Physics 201 - Lecture 10

1. Test on Friday - on WebAssign, during regular class time.

2. Assignment 3 due on Wednesday.

3. Plan for today:
   (i) A3 - # 3, # 4, # 5
   (ii) Uniform Circular Motion.
   (iii) A3 - # 11, # 12

#3. A boat can be rowed at [illegible] in still water.

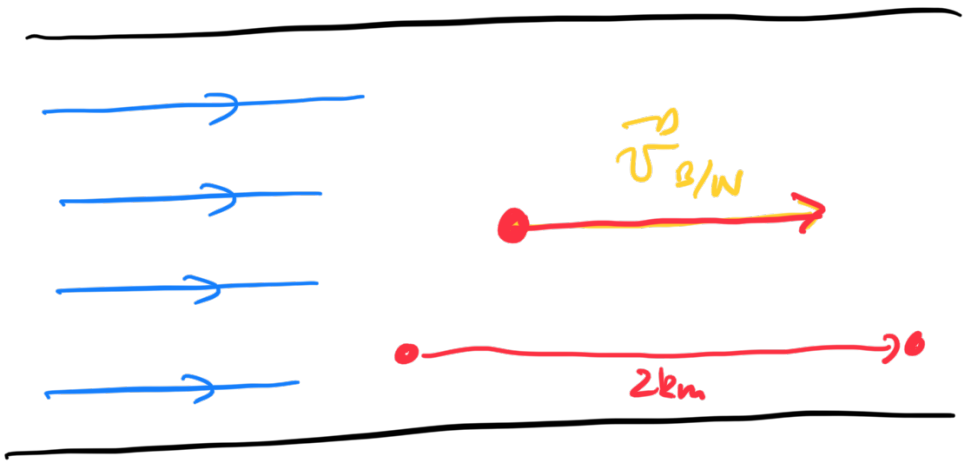
7.5 km/hr

$|\vec{v}_{B/W}| = 7.5$ km/hr

① ② ③

Reference frames: BOAT, WATER, SHORE
(B) (W) (S)

DIAGRAM !!



$\vec{v}_{W/S} = 2.7\,\hat{i}$

$\vec{v}_{B/S} = \vec{v}_{B/W} + \vec{v}_{W/S}$

$= 7.5\,\hat{i} + 2.7\,\hat{i}$

$\vec{v}_{net} = 10.2\,\hat{i}$

B/S

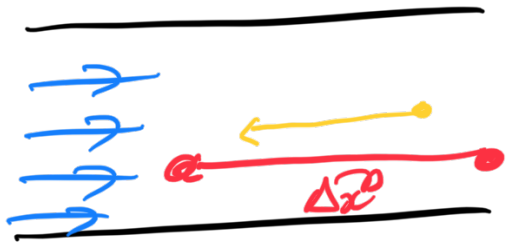
$$\boxed{\Delta\vec{x} = 2.0\,\hat{i}}$$

$$\boxed{\Delta\vec{x} = \vec{v}\cdot t} \Rightarrow t = \frac{\Delta\vec{x}}{\vec{v}_{B/S}}$$

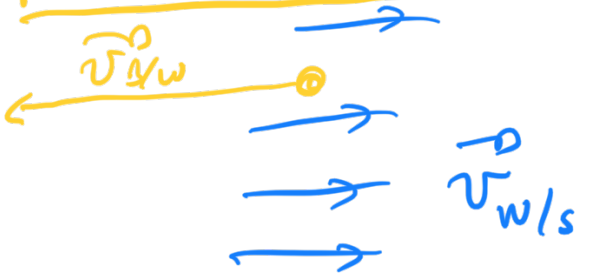
$$= \frac{2.0 \text{ km}}{10.2 \text{ km/hr}}$$

$$= 0.1961 \text{ hr}$$

$$= 11.8 \text{ min}$$



b) $\boxed{\vec{v}_{B/W} = -7.5\,\hat{i}}$



$$\vec{v}_{B/S} = \vec{v}_{B/W} + \vec{v}_{W/S}$$

$$= -7.5\,\hat{i} + 2.7\,\hat{i}$$

$$= -4.8\,\hat{i}$$

$$\boxed{\Delta\vec{x} = -2.0\,\hat{i}}$$

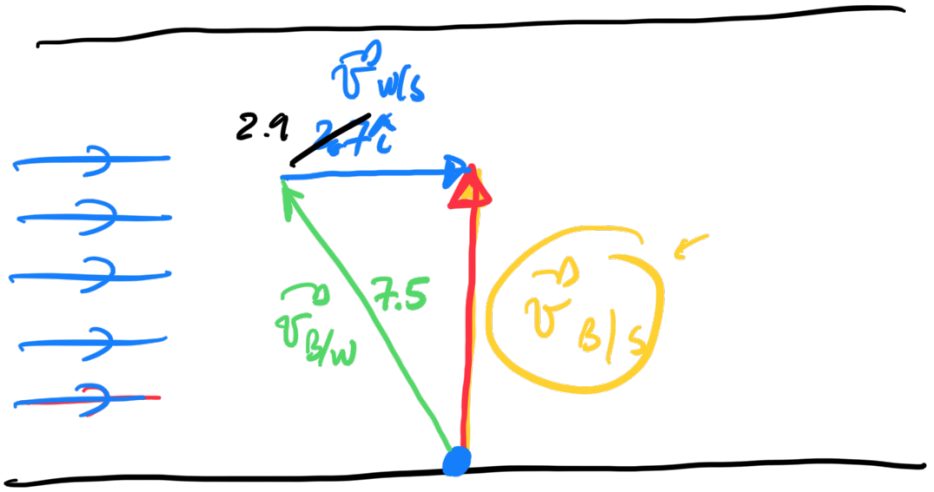
(runs back to original position

$$t = \frac{\Delta \vec{x}}{\vec{v}} = \frac{-2.0\,\hat{i}}{-4.8\,\hat{i}}$$

$$= 0.4167 \text{ hr}$$

$$= 25 \text{ min.}$$

c)

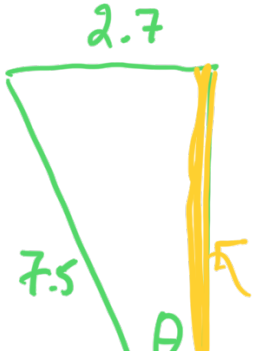


$$\vec{v}_{B/s} = \vec{v}_{B/w} + \vec{v}_{w/s}$$

$\vec{v}_{B/s}$ — resultant

$(2.7\,\hat{i})$ ✓✓

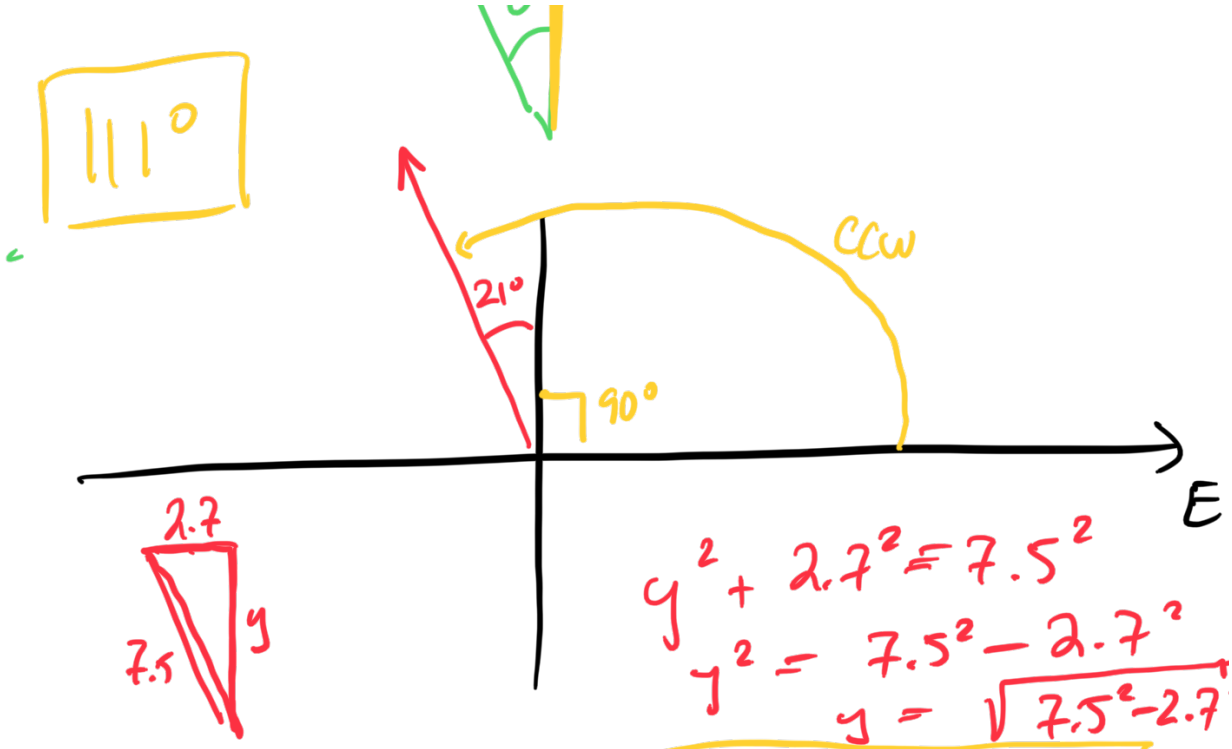
PICTURE



$$\sin\theta = \frac{2.7}{7.5}$$

$$\theta = 21^\circ$$

111°



$y^2 + 2.7^2 = 7.5^2$

$y^2 = 7.5^2 - 2.7^2$

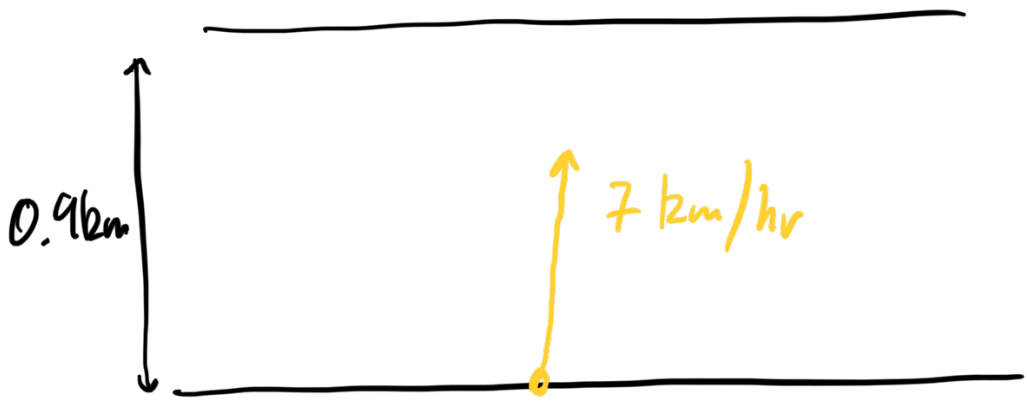
$y = \sqrt{7.5^2 - 2.7^2}$

$|\vec{v}_{B/S}| = \sqrt{7.5^2 - 2.7^2}$

$(hyp)^2 - (a^2)$

$= 7.0$ km/hr ✓

(6.9971)



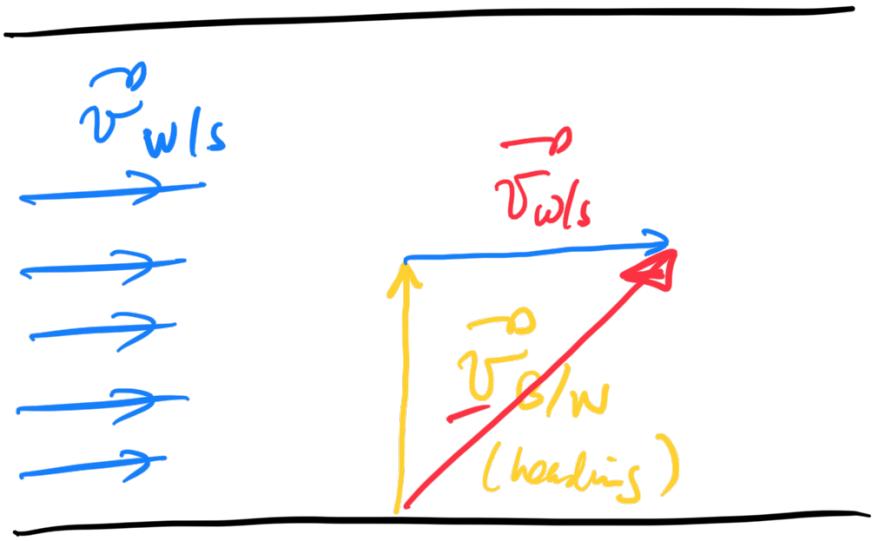
$t = \frac{d}{} = \frac{0.9 \text{ km}}{}$

v $+ 2\,km/hr$

$= 0.1286$ hours

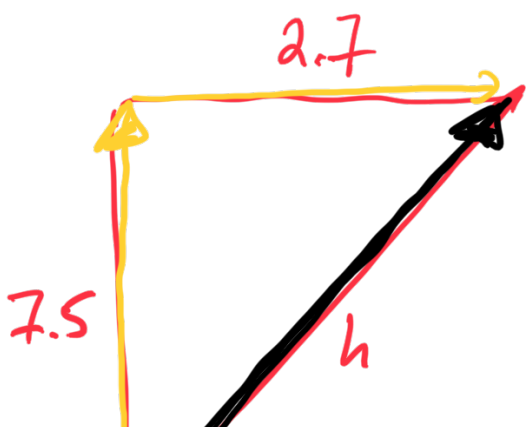
$= 7.72$ Min

(e)



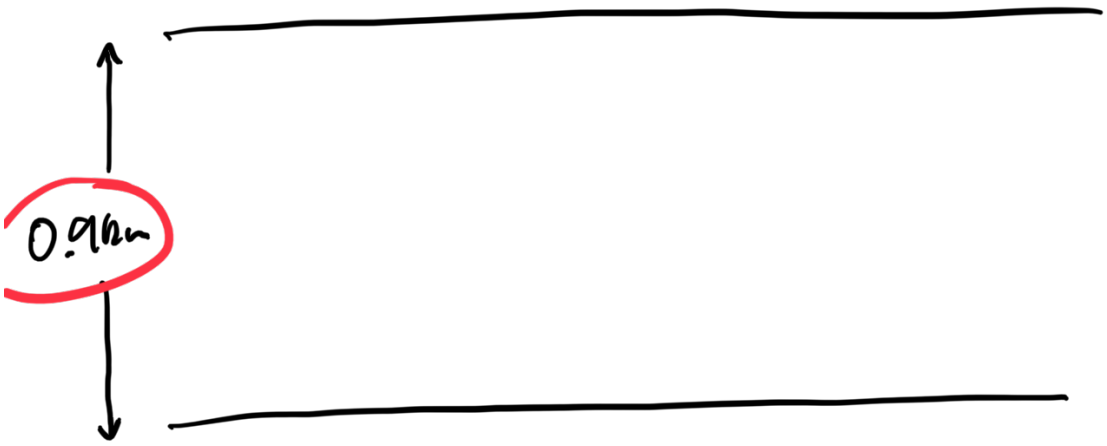
$$\vec{v}_{B/s} = \vec{v}_{B/w} + \vec{v}_{w/s}$$

$$= 7.5\,\hat{j} + 2.7\,\hat{i}$$



$$h = \sqrt{2.7^2 + 7.5^2}$$

$$|\vec{v}_{B/S}| = 7.9712 \text{ km/h}$$



$$t = \frac{0.9\text{ km}}{7.5\text{ km/hr}} \quad \leftarrow \Delta y \quad \leftarrow (V_y)$$

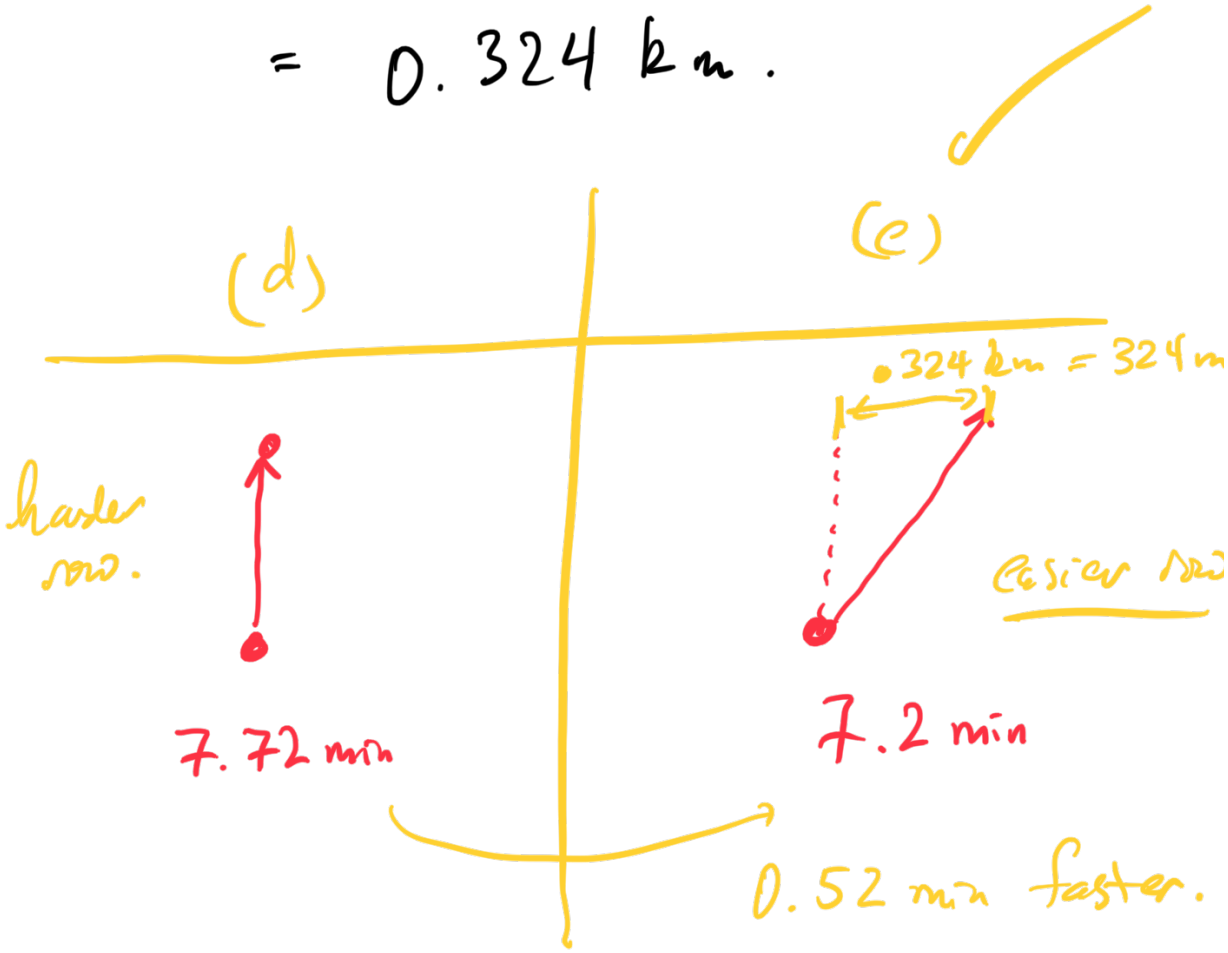
$$= 0.12 \text{ hours}$$

$$= 7.2 \text{ min.}$$

$$V_x = 2.7 \text{ km/hr}$$

$$\Delta x = 2.7 \frac{\text{km}}{\text{hr}} \times 0.12 \text{ hr}$$

$= 0.324 \text{ km}.$



$$\frac{324 \text{ m}}{31.2 \text{ s}} = 10.38 \text{ m/s}$$

$\approx$ 20 mph.

$$44.52 \text{ s} \times \frac{324}{400} = 36.1 \text{ s}$$

#4. $|\vec{v}_{P/A}| = 190$ km/hr

$\vec{v}_{A/G} = 68\,\hat{i}$

Ref: P, A, G

0 ① ②

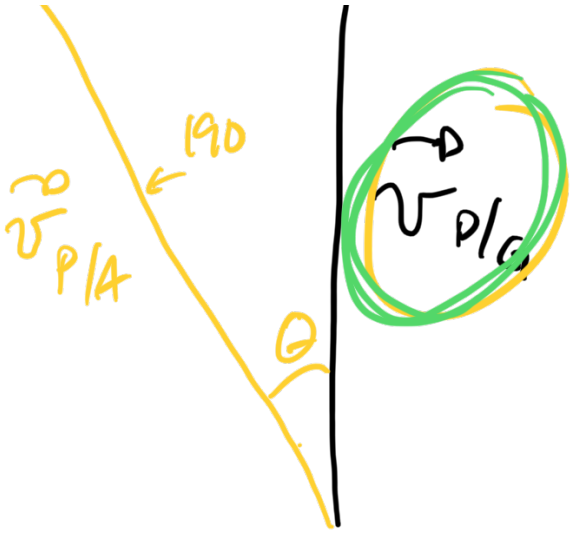
$$\vec{v}_{P/G} = \vec{v}_{P/A} + \vec{v}_{A/G}$$

(size.)

$(68\,\hat{i})$

North.

$68\,\hat{i} = \vec{v}_{A/G}$



$|\vec{v}_{P/G}|$

$= \sqrt{190^2 - 68^2}$

$= 177.41$ km/

$\sin\theta = \frac{68}{190} \Rightarrow \theta = 21°$

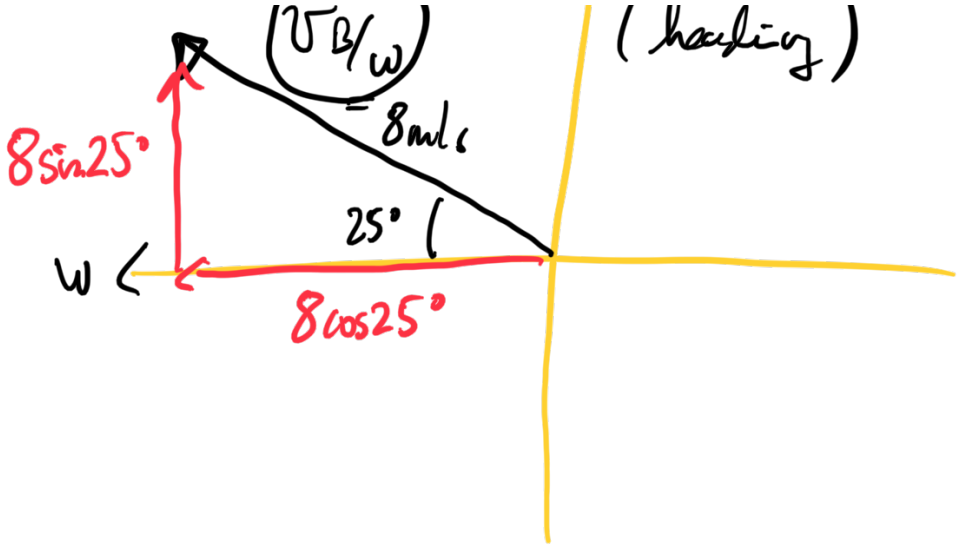
West of North

$t = \frac{\Delta y}{|\vec{v}_{P/G}|} = \frac{400 \text{ km}}{177.41 \text{ km/hr}}$

≈ 2.25 hours

#5.

$\vec{v}_{w/s} = 5\,\hat{i}$



$$\vec{v}_{B/w} = -8\cos 25°\,\hat{i} + 8\sin 25°\,\hat{j}$$

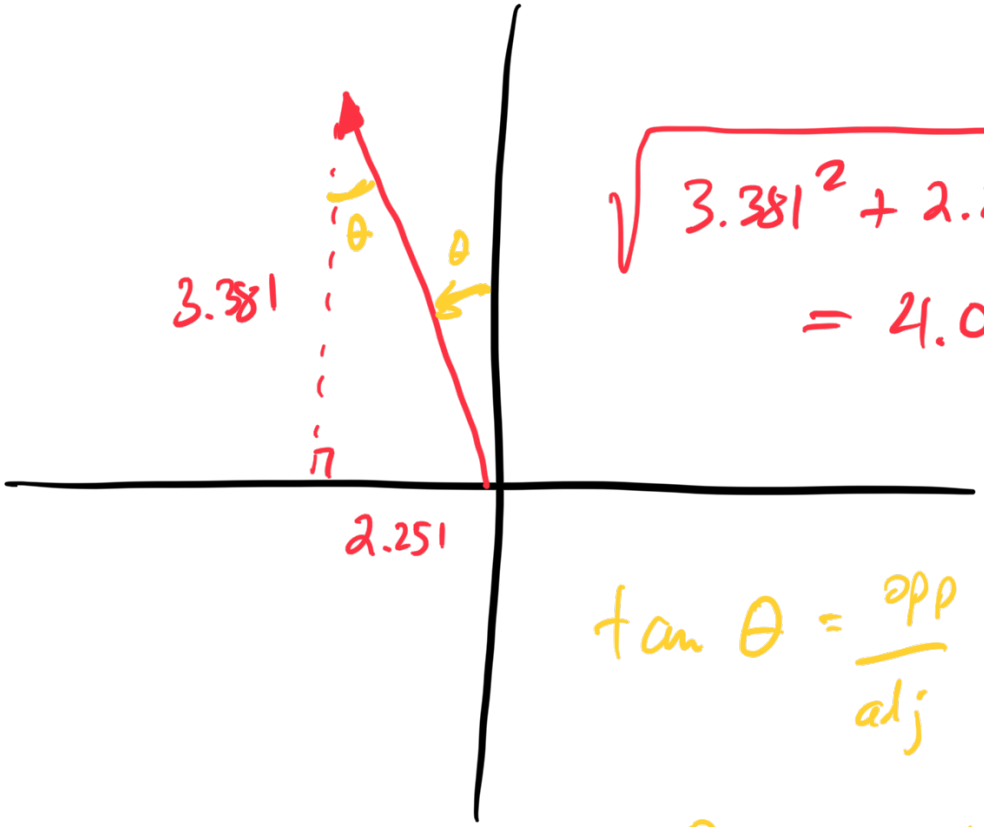
$$\vec{v}_{B/w} = -7.251\,\hat{i} + 3.381\,\hat{j}$$

$$\vec{v}_{w/s} = 5\,\hat{i}$$

$$\vec{v}_{B/s} = \vec{v}_{B/w} + \vec{v}_{w/s}$$

$$= -7.251\,\hat{i} + 3.381\,\hat{j} + 5\,\hat{i}$$

$$\vec{v}_{3/s} = -2.251\,\hat{i} + 3.381\,\hat{j}$$ ✓



$$\sqrt{3.381^2 + 2.251^2} = 4.06 \text{ m/s}$$

$$\tan\theta = \frac{opp}{adj} = \frac{2.251}{3.381}$$

$\theta = 33.6°$ W of N

1

$$t = \frac{\Delta y}{V_y} = \frac{2700\ m}{3.381\ m/s}$$

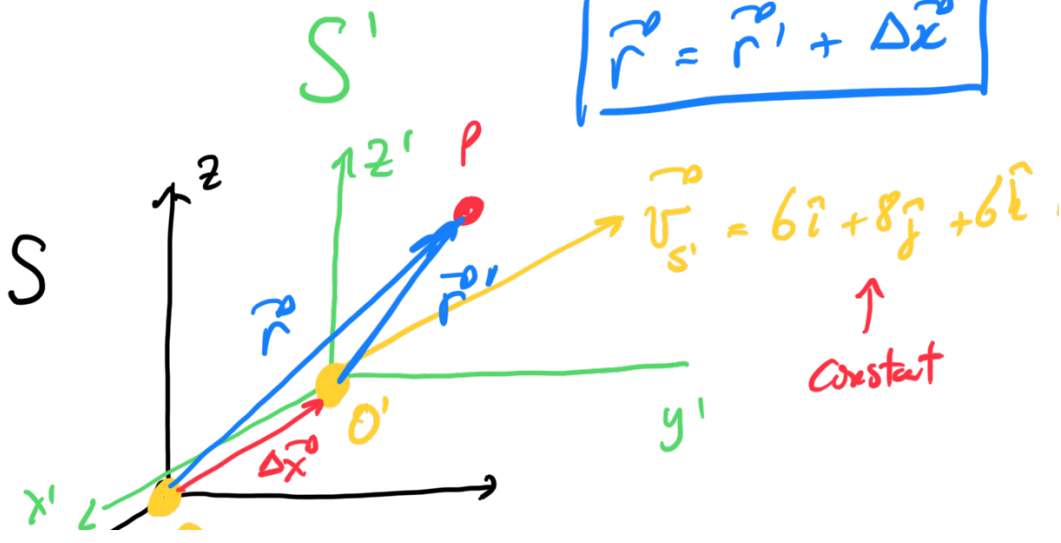
$$= 798.5\ s$$

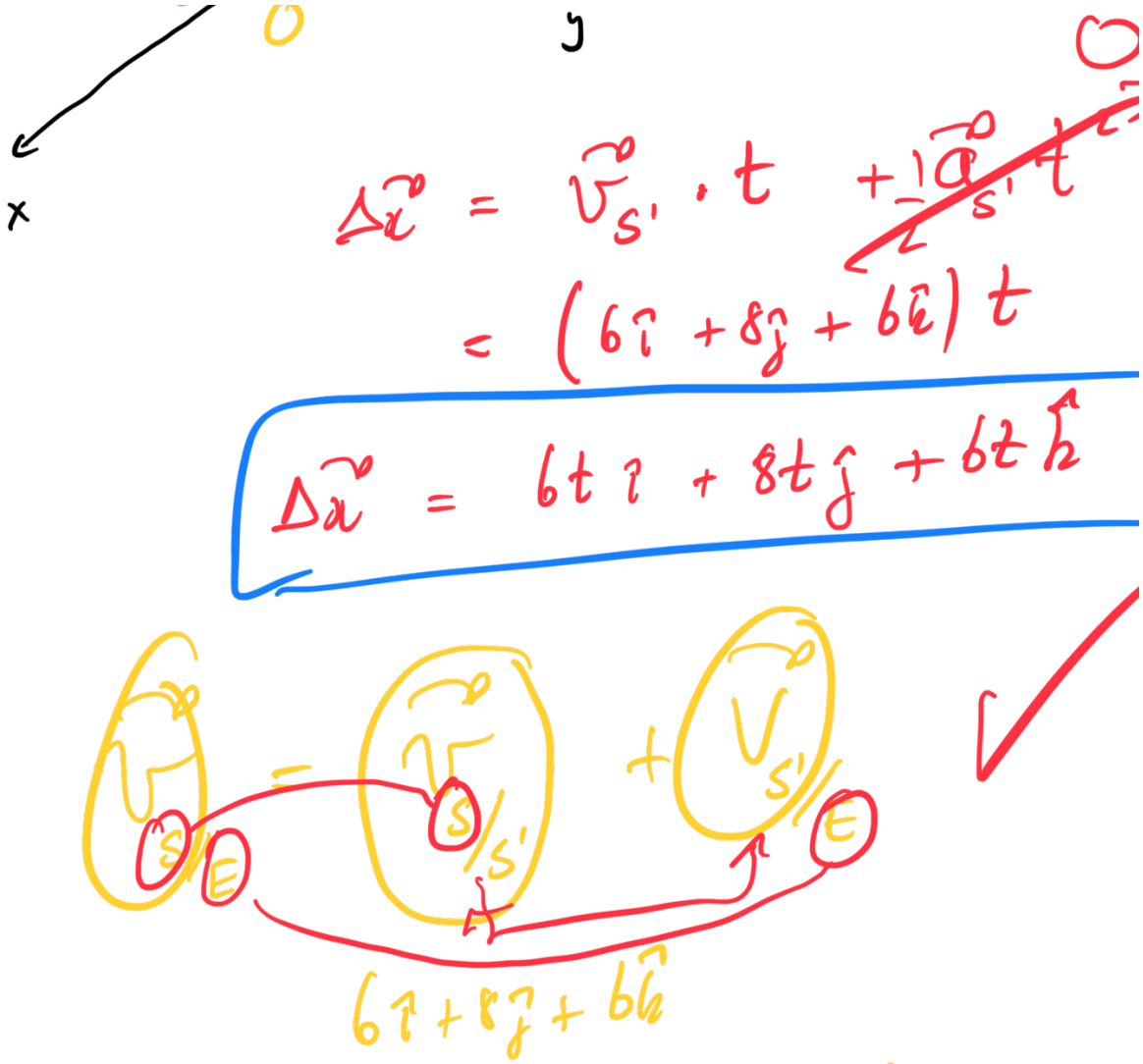
$$= 13.3\ min$$

BYE !

#6.

$$\vec{r} = \vec{r}' + \Delta\vec{x}$$




x
y
$\Delta\vec{x} = \vec{v}_{s'} \cdot t + \frac{1}{2}\vec{a}_{s'} t^2$
$= (6\hat{i} + 8\hat{j} + 6\hat{k})\, t$
$\Delta\vec{x} = 6t\,\hat{i} + 8t\,\hat{j} + 6t\,\hat{k}$
$\vec{v}_{s/E} = \vec{v}_{s/s'} + \vec{v}_{s'/E}$
$6\hat{i} + 8\hat{j} + 6\hat{k}$
$\vec{v}_s = \vec{v}_{s'} + (6\hat{i} + 8\hat{j} + 6\hat{k})$
$\vec{a}_{s/E} = \vec{a}_{s/s'} + \vec{a}_{s'/E}$
0

$$\dot{a}_s = a_{s'} + v$$