

We also know that the distance between the two points can be expressed as \( d = 5\Delta t_1 = 3\Delta t_2 \). Rearranging this equality, we see that \( \Delta t_2 = \frac{5}{3} \Delta t_1 \). Plugging this into our equation for \( s_{\text{avg}} \), we have

\[ s_{\text{avg}} = \frac{5\Delta t_1 + 3\left(\frac{5}{3} \Delta t_1\right)}{\Delta t_1 + \frac{5}{3} \Delta t_1} \]

\[ = \frac{3.75}{1 + \frac{5}{3}} \]

Thus, \( s_{\text{avg}} \approx 3.8 \text{ m/s} \).

b) To find \( v_{\text{avg}} \), we simply note that his net displacement is zero. Therefore, his average velocity is zero.

c) Yes, defining the direction from A to B to be positive, his velocity is negative the entire time that he is walking back from point B to point A.
Problem 9

a) We wish to find the distance the horse travels between the time the ranch hand drops from the tree and the time he reaches the saddle. The equation we use to find this is

$$\Delta x = v_{0x}t$$

$$= 10t.$$ 

In order to find the time it took for him to fall the 3 m, we use

$$\Delta y = v_{0y}t + \frac{1}{2}a_yt^2$$

$$3 = \frac{1}{2}(10)t^2$$

$$t \approx .77s.$$ 

Plugging back into our first equation, we find the distance to be

$$\Delta x = (10)(.77)$$

$$\Delta x \approx 7.7m.$$ 

b) The time has been found above to be .77 s.