**The Norfolk Pine Tree.**

F



🚺

***y***

A **30** B 8 C D E ***x***

The large Norfolk pine tree is 30 metres from the side of the hemispherical dome-house. AB = 30 m

The diameter of the dome-house is 16 metres.

The tree has grown so much in the last year that it is now just visible from the point E which is on the other side of the dome-house.

The distance DE is **not known** but the gradient of the “line of sight” from E to the top of the tree F, is **– ½** .

Calculate the height of the Norfolk pine tree.

***The line FE will be a tangent to the dome-house.***

***The equation will be y = - ½ x + c***

***The equation of the dome-house is x2 + y2 = 64***

***Solving simultaneously: x2 + ( - ½ x + c)2 = 64***

***x2 + x2 – cx + c2 = 64***

***4***

***4x2 + x2 – 4cx + 4c2 = 256***

***5x2 – 4cx + (4c2 – 256) = 0***

***For the line of sight to be a tangent = 0 so there is only 1 solution.***

***16c2 – 4 × 5 ×(4c2 – 256) = 0***

***16c2 – 80c2 + 5120 = 0***

***5120 = 64c2***

***c2 = 80***

***c = 8.94***

***(the negative answer refers to the tangent to the whole circle underground!)***

***The equation of FE is y = - ½ x + 8.94***

***The value of x at A is x = - 38 so substituting:***

***The height of the tree is y = - ½ × - 38 + 8.94***

***= 27.94 metres***