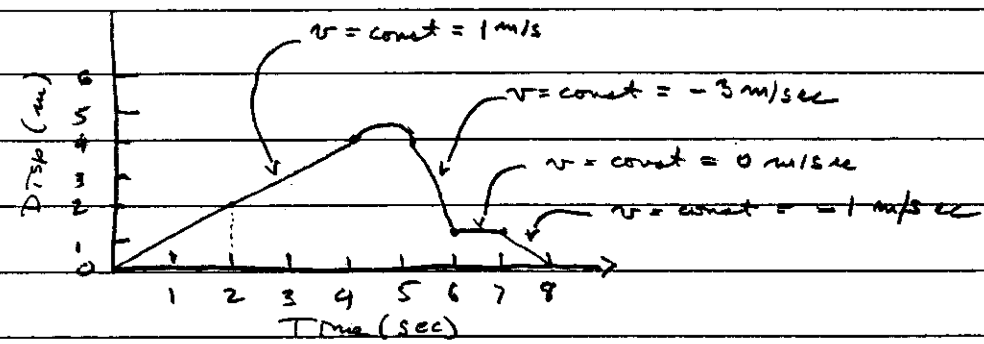
Physics 3 Homework Due 30 Jun 03 YJB

93. Velocity is constant when the slope of the distance - time curve is constant, i.e when the curve is a straight line. Graph looks straight ~~for~~ 4 places.



v(2 sec) = 1 m/s

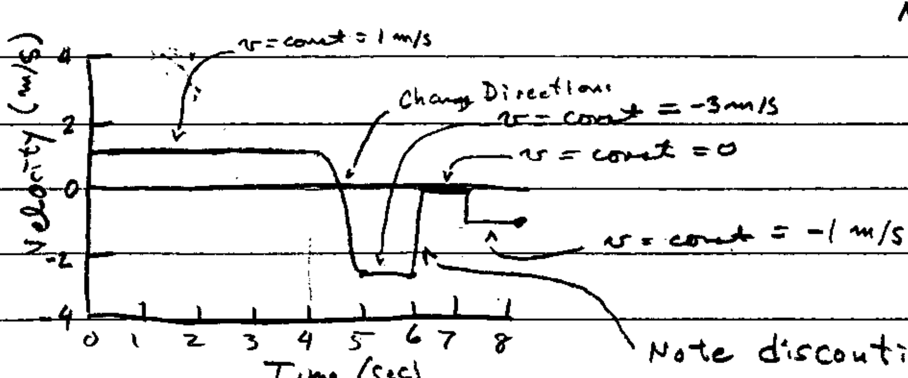
v is slope of curve at t=2sec slope = $\frac{4m - 0m}{4sec - 0sec}$

v (6.5 sec) = 0 m/s

at t=6.5sec, slope = $\frac{1m - 1m}{7sec - 6sec}$

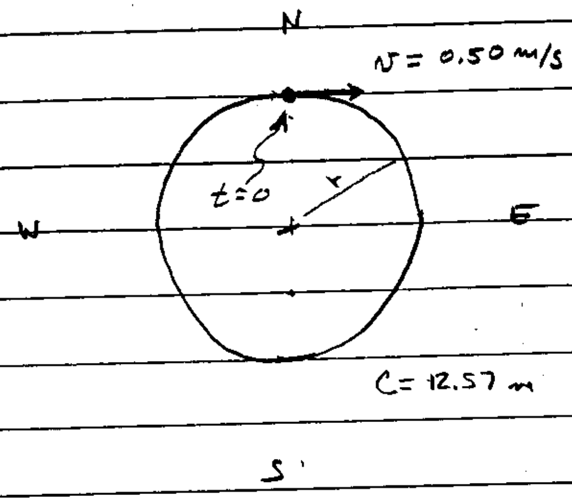
Changed Direction when slope went from pos to neg at about 4.5 sec

NOT REQ'D



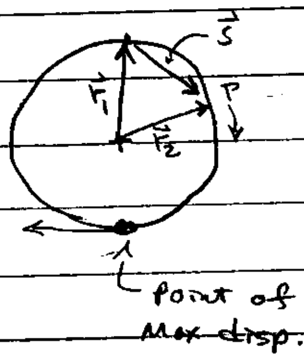
Note discontinuous steps in velocity. Due to sharp corners in x-t plot.

94.



$r = \frac{C}{2\pi} = 2.000\ m$

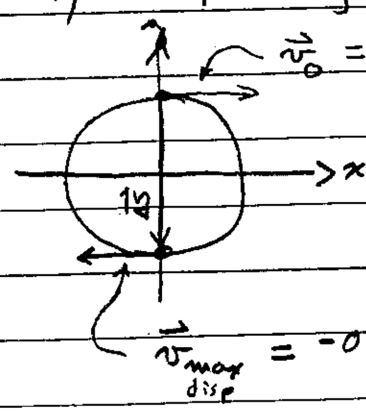
Since the path is always curved, the direction of the velocity vector is continually changing, $\vec{v}$ is never constant. This is true for all cars in the train.



$\vec{s}$ increases in magnitude until $\vec{r}$ points south, opposite from initial direction.

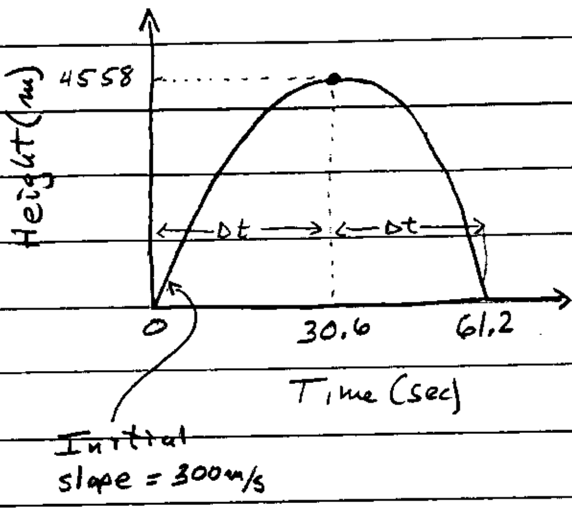
Velocity at point of max displacement is 0.50 m/s West

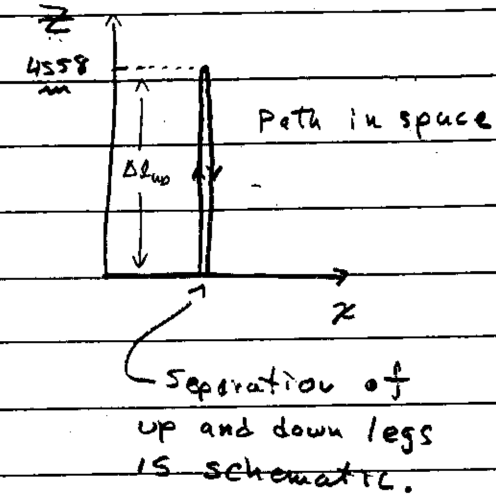
$\vec{v}_0 = +0.50\,\hat{\imath} + 0\,\hat{\jmath}$ m/s



$\vec{v}_{\substack{max \\ disp}} = -0.50\,\hat{\imath} + 0\,\hat{\jmath}$ m/s

95.





Path length going up is $\Delta l_{up} = 4558$ m in a straight line. Time required is $\Delta t_{up} = 30.6$ sec. Average speed is

$$\langle v \rangle_{up} = \frac{\Delta l_{up}}{\Delta t_{up}} = \frac{4558 \text{ m}}{30.6 \text{ sec}} = 149 \text{ m/sec}$$

Average velocity is same thing with direction up.

$$\langle \vec{v} \rangle_{up} = \frac{\vec{\Delta S}_{up}}{\Delta t_{up}} = \frac{4558 \hat{h} \text{ m}}{30.6 \text{ sec}}$$

$$= +149 \hat{h} \text{ m/s}$$

The two legs of the trip are symmetrical. Average speed is

$$\langle v \rangle_{RT} = \frac{\Delta l_{up} + \Delta l_{DN}}{\Delta t_{up} + \Delta t_{DN}} = 149 \text{ m/sec}$$

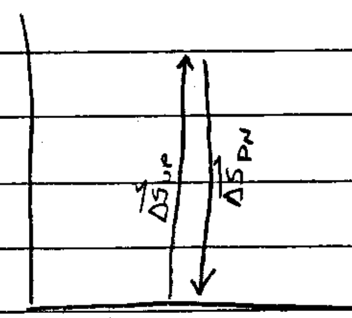
Average velocity is zero because total displacement is zero: the bullet starts and ends at the same place. Specifically

$$\langle \vec{v} \rangle_{RT} = \frac{\vec{\Delta S}_{up} + \vec{\Delta S}_{DN}}{\Delta t_{up} + \Delta t_{DN}}$$

$$= \frac{+4558\,\hat{h} - 4558\,\hat{h} \text{ m}}{30.6 + 30.6 \text{ sec}}$$

$$= 0$$

$$\vec{\Delta S}_{up} = -\vec{\Delta S}_{DN}$$



96. a. Muzzle velocity given as 300 m/s up.
(this is a complete answer).
Using vector notation

$$\vec{v}_0 = 300 \text{ m/s } \hat{k}$$

b. $\vec{v}(30.6 \text{ sec}) = 0$
At this point the bullet is stopped and in the process of reversing direction.

At $t = 61.2$ sec, the bullet has returned to the muzzle of the gun. It's velocity is 300 m/s down.
(this is a complete answer).

One could also say its velocity is −300 m/s up, or, in vector notation

$$\vec{v}(61.2 \text{ sec}) = -300 \hat{k} \text{ m/s}$$