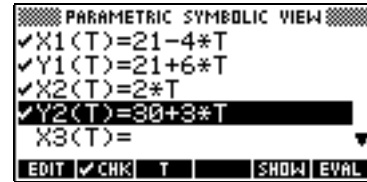
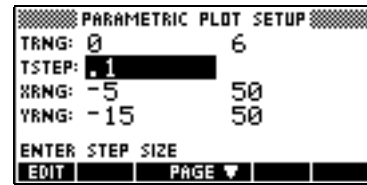


Eg. Ship A is currently at position vector  $21\mathbf{i} + 21\mathbf{j}$  km and is currently travelling at a velocity of  $-4\mathbf{i} + 6\mathbf{j}$  km/hr. Ship B is at  $30\mathbf{j}$  and travelling at  $2\mathbf{i} + 3\mathbf{j}$  km/hr. If the ships continue on their present courses, show that they will not collide and find the distance between them at the time of their closest approach.

Firstly enter the equations for the ships' paths into the **Parametric** applet using the first equation pair for ship A and the second for ship B.



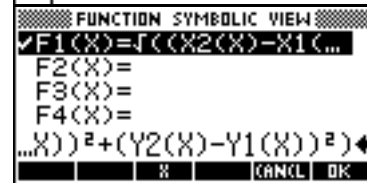
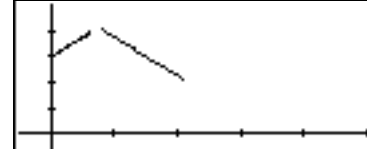
Making a guess at the ships' behavior and position, I will set up the axes as shown on the right. I am assuming that the collision will occur in the first 6 seconds and in the axes range chosen. This can always be adjusted if my guess is wrong. The reason for choosing -15 on the **YRng** is to ensure that the x axis is visible on the screen. Note *Simult*: must be **CHKed**.



Careful examination of the paths of the ships as they appear on the screen (shown on the right just before closest approach) will show visibly that they do not collide. However we need to verify this algebraically.

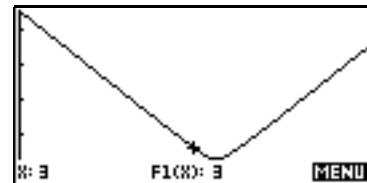


The formula for the distance between the ships is  $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$  and this can now be entered into the Function applet as shown right. With an equation this complex it is probably worth checking with the **SHOW** key that you have typed it correctly. Notice that the active variable in Function must be X not T.



I want to graph this function for the first six seconds but I am not sure what y scale to use so I will set XRng to be 0 to 6 in the **PLOT SETUP** view and then choose **VI EWS - Auto Scale**. The result is shown right.

$$F1(X) = \sqrt{(X2(X) - X1(X))^2 + (Y2(X) - Y1(X))^2}$$



Using **FCN** - *Extremum*, I find that the time of closest approach is at  $t = 3.4$  hours (3:24 pm) with a separation at that time of  $d = 1.3416$  km. (I have adjusted the axes slightly.)

