

Chapter 6 / **Example 41**

# Drawing the tangent and normal

Given the function  $y = 3\cos\left(x - \frac{\pi}{3}\right) - 1, -\infty < x < \infty$

at the point P where the graph intersects the y-axis.

- a** Find the equation of the tangent.    **b** Find the equation of the normal.  
**c** Verify using your calculator.

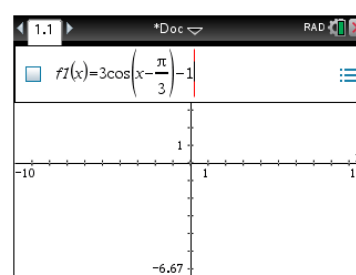
Open a new document and add a Graphs page.

The entry line is displayed at the top of the work area.

The default graph type is function, so 'f1(x)= ' is displayed.

The default axes are  $-10 \leq x \leq 10$  and  $-6.67 \leq y \leq 6.67$ .

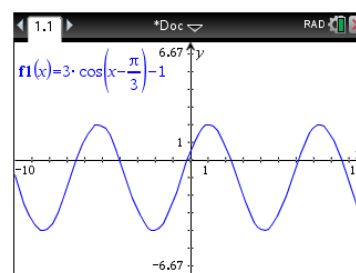
Type  $3\cos\left(x - \frac{\pi}{3}\right) - 1$  and press **enter**.



The GDC displays the graph  $f1(x) = 3x^2 - 2$  with the default axes.

*Note that the default axes have the same x and y scales. This means that the tangent and normal will appear to be at perpendicular.*

*Changing the x-axis scale, for example, would distort the graph and alter the angle between the lines.*



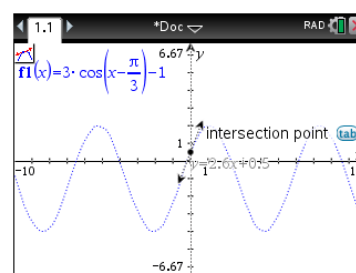
To draw the tangent at  $x = 1$  press

**menu** 8:Geometry | 1:Points & Lines | 7:Tangent.

Use the touchpad to position the cursor on the point at  $x = 0$ .

The GDC will display 'intersection point' when you are close enough as it is the intersection of the curve and the y-axis.

Click the touchpad and press **esc** to leave the tangent mode.

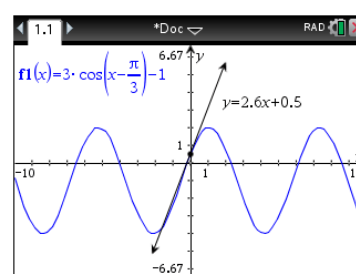


The GDC displays the function and the tangent at  $x = 0$ .

You can extend the line by pulling on the two arrows at its ends.

The equation of the tangent is displayed too.

$y = 2.6x + 0.5$ .



Chapter 6 / **Example 41**

# Drawing the tangent and normal

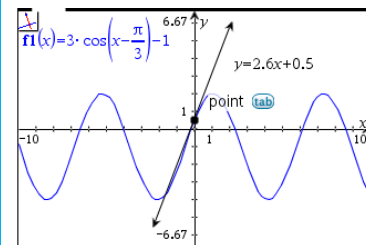
The TINspire CX will not find the normal to the curve directly. However the following steps can be used.

Press **menu** 8:Geometry | 4:Construction | 1:Perpendicular.

Use the touchpad to move the cursor to the point at  $x = 0$ .

The GDC will display the words 'point on' when you are close enough.

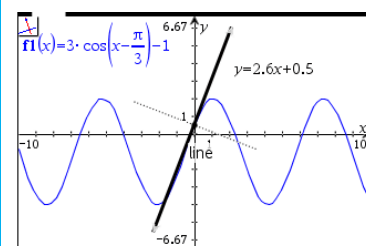
Click the touchpad.



Use the touchpad to move the cursor to the tangent line.

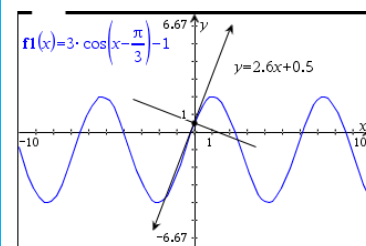
The GDC will display the word 'line'.

Click on the touchpad.



The GDC displays the normal at the point  $x = 0$ .

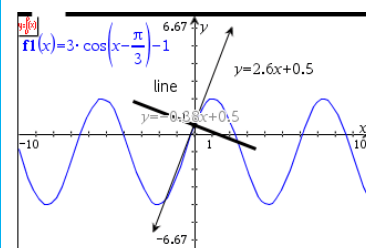
Press **esc** to exit perpendicular line drawing mode.



To find the equation of the normal line you have drawn press **menu** 1:Actions | 8:Coordinates and Equations.

Use the trackpad to move the cursor to the line. When you are close enough the word 'line' is displayed.

Click the touchpad and press **esc** to leave the equation mode.



The GDC displays the equation of the normal at  $x = 0$ .

The equation of the normal is  $y = -0.38x + 0.5$ .

