

Mid-Unit Assignment: Expert Witness Part 1

MHF4U

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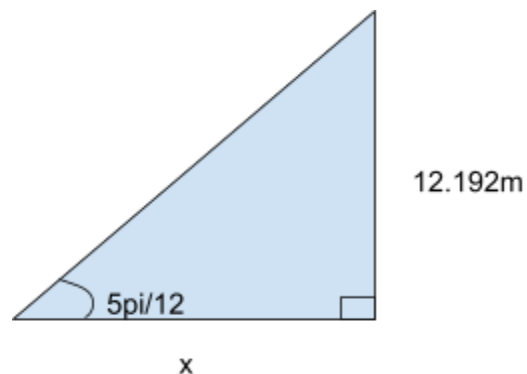
Things that we know

- The entry angle of bullet is $\frac{5\pi}{12}$, which means that the angle θ on the crime scene sketch is $\frac{5\pi}{12}$.
- We can assume that angle G on the crime scene sketch is 90 degree. We sure that the flat ground is perpendicular to vertical building, which means that the scene of the crime is perpendicular to the apartment.
- Since the each apartment floor is 3.048m in height, we can confidently say that the floor n has $3.048(n - 1)$ to 3.048meters from the ground.
 - 5th floor: (12.192~15.24) meters off
 - 6th floor: (15.24~18.288) meters off
 - 7th floor: (18.288~21.366) meters off
- Triangle Inequality Theorem means the sum of the lengths of any two sides of a triangle is greater than the length of the third side.
- An isosceles triangle can be used to represent the distance between the suspect and the witness in relation to their equidistant distance from the apartment's front entrance, as seen in the crime scene sketch.
- Given that the accused and witness were separated by 10 meters, the theorem dictates that the number of their equidistant distances to the front door must be greater than 10 meters.
 - $2x > 10$ while x represents the distance between the victim and witness and the front door.

Calculation who might commit it

Let's use tangent to figure out how far the victim is from the front door on each of the specified floors in their upper and lower height levels. If either of the results are less than or equal to 10 meters when doubled, we may be certain that the person who lives on the floor is mathematically innocent.

- 5th floor
 - Minimum distance from the floor: 12.192 meters



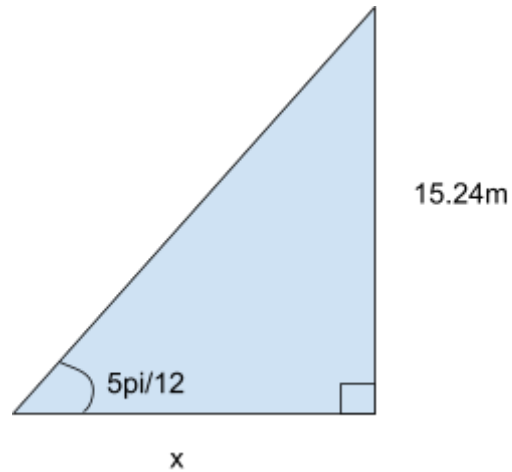
$$\tan\left(\frac{5\pi}{12}\right) = \frac{12.192}{x}$$

$$x \cdot \tan\left(\frac{5\pi}{12}\right) = 12.192$$

$$x = \frac{12.192}{\tan(\frac{5\pi}{12})}$$

$$x \approx 3.267$$

- Maximum distance from the ceiling: 15.24 meters



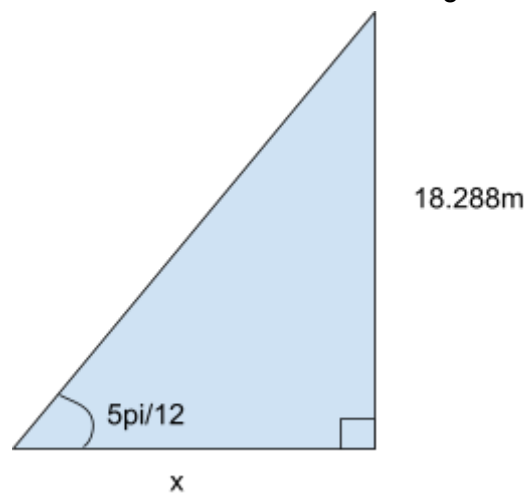
$$\tan(\frac{5\pi}{12}) = \frac{15.24}{x}$$

$$x \cdot \tan(\frac{5\pi}{12}) = 15.24$$

$$x = \frac{15.24}{\tan(\frac{5\pi}{12})}$$

$$x \approx 4.084$$

- 6th Floor
 - Maximum distance from the floor: 15.24 meters
 - same as the above
 - Maximum distance from the ceiling: 18.288 meters



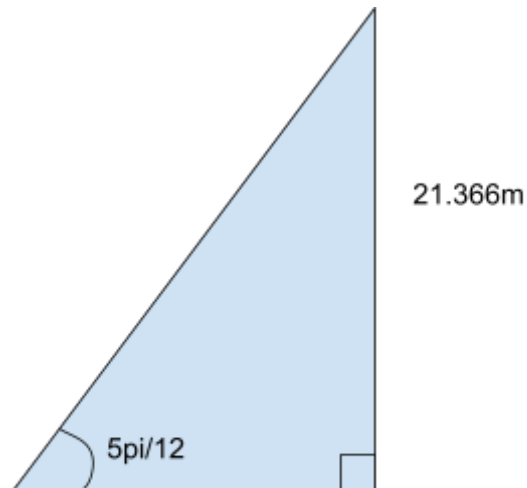
$$\tan(\frac{5\pi}{12}) = \frac{18.288}{x}$$

$$x \cdot \tan\left(\frac{5\pi}{12}\right) = 18.288$$

$$x = \frac{18.288}{\tan\left(\frac{5\pi}{12}\right)}$$

$$x \approx 4.9$$

- 7th floor
 - Maximum distance from the floor: 18.288 meters
 - same as the above
 - Maximum distance from the ceiling: 21.366 meters



x

$$\tan\left(\frac{5\pi}{12}\right) = \frac{21.366}{x}$$

$$x \cdot \tan\left(\frac{5\pi}{12}\right) = 21.366$$

$$x = \frac{21.366}{\tan\left(\frac{5\pi}{12}\right)}$$

$$x \approx 5.717$$

Conclusion

Since the measure of side 'x' within the 7th floor is 4.9m to 5.717m, the measure of side "x" provided the full height of the 7th floor is the only measure of side "x" that is greater than 10 meters, when the measure is doubled. **This means that the resident of the 7th floor is guilty.**