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Problem: A wall extending East and west is 6 feet high. The sun has an altitude (angle of elevation) of $49^{\circ} 32^{\prime}$ and is $47^{\circ} 20^{\prime}$ east of south. Find the width of the shadow of the wall.

## Solution:

In Fig-1, let $\mathrm{BC}=6 \mathrm{ft}$ be the height of the wall and let AC be the width of the shadow of the wall when the sun is from the south with the elevation of
$\angle B A C=49^{\circ} 32^{\prime}$.
$\tan \left(49^{\circ} 32^{\prime}\right)=\frac{B C}{A C}$
$A C=\frac{B C}{\tan \left(49^{\circ} 32^{\prime}\right)}=\frac{6}{\tan \left(49^{\circ} 32^{\prime}\right)}=5.1185 \mathrm{ft}$.


Fig-1


Fig-2

If the sun is shifted towards east of $47^{\circ} 20^{\prime}$ (that is, clockwise direction) then the end of shadow will be shifted towards west of $47^{\circ} 20^{\prime}$ (that is, clockwise direction). In Fig-2, $\angle A C A^{\prime}=47^{\circ} 20^{\prime}$.

Now the width of the shadow is $A^{\prime} C^{\prime}$. In the right angled triangle $A^{\prime} C^{\prime} C$,
$\sin \angle A^{\prime} C C^{\prime}=\frac{A^{\prime} C^{\prime}}{A^{\prime} C}$
$\Rightarrow A^{\prime} C^{\prime}=\left(A^{\prime} C\right) \sin \angle A^{\prime} C C^{\prime}=(A C) \sin \left(90-47^{\circ} 20^{\prime}\right)=(5.1185) * \cos \left(42^{\circ} 40^{\prime}\right)=3.7637 \mathrm{ft}$

Required width of the shadow of the wall $=3.7637 \mathrm{ft}$.

