Chapter 7 / **Example 12**

Exponential modelling

The equation $M(t) = 85.7 \times 0.966^t$ gives the amount (M) in grams of a radioactive material t years from its production.

a What was the original mass of the radioactive material?

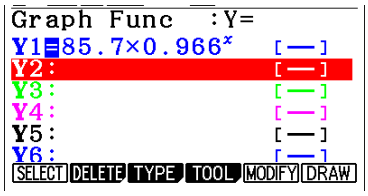
b How much of the radioactive material is left after one decade?

c Calculate the complete number of years it would take for the radioactive material to reduce below 55 grams.

d What is the half-life of the material?

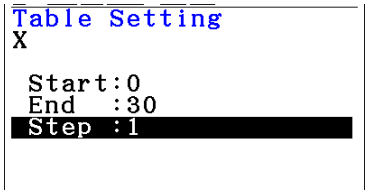
Press MENU 5 GRAPH to display the equation entry screen.

Type 85.7×0.966^x and press EXE to enter the equation as Y1.



Press MENU 7 TABLE. Press F5 SET and change the settings so that the table starts from 0 and ends at 30.

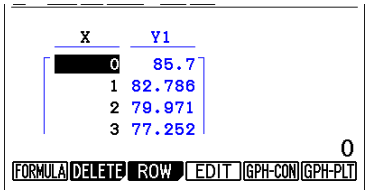
Press EXIT.



Press F6 TABLE.

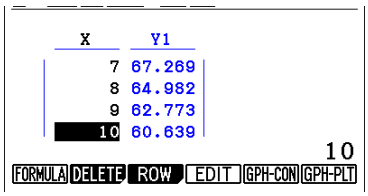
A table of values is displayed.

From the table, you can see that $M(0) = 85.7$.



Scroll down with ▼.

$M(10) = 60.6$.



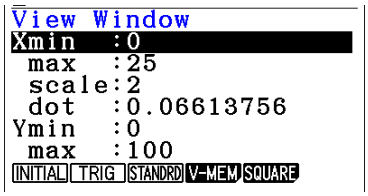
Use this information to choose suitable window settings to display the graph.

Press MENU 5 GRAPH ⏸

Press SHIFT F3 V-WIN.

Set the axes to show $0 \le x \le 25$ with a scale of 2 and $0 \le y \le 100$ with a scale of 20, leaving the remaining items the same.

Press EXIT when you have finished.



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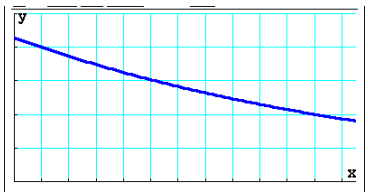
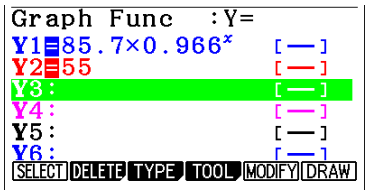
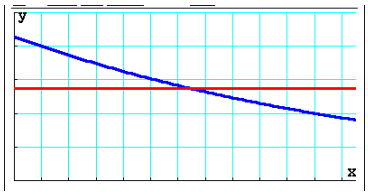
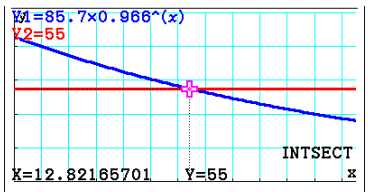
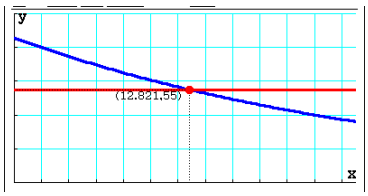
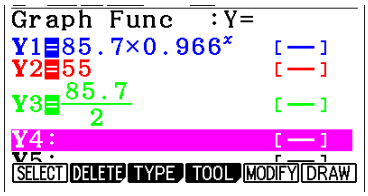
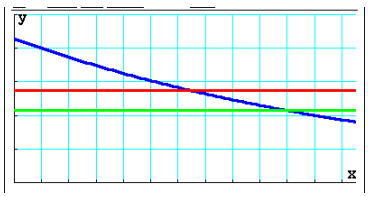
Exponential modelling

Press [F6] DRAW to display the graph screen. The GDC displays the graph of the mass of radioactive material in a suitable window.	
Press [EXIT] to return to the equation entry screen. Type 55 press [EXE] to enter the equation as Y2.	
Press [F6] DRAW. The GDC displays $Y1 = 85.7 \times 0.966^x$ and $Y2 = 55$.	
To find the intersection press [F5] G-Solv [F5] Intersect. Press [EXE] to display the coordinates. Press [EXIT] to leave G-Solv mode and [F6] DRAW to display the graph screen again.	
The GDC displays the intersection of the two straight lines at the point $(12.8, 55)$. After 13 years the amount of the radioactive material has reduced below 55 g.	
Press [EXIT] to return to the equation entry screen. Type $\frac{85.7}{2}$ press [EXE] to enter the equation as Y3.	
Press [F6] DRAW. The GDC displays the curve and two straight lines.	

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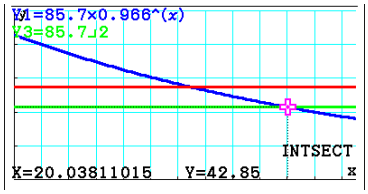
Exponential modelling

To find the intersection press F5 G-Solv F5 Intersect.

Select F1 and F3 by pressing ▼ and pressing EXE.

Press EXE to display the coordinates.

Press EXIT to leave G-Solv mode and F6 DRAW to display the graph screen again.



The GDC displays the intersection of the two straight lines at the point $(20.0, 42.85)$.

The half-life of the material is 20 years.