Leading to Excellence.



The diagram represents a cross-sectional view of a Hay Barn made of corrugated iron. The radius of the Hay Barn is 10 metres.

There is a flagpole at the end of the building whose height is not known and the girl at P is holding the rope AB tight.

The rope is just touching the roof and the girl calculates that the gradient of the rope is -1.

AB is obviously a TANGENT to the semi-circular roof. Find the height of the flagpole.

SOLUTION.

Let the flagpole represent the y axis. Let the flagpole's height be c so the equation of the rope is y = -x + cThe line (AB) is a tangent to the circular roof so the intersection of the graphs will be at one point. The intersection point is found by solving $x^2 + y^2 = 100$ and y = -x + c

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Substituting: $x^2 + (-x + c)^2 = 100$

$$x^{2} + x^{2} - 2cx + c^{2} = 100$$
$$2x^{2} - 2cx + (c^{2} - 100) = 0$$

This equ will have 1 solution if the discriminant $\Delta = 0$

$$4c^{2} - 4 \times 2 \times (c^{2} - 100) = 0$$
$$4c^{2} - 8c^{2} + 800 = 0$$
$$800 = 4c^{2}$$
$$c^{2} = 200$$

c = 14.14 metres The flagpole is 14.14 metres high.