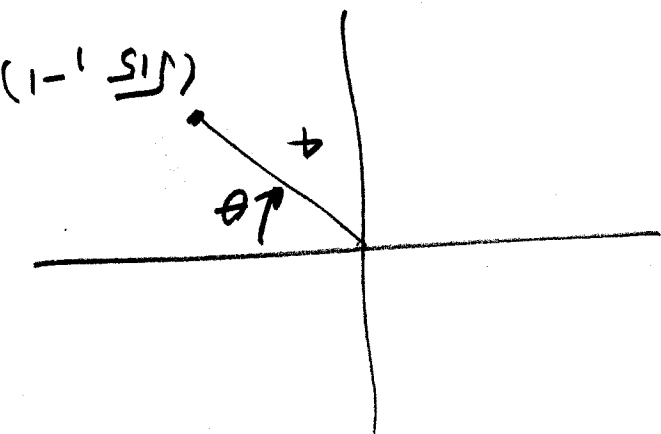


$\alpha = \tan^{-1}(-2)$



$$= -\frac{2}{\sqrt{2}} + \frac{3}{\sqrt{2}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$= \sin(\alpha + \beta) = \sin\alpha \cos\beta + \cos\alpha \sin\beta$$

$$= \left(-\frac{2}{\sqrt{5}}\right)\left(\frac{1}{\sqrt{10}}\right) + \left(\frac{3}{\sqrt{10}}\right)\left(\frac{1}{\sqrt{5}}\right)$$

5 pts (14)

$$\sin(\tan^{-1}(-2) + \tan^{-1}(3))$$

$$= \frac{4}{7}$$

$$= \frac{16}{14}$$

$$= \frac{16}{15} - \frac{1}{16}$$

$$= \left(\frac{\sqrt{5}}{4}\right)^2 - \left(-\frac{1}{4}\right)^2$$

$$= \cos^2\theta - \sin^2\theta$$

$$= \cos 2\theta$$

5 pts (12)

$$\cos(2\sin^{-1}(-\frac{1}{4}))$$

5 pts
20

$$2 \cos^2 \frac{x}{2} = 3 \cos x$$

$$2 \left[\frac{1 + \cos x}{2} \right] = 3 \cos x$$

$$1 + \cos x = 3 \cos x$$

$$1 = 2 \cos x$$

$$\cos x = \frac{1}{2}$$

$$x = \frac{\pi}{3}, \frac{5\pi}{3}$$

5 pts
21

$$4 + 5 \sin x = 2 \cos^2 x$$

$$4 + 5 \sin x = 2(1 - \sin^2 x)$$

$$4 + 5 \sin x = 2 - 2 \sin^2 x$$

$$2 \sin^2 x + 5 \sin x + 2 = 0$$

$$(2 \sin x + 1)(\sin x + 2) = 0$$

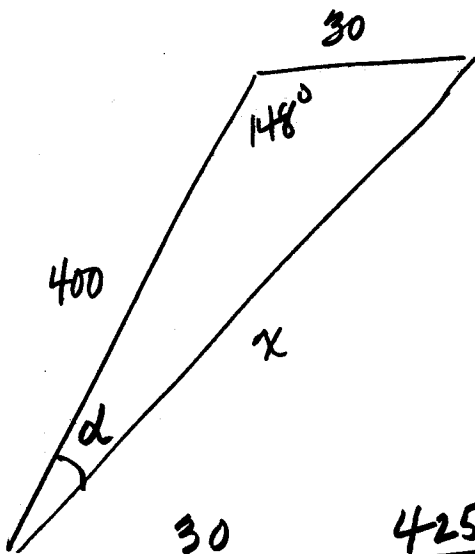
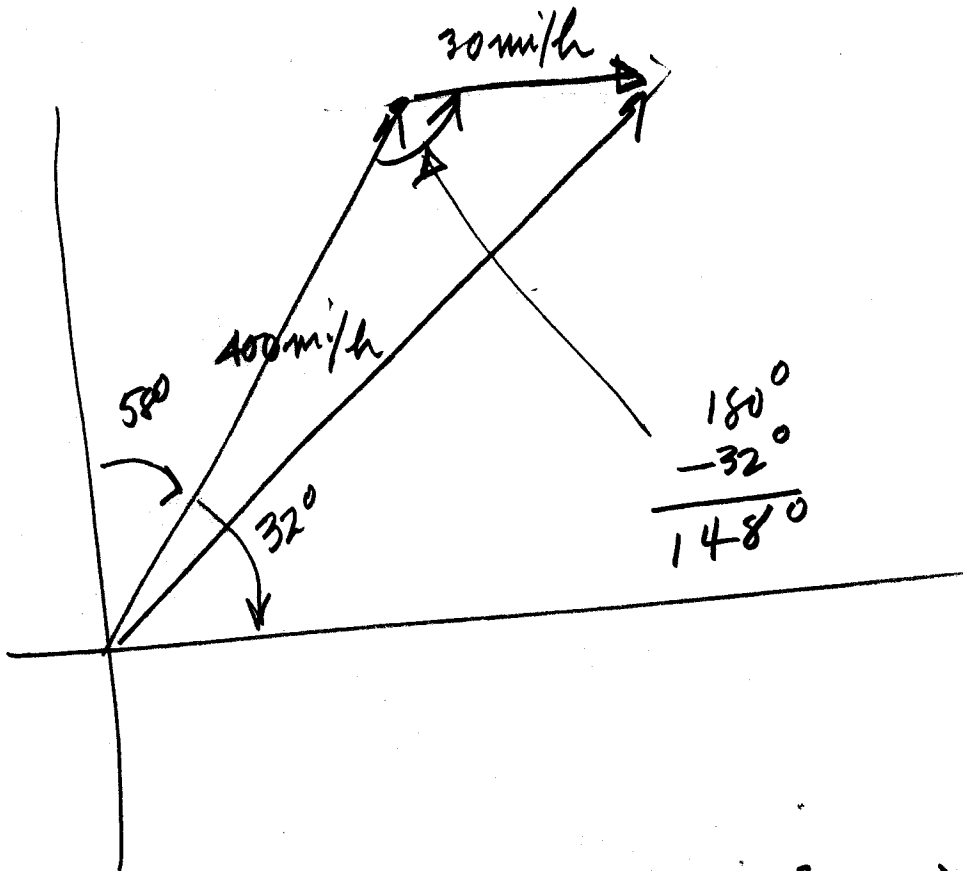
$$\sin x = -\frac{1}{2} \quad \text{or} \quad \sin x = -2$$

No solutions

$$x = \frac{7\pi}{6}, \frac{11\pi}{6}$$

Spts

(3)



$$x^2 = 30^2 + 400^2 - 2(30)(400) \cos 148^\circ$$

$$x = \sqrt{30^2 + 400^2 - 2(30)(400) \cos 148^\circ}$$

$$x \approx 425 \text{ mi/h}$$

$$\frac{30}{\sin \alpha} = \frac{425}{\sin 148^\circ}$$

$$\alpha = \sin^{-1} \left(\frac{30 \sin 148^\circ}{425} \right)$$

$$425 \sin \alpha = 30 \sin 148^\circ$$

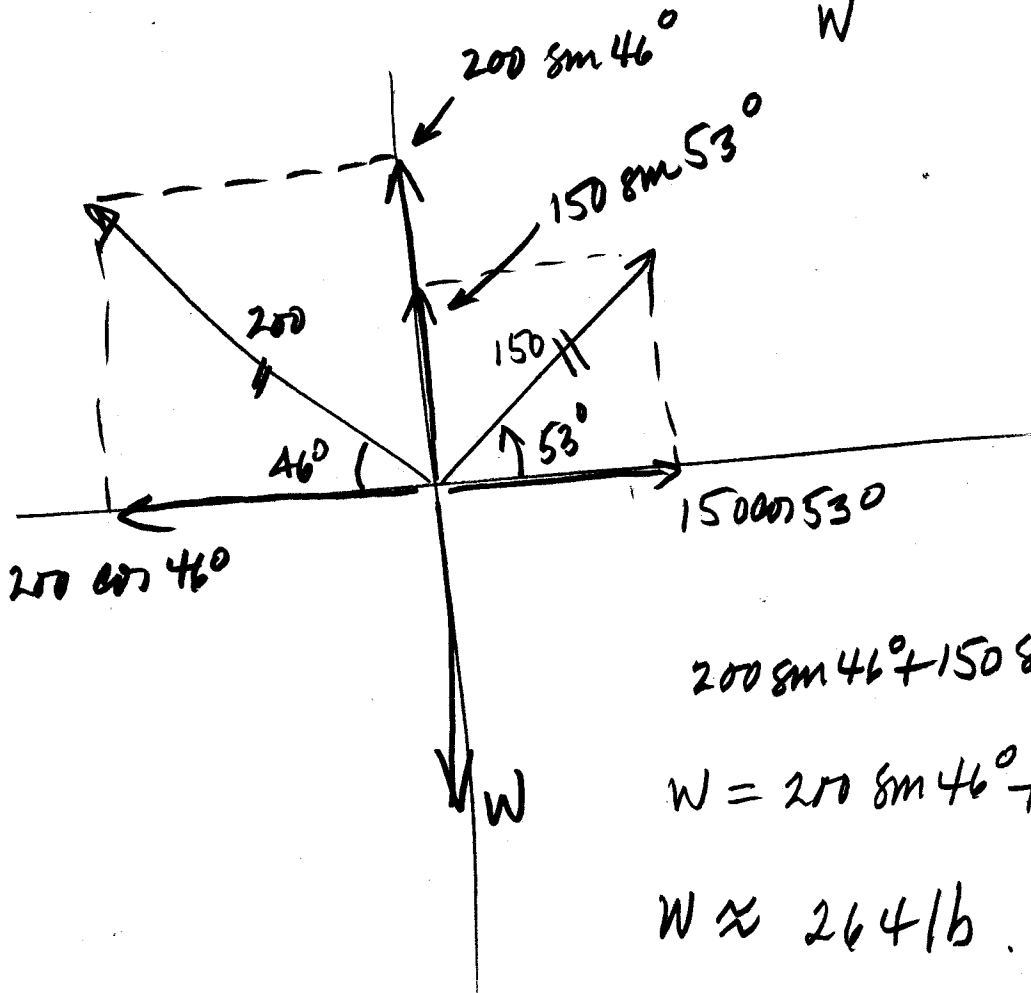
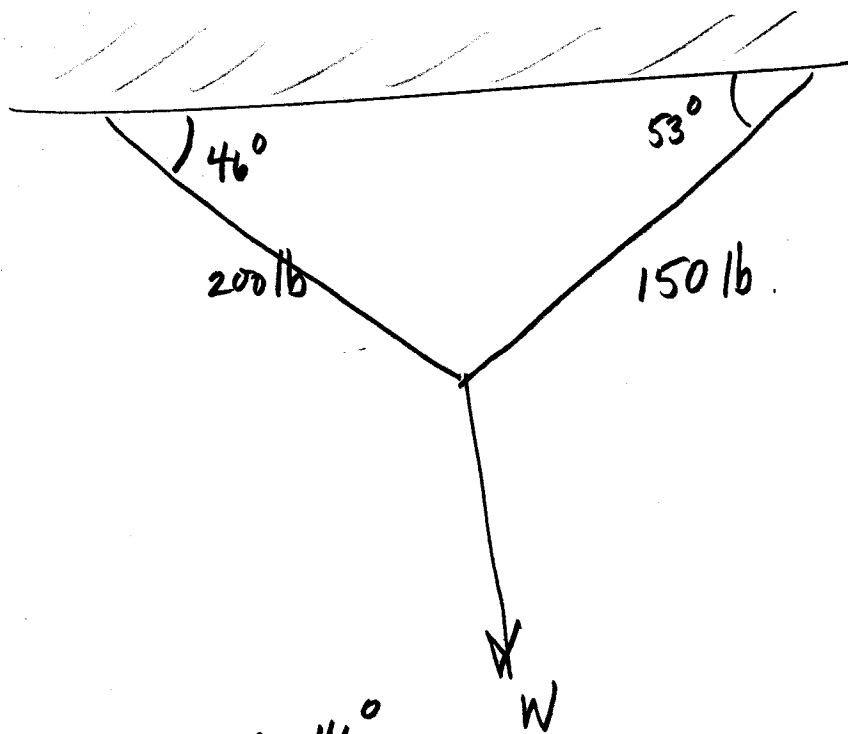
$$\alpha \approx 2.1^\circ$$

$$\sin \alpha = \frac{30 \sin 148^\circ}{425}$$

$$\text{Bearing} = 58^\circ + 2.1^\circ$$

$$\text{Bearing} = 60.1^\circ$$

5/15
④



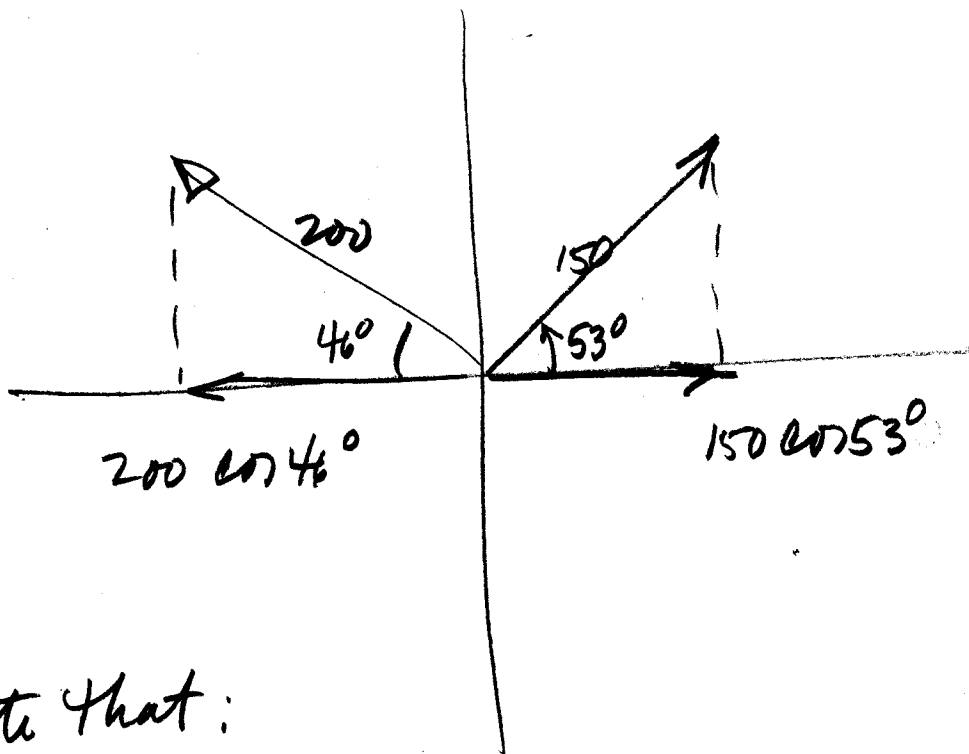
$$\Sigma F_y = 0$$

$$200 \sin 46^\circ + 150 \sin 53^\circ - W = 0$$

$$W = 200 \sin 46^\circ + 150 \sin 53^\circ$$

$$W \approx 264 \text{ lb}$$

Nobody caught this difficulty, but the block cannot achieve an equilibrium state



Note that:

$$\begin{aligned}\Sigma F_x &= 150 \cos 53^\circ - 200 \cos 46^\circ \\ &= -48.6 \text{ lb.}\end{aligned}$$

Hence, the block will accelerate to the left.

