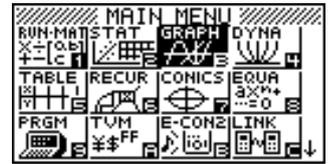


# Calculus – the use of the derivative.

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Select the **GRAPH** mode from the **MAIN MENU** by using the arrow keys to highlight the **GRAPH** icon and pressing **[EXE]** or pressing **[3]**.



Calculus requires the student to visualise a tangent to a curve – you can simulate this by drawing a tangent to a curve, but seeing the curve changing as you **ZOOM** on a particular part (isolate) of the curve highlights the fact that any curve is a series of infinitesimally small pieces (piecewise) of straight lines. **DO NOT** forget to make the equation in question ‘fit’ onto the viewing screen before **ZOOMING** in.

**[SHIFT] [F3]** for the **V-window**.

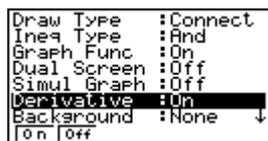


**INIT**ial setting



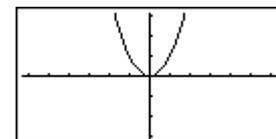
**ST**andard setting

And turn the derivative settings to **on**. Then **[EXIT]**.

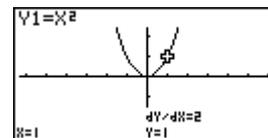
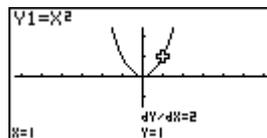
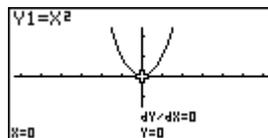


**[SHIFT] [MENU]**

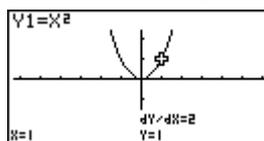
**Example:** Illustrate the graph of  $y = x^2$  and then **ZOOM** in on the co-ordinate point (1,1)  
Type in the equation and draw the graph of  $y = x^2$ .



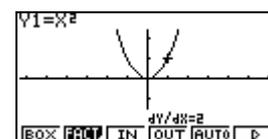
**[SHIFT] [F1]** will trace the curve illustrating the co-ordinate point and also displaying the derivative at that point  $dy/dx$ . Use the left **[◀]** and right **[▶]** arrows to move the cursor.



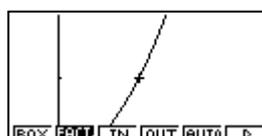
Moving the cursor around the graph of  $y = x^2$  using the **←** and **→** arrows.  
Move the cursor to (1, 1)



Now **ZOOM** in on that point – press **SHIFT] [F2]** for **Zoom**, then **[F3]** for **IN**. Keep pressing **[F3]** each time the graph is redrawn to see the curve being ‘straightened’.

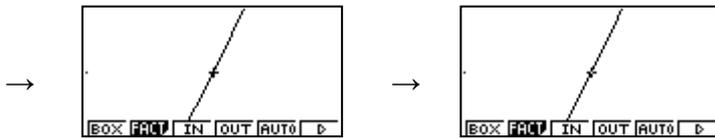


→

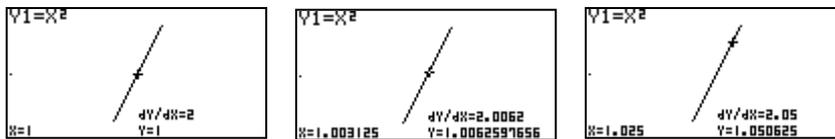


→





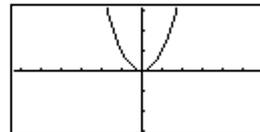
You can re-trace the curve at any time by pressing [SHIFT] [F1] for **Trace**, then use the arrow keys to move along the graph of  $y = x^2$ .



### Drawing tangents to a curve:

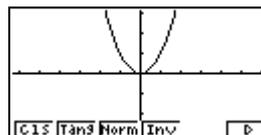
To draw a tangent to a curve  $y = x^2$  at  $(1.5, 2.25)$ .

Redraw the graph of  $y = x^2$  and set the **V-window** to **STD**.



Select [SHIFT] [F4] for **Sketch**.

Then [F2] for **Tangent**.

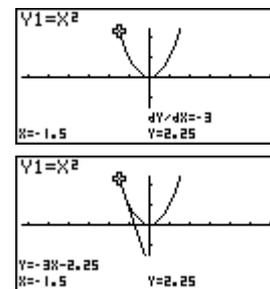


Using the ◀ or ▶ arrows to move the cursor to the

coordinate point  $(1.5, 2.25)$ .

Then press [EXE] to draw in the tangent line to the curve.

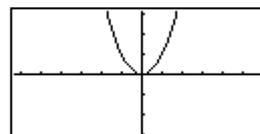
[Note: The equation of the tangent line is displayed on the bottom left of the screen.]



### Drawing normal to a curve:

To draw a normal to a curve  $y = x^2$  at  $(1, 1)$ :

Redraw the graph of  $y = x^2$  and set the **V-window** to **STD**.



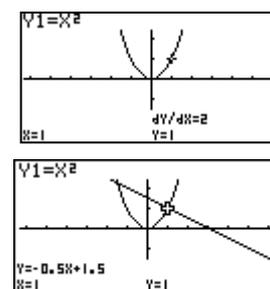
Select [SHIFT] [F4] for **Sketch**.

Then [F3] for **Normal**.

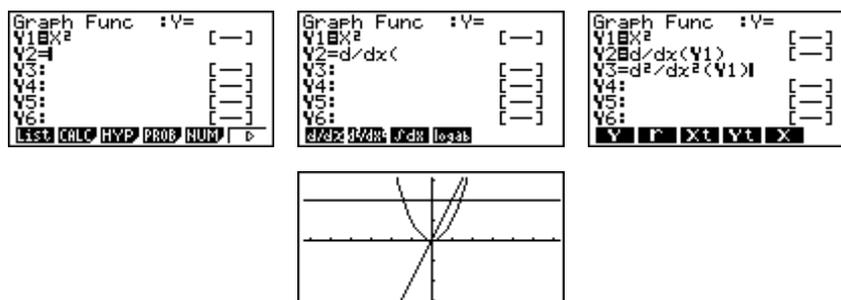
Using the ◀ or ▶ arrows to move the cursor to the coordinate point  $(1, 1)$ .

Then press [EXE] to draw in the normal line to the curve.

[Note: The equation of the normal line is displayed on the bottom left of the screen.]



### Drawing the first and second derivatives to any curve:



[SHIFT] [F1] will trace the curves illustrating the co-ordinate point and also displaying the derivative at that point  $\frac{dy}{dx}$ . Use the left [◀] and right [▶] arrows to move the cursor. Use the up [▲] and down [▼] arrows to move from one graph to the other.