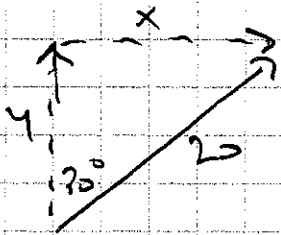


Vectors 2

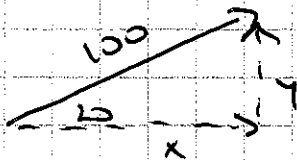
①



$$x = 20 \sin 30 = 10 \text{ km [E]}$$

$$y = 20 \cos 30 = 17.3 \text{ km [N]}$$

②



$$x = 100 \cos 20 = 94 \text{ m/s}$$

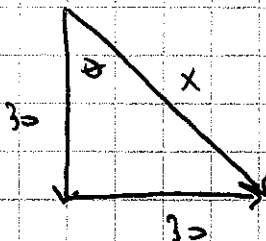
$$y = 100 \sin 20 = 34.2 \text{ m/s}$$

③

Velocities are not equal b/c they move in different directions.

Speeds are equal.

④



$$x^2 = 30^2 + 30^2$$

$$\theta = \tan^{-1} \left(\frac{30}{30} \right)$$

$$x = 42.4 \text{ m}$$

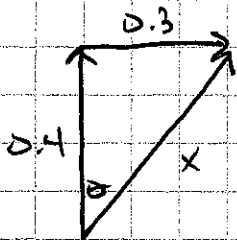
$$\theta = 45^\circ$$

$$42.4 \text{ m [SE]}$$

⑤

a) Since he starts and ends at the same location, his displacement is zero.

b)



$$x^2 = 0.3^2 + 0.4^2$$

$$\theta = \tan^{-1} \left(\frac{0.3}{0.4} \right)$$

$$x = 0.5 \text{ km}$$

$$\theta = 36.9^\circ$$

$$0.5 \text{ km [} 36.9^\circ \text{ E of N]}$$

- ⑤ c) To get home, he must have the same displacement, but in the opposite direction.

$$\boxed{0.5 \text{ km } [36.9^\circ \text{ W of S}]}$$

d) $\text{speed} = \frac{\text{dist}}{\text{time}}$

$$= \frac{0.3 + 0.4 + 0.5}{0.5}$$
$$= \boxed{2.4 \text{ km/h}}$$

e) $\text{velocity} = \frac{\text{disp.}}{\text{time}}$

$$= \frac{0.5 \text{ km } [36.9^\circ \text{ E of N}]}{0.5 \text{ h}}$$
$$= \boxed{1 \text{ km/h } [36.9^\circ \text{ E of N}]}$$

⑥ $v_{\text{avg}} = \frac{\text{total disp}}{\text{total time}}$

Part 1

$$d = vt$$

$$= (100 \text{ km/h})(0.66 \text{ h})$$

$$d_1 = 66.6 \text{ km } [\text{E}]$$

Part 2

$$d = vt$$

$$= (100)(0.3)$$

$$d_2 = 33.3 \text{ km } [30^\circ \text{ E of N}]$$

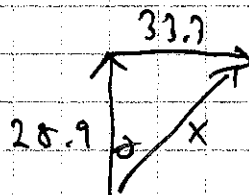
⑥ Part 3

$$d = vt$$

$$= (100)(0.5)$$

$$d_3 = 50 \text{ km [W]}$$

	N	E
d_1	0	$66.\bar{6}$
d_2	$33.\bar{3} \cos 30$	$33.\bar{3} \sin 30$
d_3	0	-50
Total	<u>28.868</u>	<u>$33.\bar{3}$</u>



$$X^2 = 28.868^2 + 33.333^2$$

$$X = 44.1 \text{ km}$$

$$\theta = \tan^{-1} \left(\frac{33.333}{28.868} \right)$$

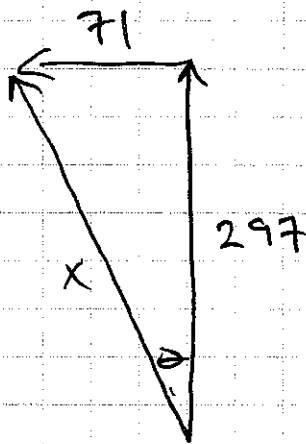
$$\theta = 49.1^\circ$$

$$v_{\text{avg}} = \frac{d}{t} = \frac{44.1 \text{ km}}{1.5 \text{ h}}$$

$$= \boxed{29.4 \text{ km/h [49}^\circ \text{ E of N]}}$$

7

	N	E
d_1	$600 \sin 47$	$600 \cos 47$
d_2	$500 \cos 38$	$-500 \sin 38$
d_3	$-300 \sin 29$	$-300 \cos 29$
d_4	$-400 \cos 13$	$400 \sin 13$
Total	297.627	-71.037



$$x^2 = 297.627^2 + (-71.037)^2$$

$$x = 306 \text{ m}$$

$$\theta = \tan^{-1} \left(\frac{71.037}{297.627} \right)$$

$$\theta = 13.4^\circ$$

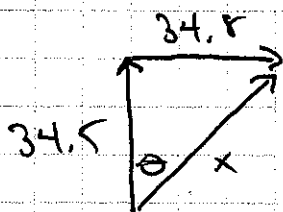
306 m [13° W of N]

8)

a) $50 + 22 + 30 + 30 + 44 = \boxed{176 \text{ m}}$

b)

	N	E
d_1	$50 \cos 47$	$-50 \sin 47$
d_2	$22 \sin 43$	$-22 \cos 43$
d_3	$-30 \sin 60$	$30 \cos 60$
d_4	0	30
d_5	$44 \cos 75$	$44 \sin 75$
Total	<u>34.511</u>	<u>34.843</u>



$$x^2 = 34.511^2 + 34.843^2$$

$$x = 49.0$$

$$\theta = \tan^{-1} \left(\frac{34.843}{34.511} \right)$$

$$\theta = 45.3^\circ$$

$$d = \boxed{49 \text{ m [NE]}}$$

c) $\boxed{\text{SW}}$ (opposite to the direction of the displacement)