Chapter 5 / **Example 9**

Tangents and normals

The GDC can be used to find the equations of tangents as an alternative to using differentiation. The TI-84 Plus C will not find the equation of the normal directly, but you can use it to check your result.

$f(x)=3x^2-2$

Find:

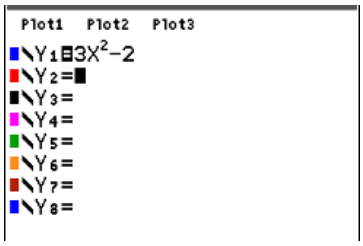
a the derivative of the curve at $x=1$

b the equation of the tangent to the curve at $x=1$

c the equation of the normal to the curve at $x=1$

Press [f1] [y=] to display the equation entry screen.

Type $3x^2-2$ and press [enter] to enter the equation as Y_1.

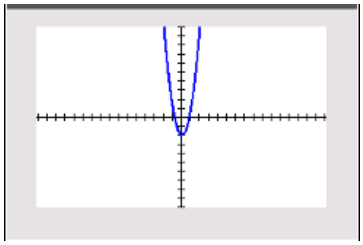


Press [f5] [graph] to display the graph screen

The GDC now displays the quadratic function:

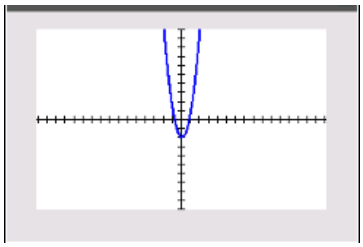
$Y_1=3x^2-2$

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



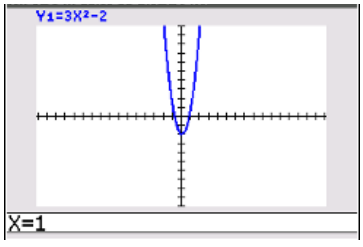
In this question to make the tangent and normal appear to be at perpendicular. You want to change the axes to have the same x and y scales. Otherwise the window would distort the graph and alter the angle between the lines.

Press [f3] [zoom] 5:ZSquare



To find the gradient at $x=1$ press [2nd] [calc] 6:dy/dx

Type 1, the value of the x-coordinate, and press [enter].

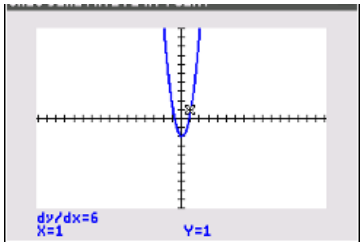


Chapter 5 / **Example 9**

Tangents and normals

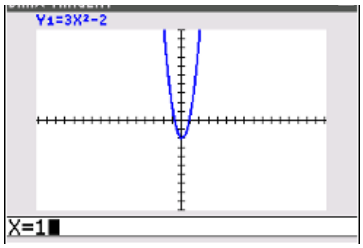
The GDC displays a point on $f(x) = 3x^2 - 2$ and the gradient of the curve at that point.

$f'(1) = 6$.



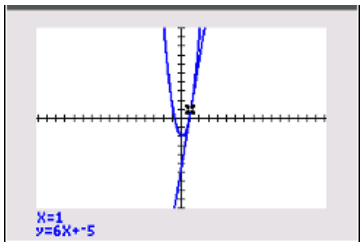
To draw the tangent at $x = 1$ press [2nd] [draw] 5:Tangent(

Type 1 to position the cursor on the point at $x = 1$ and press [enter].



The GDC displays the function and the tangent at $x = 1$

The equation of the tangent is $y = 6x - 5$.



The TI-84 Plus C will not find the equation of the normal directly.

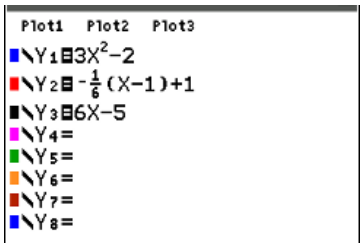
The tangent has gradient 6 and meets the curve at $(1,1)$ therefore the normal will have gradient $-\frac{1}{6}$ and will also meet the curve at $(1,1)$.

The equation will be $y - 1 = -\frac{1}{6}(x - 1)$ or $y = -\frac{1}{6}(x - 1) + 1$.

Press [f1] [y=] to display the equation entry screen.

Type $-\frac{1}{6}(x - 1) + 1$ and press [enter] to enter the equation as Y_2.

You will also need to enter $6x - 5$ in Y_3.



The GDC displays the tangent and normal at the point $x = 1$.