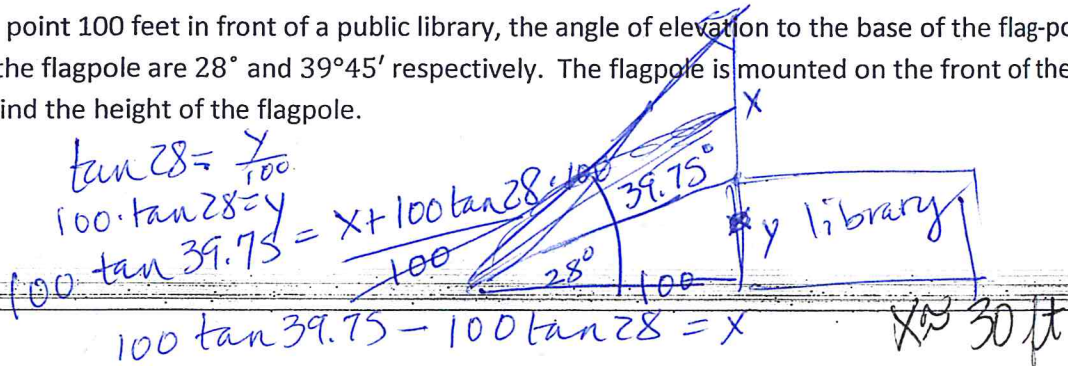
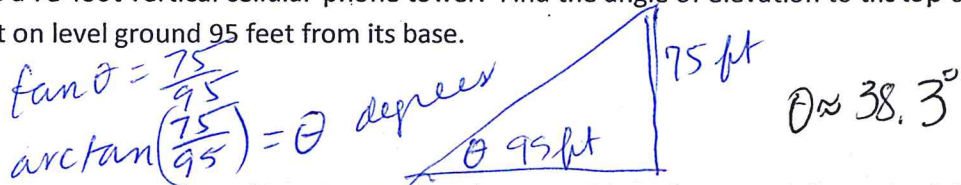


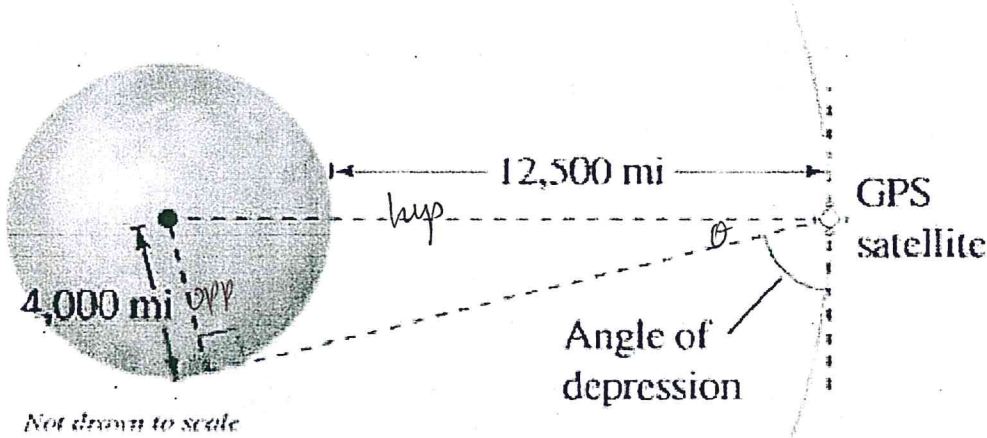
16. From a point 100 feet in front of a public library, the angle of elevation to the base of the flag-pole and the top of the flagpole are 28° and $39^\circ 45'$ respectively. The flagpole is mounted on the front of the library's roof. Find the height of the flagpole.



17. An engineer erects a 75-foot vertical cellular-phone tower. Find the angle of elevation to the top of the tower from a point on level ground 95 feet from its base.



18. A Global Positioning System satellite orbits 12,500 miles above Earth's surface. Find the angle of depression from the satellite to the horizon. Assume the Earth has a radius of 4000 miles.



$$\sin \theta = \frac{4000}{12500}$$

$$\arcsin\left(\frac{40}{125}\right) = \theta$$

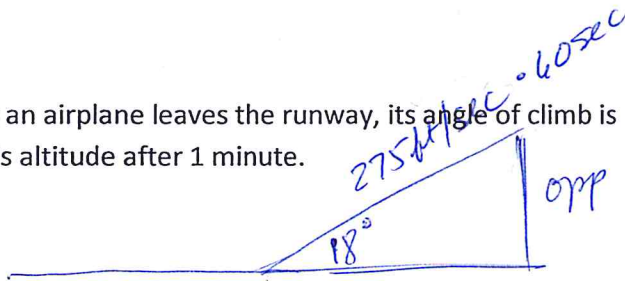
$$\approx 18.663^\circ$$

$$90 - 18.663 \approx$$

$$71.337^\circ$$

$$\approx 71.3^\circ$$

19. When an airplane leaves the runway, its angle of climb is 18° and its speed is 275 feet per second. Find the plane's altitude after 1 minute.



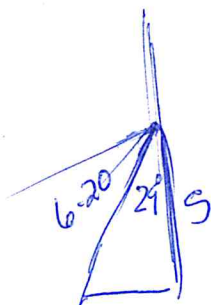
$$\sin 18 = \frac{a}{275 \cdot 60}$$

$$16,500 \cdot \sin 18 = a$$

$$\approx 5099 \text{ ft}$$

Final answer: $\text{or } \approx 5100 \text{ ft.}$

20. A ship leaves port at noon and has a bearing of $S29^\circ W$. The ship sails at 20 knots. How many nautical miles south and how many nautical miles west will the ship have traveled by 6:00 P.M.?



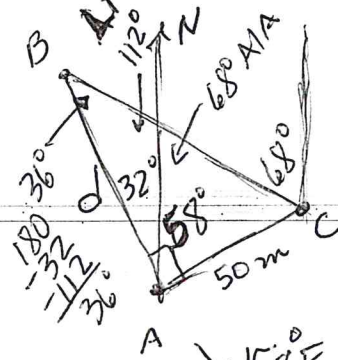
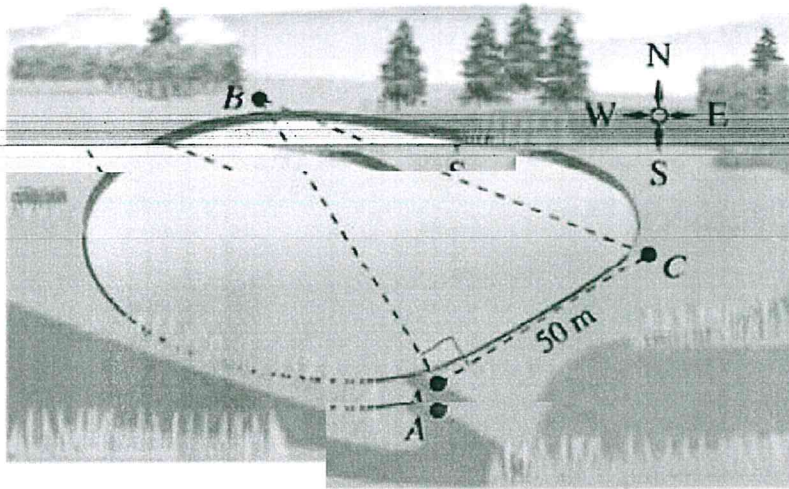
$$\cos 29^\circ = \frac{S}{120}$$

$$\sin 29^\circ = \frac{W}{120}$$

$$120 \cdot \cos 29^\circ \approx 105 \text{ nmi}$$

$$120 \cdot \sin 29^\circ \approx 58 \text{ nmi}$$

21. A surveyor wants to find the distance across a swamp. The bearing from A to B is $N32^\circ W$. The surveyor walks 50 meters from A, and at the point C the bearing to B is $N68^\circ W$. Find (a) the bearing from A to C and (b) the distance from A to B.

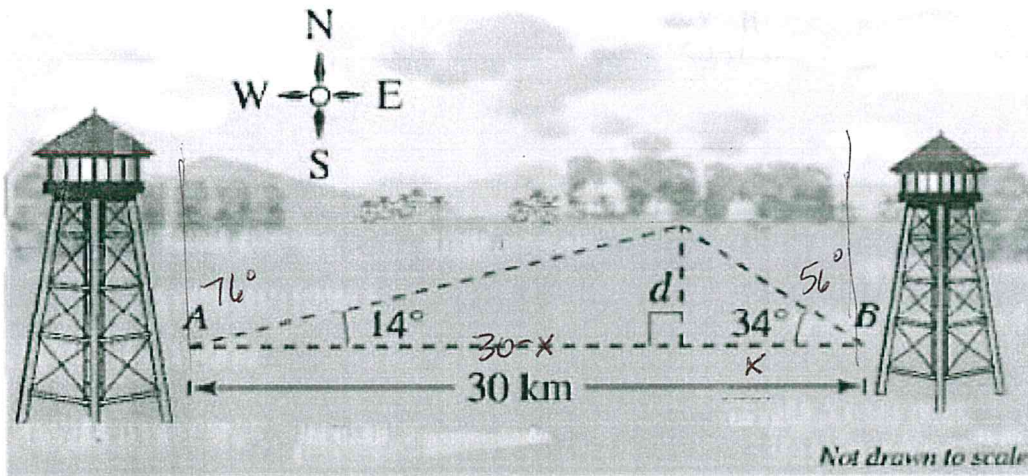


a) $N58^\circ E$

b) $\tan 36^\circ = \frac{50}{d}$

$d = \frac{50}{\tan 36^\circ} \approx 68.8 \text{ m}$

22. Two fire towers are 30 kilometers apart, where tower A is due west of tower B. A fire is spotted from the towers, and the bearings from A and B are $E14^\circ N$ and $W34^\circ N$, respectively. Find the distance d of the fire from the line segment AB.
or $N76^\circ E$ or $N56^\circ W$



$\tan 14^\circ = \frac{d}{30-x}$
 $(30-x) \tan 14^\circ = d$
 $30-x = \frac{d}{\tan 14^\circ}$

$\tan 34^\circ = \frac{d}{x}$
 $x \tan 34^\circ = d$
 $x = \frac{d}{\tan 34^\circ}$

$30 - \frac{d}{\tan 14^\circ} = \frac{d}{\tan 34^\circ}$
 $30 = \frac{d}{\tan 14^\circ} + \frac{d}{\tan 34^\circ}$
 $30 = d \left(\frac{1}{\tan 14^\circ} + \frac{1}{\tan 34^\circ} \right)$

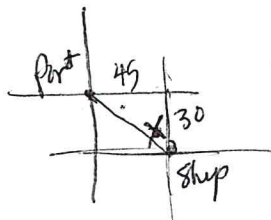
$30 - \frac{d}{\tan 14^\circ} = x$

$\downarrow \approx 5.46 \text{ km}$

$\frac{30}{\left(\frac{1}{\tan 14^\circ} + \frac{1}{\tan 34^\circ} \right)} = d$
 $\frac{30}{4.01 + 1.483} = \frac{30}{5.493}$

$\tan 34^\circ = \frac{d}{x}$
 $\tan 34^\circ = \frac{5.46}{x}$
 $x = \frac{5.46}{\tan 34^\circ}$
 $x \approx 8.1$
 $30-x \approx 21.9$

23. A ship is 45 miles east and 30 miles south of port. The captain wants to sail directly to port. What bearing should be taken?



$\tan x = \frac{45}{30}$
 $\tan^{-1} \frac{3}{2} = \theta$
 $x \approx 56.3^\circ$

$N56.3^\circ W$