**Leading to Excellence.**

 **3D view**

 A

 B

 🚺

 O P ***x***

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 + c***

***The 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 x2 + y2 = 100 and y = – x + c***

***Substituting: x2 + ( –x + c )2 = 100***

 ***x2 + x2 – 2cx + c2  = 100***

 ***2x2 – 2cx + (c2 – 100) = 0***

***This equ will have 1 solution if the discriminant = 0***

 ***4c2 – 4 × 2 × (c2 – 100) = 0***

 ***4c2 – 8c2 + 800 = 0***

 ***800 = 4c2***

 ***c2 = 200***

***c = 14.14 metres The flagpole is 14.14 metres high.***