The Dam Busters!

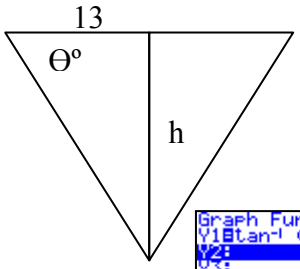
Select GRAPH icon (press 5) from the main menu or by using the arrow keys to highlight and then press EXE.

The destruction of dams during World War Two (WW2) has been described in both books and films. Bouncing (or skimming) bombs released by Lancaster bomber which flew over and close to the surface of the dam filled lakes. The accuracy of the altimeters when flying at this altitude were not accurate so a devise designed by a mathematician Barnes Wallis. The device engaged two beams of light, one red and the other green. These lights were positioned under the wings, a measured distance apart. The red and green lights met at a point on the surface of the water and formed a yellow light.
Set up a mathematical model that will allow the angles for the beams to be calculated for a flying height of the Lancaster aeroplane between 0-100 metres and an angle between 0º - 90º.
For more information on Barnes Wallis and the Lancaster bomber visit:
http://www.computing.dundee.ac.uk/staff/irmurray/bigbounc.asp

Question: Find what angle the beams need to be set for if the bomber is able to fly at any height above the water surface and in particular the solution when it flies 70 metres above the water surface?
[Use the distance between the two source lights on the wings to be 26 metres.]

Solution:

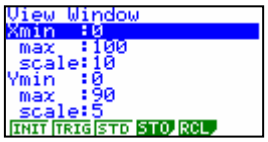
Tan Θº = $^{h}/_{13}$ giving Θº = $\text{Tan}^{-1}(^{h}/_{13})$



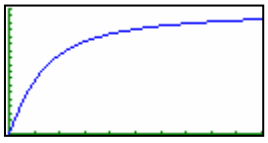
In the **Y1** space, enter the equation Y1 = $\tan^{-1}(x \div 13)$

Set the **V-Window** **SHIFT** **F3** to **TRIG** **F2** [Make sure you are in degrees NOT Radians] and change the settings to:

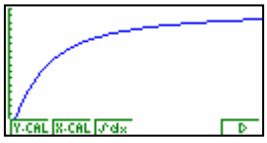
Xmin: 0
Xmax: 100
Scl: 10
Ymin: 0
Ymax: 90
Scl: 5

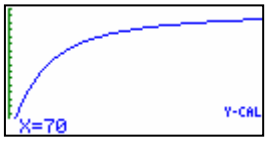


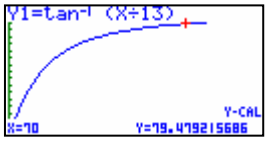
Draw the graph **F6** or **EXE**



Now, **G-Solv** **SHIFT** **F5** to find the angle required for when x = 70, this is a **Y-CAL,** **F6** **F1**







Answer: When the bomber flies at an altitude of 70 metres above the water surface the light beams need to be angled at 79.479º [3 d.p.]