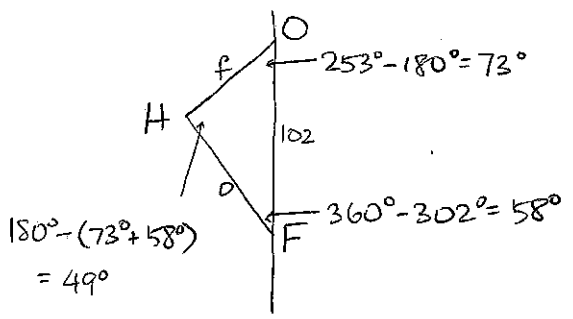
[1] A car travels along an north-south road. A house sits off the side of the road.
Originally, the house is on a bearing of 253° from the car.
After the car has travelled 102 feet, the house is then on a bearing of 302° from the car.
Find the original and final distance between the car and the house.

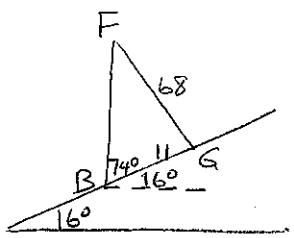


$$\frac{102}{\sin 49^\circ} = \frac{f}{\sin 58^\circ} = \frac{o}{\sin 73^\circ}$$

$$\text{ORIGINAL DISTANCE} = f = \frac{102\sin 58^\circ}{\sin 49^\circ} \approx 115 \text{ FT}$$

$$\text{FINAL DISTANCE} = o = \frac{102\sin 73^\circ}{\sin 49^\circ} \approx 129 \text{ FT}$$

[2] A flagpole is mounted vertically (to the Earth) along a sloped road which has an angle of inclination of 16°.
A 68 foot cable connects the top of the flagpole to a point on the ground 11 feet uphill from the base of the flagpole.
Find the height of the flagpole.



$$\frac{\sin F}{11} = \frac{\sin 74^\circ}{68} \quad (F \text{ MUST BE} < 74^\circ, \text{ SO } F \text{ IS ACUTE})$$

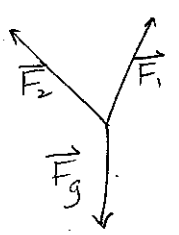
$$F = \sin^{-1}\frac{11\sin 74^\circ}{68} \approx 9^\circ$$

$$G = 180^\circ - (74^\circ + 9^\circ) = 97^\circ$$

$$\frac{g}{\sin 97^\circ} = \frac{68}{\sin 74^\circ}$$

$$\text{HEIGHT OF FLAGPOLE} = g = \frac{68\sin 97^\circ}{\sin 74^\circ} \approx 70 \text{ FT}$$

[3] A mass of 48 kg is suspended motionless in mid air by two forces with direction angles 60° and 135° respectively.
Find the magnitudes of the forces.



$$\vec{F_1} + \vec{F_2} + \vec{F_g} = \vec{0}$$

$$\langle F_1\cos 60^\circ, F_1\sin 60^\circ\rangle + \langle F_2\cos 135^\circ, F_2\sin 135^\circ\rangle + \langle 470.4\cos 270^\circ, 470.4\sin 270^\circ\rangle = \langle 0,0\rangle$$

$$\langle \tfrac{1}{2}F_1 - \tfrac{\sqrt{2}}{2}F_2, \tfrac{\sqrt{3}}{2}F_1 + \tfrac{\sqrt{2}}{2}F_2 - 470.4\rangle = \langle 0,0\rangle$$

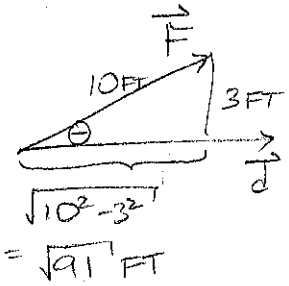
$F_g = 9.8 * 48 = 470.4$

$$\tfrac{1}{2}F_1 - \tfrac{\sqrt{2}}{2}F_2 = 0 \longrightarrow F_2 = \tfrac{1}{\sqrt{2}}F_1$$

$$\tfrac{\sqrt{3}}{2}F_1 + \tfrac{\sqrt{2}}{2}F_2 - 470.4 = 0$$

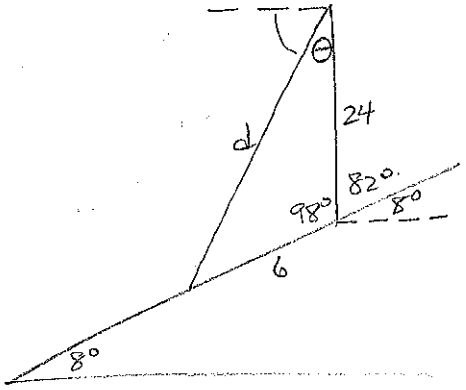
$$\left(\tfrac{1}{2} + \tfrac{\sqrt{3}}{2}\right)F_1 - 470.4 = 0 \longrightarrow F_1 = 344 \text{ N} \longrightarrow F_2 = 243 \text{ N}$$

[4] A warehouse worker is pulling a pallet across the floor using a strap.
The strap is 10 feet long and the worker's hand is 3 feet above the ground.
Find the work done if the worker exerts a force of 40 pounds along the strap and pulls the pallet 20 feet.



$$W = \vec{F}\cdot\vec{d}$$
$$= \|\vec{F}\|\,\|\vec{d}\|\cos\theta$$
$$= (40\text{ LB})(20\text{ FT})\frac{\sqrt{91}}{10}$$
$$= 80\sqrt{91}\text{ FT-LB}$$

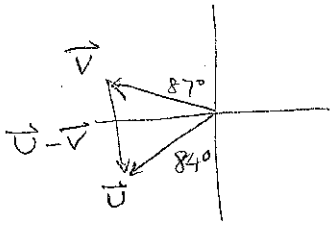
[5] A 24 foot flagpole is mounted vertically (to the Earth) along a sloped road which has an angle of inclination of 8°.
A sewer cover is located in the road, 6 feet downhill from the base of the flagpole.
Find the angle of depression from the top of the flagpole to the sewer cover.



$$d^2 = 6^2 + 24^2 - 2(6)(24)\cos 98^\circ$$
$$d \approx 26\text{ FT}$$
$$\frac{\sin\theta}{6} = \frac{\sin 98^\circ}{26}$$
$$\theta = \sin^{-1}\frac{6\sin 98^\circ}{26} \approx 13^\circ$$

ANGLE OF DEPRESSION $= 90^\circ - 13^\circ = 77^\circ$

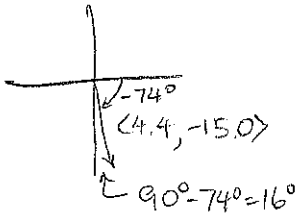
[6] You wish to reach a point 94 miles on a bearing of S 84° W from home.
Due to weather conditions, you instead travel 98 miles on a bearing of N 87° W.
How far, and on what bearing, must you now travel to reach your destination ?
Use vectors to solve the problem. Write bearing in the same format used in the question.



$$\vec{u}-\vec{v}$$
$$= \langle 94\cos 186^\circ, 94\sin 186^\circ\rangle - \langle 98\cos 177^\circ, 98\sin 177^\circ\rangle$$
$$= \langle 4.4, -15.0\rangle$$

$\theta_{\vec{u}} = 270^\circ - 84^\circ = 186^\circ$

$\theta_{\vec{v}} = 90^\circ + 87^\circ = 177^\circ$



DISTANCE $= \|\langle 4.4, -15.0\rangle\| \approx 15.6$ MILES

$\theta_{\vec{u}-\vec{v}} = \tan^{-1}\frac{-15.0}{4.4} = -74^\circ$

BEARING = S16°E