

## 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 Casio fx-GC50 will not find the equation of the normal directly, but you can use it to check your result.

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

Find:

- the derivative of the curve at  $x = 1$
- the equation of the tangent to the curve at  $x = 1$
- the equation of the normal to the curve at  $x = 1$

Press **MENU** 5 **GRAPH** to display the equation entry screen.

Type  $3x^2 - 2$  and press **EXE** to enter the equation as Y1.

Graph Func : Y=

Y1:  $3x^2 - 2$  [—]

Y2: [—]

Y3: [—]

Y4: [—]

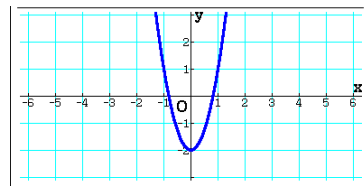
Y5: [—]

Y6: [—]

[SELECT] [DELETE] [TYPE] [TOOL] [MODIFY] [DRAW]

Press **F6** DRAW to display  $Y1 = 3x^2 - 2$  on the graph screen

The default axes are  $-6.3 \leq x \leq 6.3$  and  $-3.1 \leq y \leq 3.1$ . These axes have the same x and y scales. This will make the tangent and normal appear to be at perpendicular.



Press **EXIT** then press **SHIFT** **MENU** SET UP.

Scroll down to Derivative with **▼** and use **F1** to set this to 'On'. Press **EXIT** to return to the equation entry screen and **F6** DRAW to return to the graph.

Input/Output: Math

Draw Type : Connect

Ineq Type : Union

Graph Func : On

Dual Screen : Off

Simul Graph : Off

Derivative : On **↓**

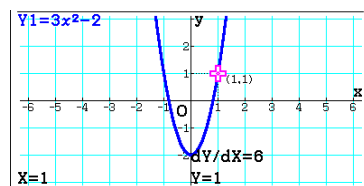
On Off

To find the gradient at  $x = 1$  press **F1** Trace

Type 1, the value of the x-coordinate, and press **EXE**.

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

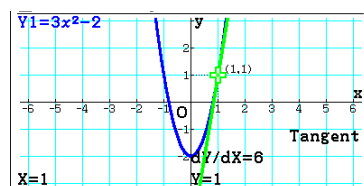
$$f'(1) = 6.$$



To draw the tangent at  $x = 1$  press **F4** Sketch and **F2** Tangent

Type 1 the value of the x-coordinate and press **EXE**.

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



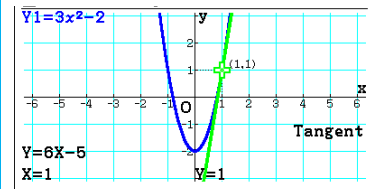
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press **EXE** again.

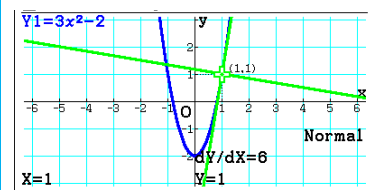
The GDC displays the function and the tangent at  $x = 1$

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



To draw the normal at  $x = 1$  press **F4** Sketch and **F3** Norm  
Type 1 the value of the  $x$ -coordinate and press **EXE**.

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



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

The equation of the normal is  $y = -0.166x + 1.1666$ .

