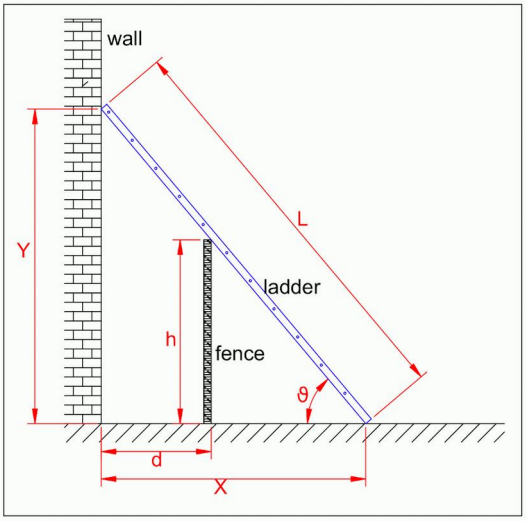
MINIMUM LENGTH OF LADDER TO A HOUSE OVER A FENCE



Given the height of the fence (h) and the distance of the fence from the wall (d), the length of the ladder (L) is given by the equation: $L=\frac{h}{\sin(\vartheta)}+\frac{d}{\cos(\vartheta)}$ (1)

where ϑ is the angle between the ladder and the ground.

The first derivative of L is: $L'=h\cdot\frac{\cos(\vartheta)}{\sin^2(\vartheta)}+d\cdot\frac{\sin(\vartheta)}{\cos^2(\vartheta)}$ (2)

In order to minimize L, its first derivative should be zero, ie.

$h\cdot\frac{\cos(\vartheta)}{\sin^2(\vartheta)}=d\cdot\frac{\sin(\vartheta)}{\cos^2(\vartheta)}$ or $h\cdot\cos^3(\vartheta)=d\cdot\sin^3(\vartheta)$ or

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$\frac{\sin^3(\vartheta)}{\cos^3(\vartheta)}=\frac{h}{d}$ or $\tan(\vartheta)=\sqrt[3]{\frac{h}{d}}$

$\frac{\sin^3(\vartheta)}{\cos^3(\vartheta)}=\frac{h}{d}$ or $\tan^3(\vartheta)=\sqrt[3]{\frac{h}{d}}$ and, finally, $\vartheta=\arctan(\sqrt[3]{\frac{h}{d}})$ (3)

After calculating the value of ϑ from (3) the L can be calculated from (1) and then the distance of foot of ladder from the wall X is equal to L*cos(ϑ), and the distance of the top of the ladder from the ground Y is equal to L*sin(ϑ).