

Chapter 9 / **Example 6**

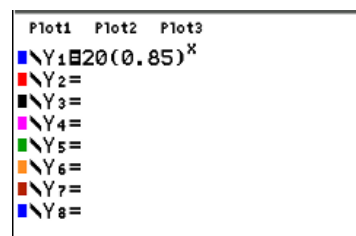
Solving exponential equations

The value of a boat, y , in thousands of UK pounds (£) is modelled by the function $y = 20(0.85)^x$, where x is the number of years since the boat was manufactured.

- Find the value of the boat when it was brand new.
- Estimate the value of the boat when it is 3 years old. Give your answer to the nearest pound.
- Use your GDC to estimate when the value of the boat will be worth half its original value.

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

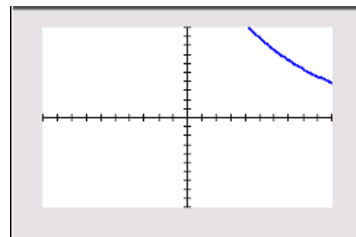
Type $20(0.85)^x$ and press $[enter]$ to enter the equation as Y_1 .



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

The GDC now displays the curve $Y_1 = 20(0.85)^x$.

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



To view values of the function it is helpful to use a table of values.

Press $[mode]$. Use the $[left]$ $[up]$ $[right]$ $[down]$ keys to place the cursor on GRAPH-TABLE in the Mode menu, and then press $[enter]$ to highlight it.

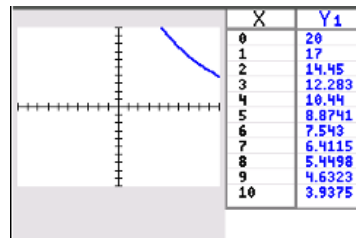


Press $[f5]$ $[graph]$.

A table of values is displayed alongside the graph.

You can scroll through the table using $[up]$ and $[down]$ on the touchpad.

From the table, you can see that the graph can see that $f(0) = 20$ and $f(3) = 12.3$.



Chapter 9 / Example 6

Solving exponential equations

Use this information to choose suitable window settings to display the graph.

Return to a full graph display without the table.

Press **[mode]** Use the **[◀]** **[▶]** **[▶]** **[▶]** keys to place the cursor on FULL in the Mode menu, and then press **[enter]** to highlight it.

Press **[f2]** **[window]**.

Set the axes to show $-2 \leq x \leq 14$ and $-2 \leq y \leq 22$ and set both the scales set to 2.

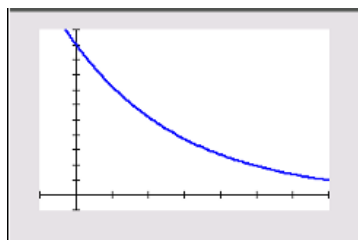
Press **[f5]** **[graph]**.

```

WINDOW
Xmin=-2
Xmax=14
Xscl=2
Ymin=-2
Ymax=22
Yscl=2
Xres=1
ΔX=.06060606060606
TraceStep=.12121212121212

```

The GDC displays the curve $Y_1 = 20(0.85)^x$ in a suitable window.



The value of the boat will have halved when it is £10 thousand. Plot the line $y = 10$ on the same graph to find the intersection.

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

Type 10 and press **[enter]** to enter the equation as Y_2 .

Press **[f5]** **[graph]**.

```

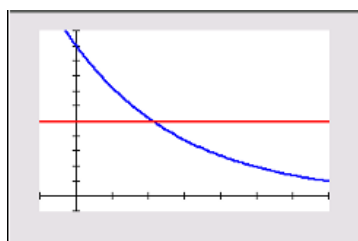
Plot1 Plot2 Plot3
Y1=20(0.85)^X
Y2=10
Y3=
Y4=
Y5=
Y6=
Y7=
Y8=

```

The GDC now displays the curve and the straight line:

$$Y_1 = 20(0.85)^x$$

$$Y_2 = 10$$

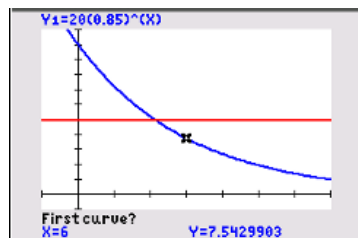


Press **[2nd]** **[f4]** **[calc]** 5:intersect

To find the intersection you need to choose the two curves that intersect.

The GDC shows a cross on the curve and 'First curve?'.

Press **[enter]**.

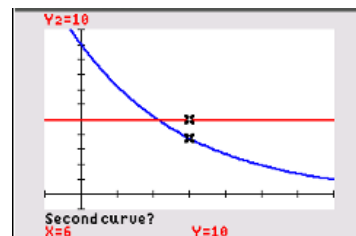


Chapter 9 / **Example 6**

Solving exponential equations

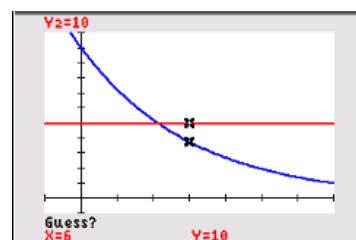
The GDC shows a cross on the line and 'Second curve?'.

Press **enter**.



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

Press **enter**.



The GDC displays the intersection at the point (4.27, 10).

The boat will be worth half its original value in approximately 4.27 years.

