Chapter 10 / **Example 2**

Graphing a function and its derivative

For each of the functions below:

i find $f'(x)$

ii find the gradient of the curve at the point where $x = 2$

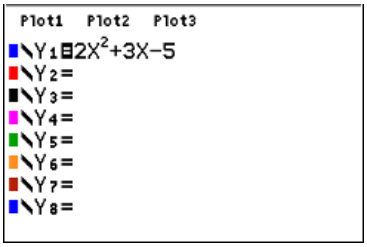
iii sketch the graph of the function and its derivative on the same axes

iv write down the set of values of x for which the function is increasing.

a $f(x) = 2x^2 + 3x - 5$ **b** $f(x) = \frac{2}{x} + x, x \neq 0$

Press [F1] [Y=] to display the equation entry screen.

Type $2x^2 + 3x - 5$ and press [ENTER] to enter the equation as Y_1.



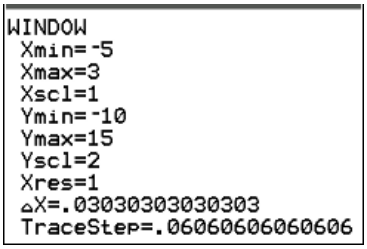
For a better view of the curve, adjust the window.

Press [F2] [WINDOW]

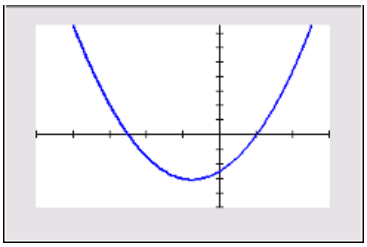
Set the axes to show $-5 \leq x \leq 3$ with a scale of 1 and $-10 \leq y \leq 15$ with a scale of 2

Leave the remaining items unchanged.

Press [F5] [GRAPH] when you have finished.



The GDC displays the graph with suitable axes.

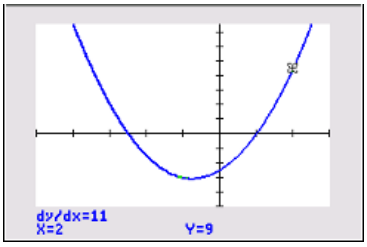


To find the gradient at $x = 2$ press [2nd] [CALC] 6:dy/dx

Type 2, the value of the x-coordinate, and press [ENTER].

The GDC displays a point on $f(x) = 2x^2 + 3x - 5$ and the gradient of the curve at that point.

$f'(2) = 11$.



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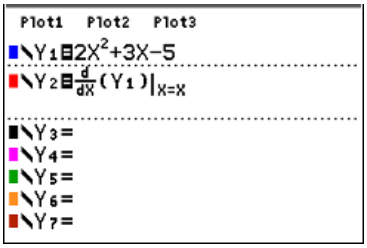
Graphing a function and its derivative

To display the derivative, press [F1] [Y=] to display the equation entry screen.

Press [ALPHA] [F2] 3:nDeriv

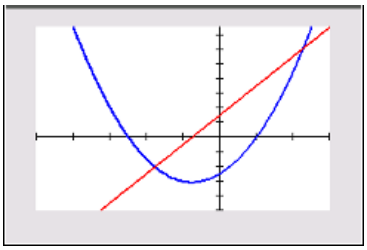
The template has spaces for the variable, *x*, the function and the value that it is evaluated at.

Enter X in the denominator and the function Y_1 using [ALPHA] [F4] 1:Y_1. Type X and press [ENTER] to enter the equation as Y_2.



Press [F5] [GRAPH] to display the graph screen.

The GDC displays the graph of Y_1 and its derivative.



To find where the function is increasing, either find its minimum value of the zero of the derived function.

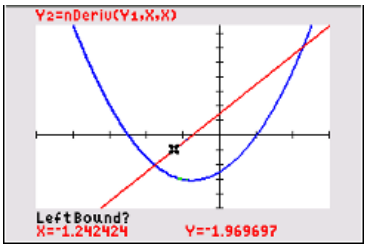
To find the zero press [2nd] [F4] [CALC] 2:zero

You will need to give the left and right bounds of the region that includes the zero.

Use } † to select Y_2.

The GDC shows a point on the curve and asks you to set the left bound. Move the point using ~ | and choose a position to the left of the zero.

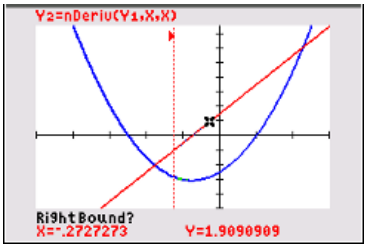
Press [ENTER].



The GDC shows a line where you have set the left bound and a point on the curve.

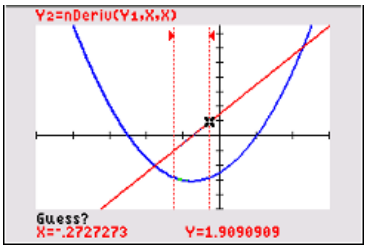
Move the point using ~ | and choose a position to the right of the zero.

When the region contains the zero, Press [ENTER].



The GDC requires an initial guess for the position of the zero. Choose the default position.

Press [ENTER].



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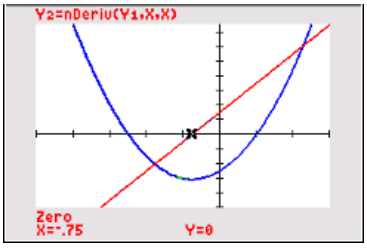
The zero of $f'(x)$ is at $(-0.75, 0)$

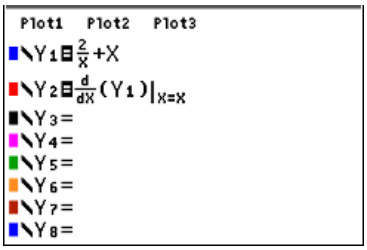
The function is increasing where $x > -0.75$.



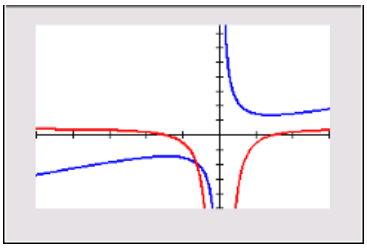
Press [F1] [Y=] to display the equation entry screen again.

Edit the function Y_1. Press [CLEAR] and change it to $\frac{2}{x} + x$ and press [ENTER].

Use the fraction template: [ALPHA] [F1] 1:n/d.



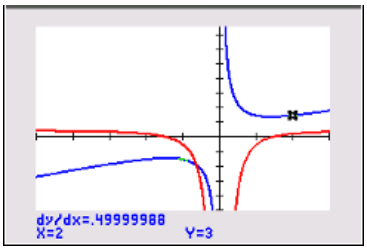
Press [F5] [GRAPH] to display the new function and its derivative.



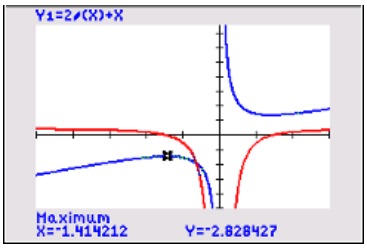
Find the gradient at the point where $x = 2$.

$f'(2) = 0.5$

0.49999988 is very close to 0.5. The difference is due to the way in which this value is calculated. Ignore the slight difference.



Find the maximum and minimum points.



$f(x)$ has a maximum and minimum point at (−1.41, −2.83) and (1.41, 2.83).

The function is increasing when $x < -1.41$ and $x > 1.41$