

Chapter 4 / **Example 14****Modelling with arithmetic sequences**

A piledriver is a machine used in construction to drive support poles into the ground by repeatedly striking them. Acme construction company uses a piledriver that drives support poles 0.12 m deeper into the ground with each strike. The current support pole has already been driven 13.6 m into the ground.

- a** If the sequence $\{u_n\}$ represents the depth of the support pole after n strikes, find the first three terms of the sequence.
- b** Write down an expression for the n th term of the sequence.
- c** The support poles must be driven to a depth of at least 38 m below ground.
Determine
 - i** the number of strikes needed to reach this depth
 - ii** the exact depth it will then have reached.

$$u_1 = 13.6, u_2 = 13.72, u_3 = 13.84.$$

$$u_n = 13.6 + 0.12(n - 1).$$

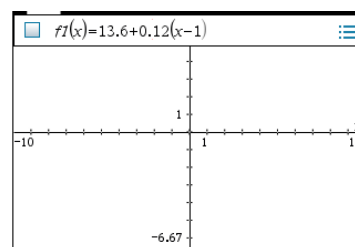
Open a new document and add a Graphs page.

The entry line is displayed at the top of the work area.

The default graph type is function, so 'f1(x)= ' is displayed.

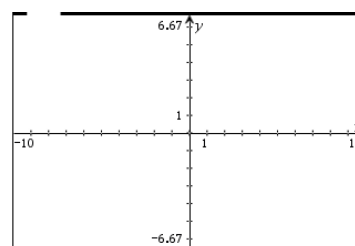
The default axes are $-10 \leq x \leq 10$ and $-6.67 \leq y \leq 6.67$.

Type $13.6 + 0.12(x - 1)$ and press **enter**.



The GDC displays the graph $f1(x) = 13.6 + 0.12(x - 1)$ with the default axes.

With these scales there is nothing to see on the screen.

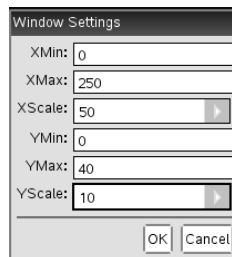


Change the window settings for a better view.

Press **menu** 4:Window/Zoom | 1:Window Settings...

Set the axes to show $0 \leq x \leq 250$ with a scale of 50 and $0 \leq y \leq 40$ with a scale of 10.

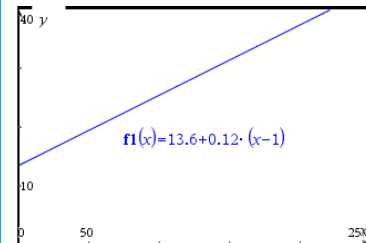
Press **enter** when you have finished.



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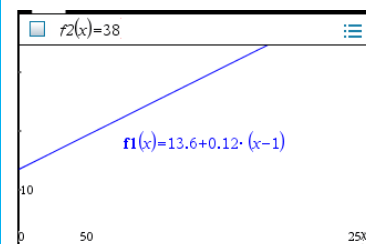
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The GDC displays the graph in a suitable window.



Press **[tab]** to display the entry line again. This time ' $f2(x)=$ ' is displayed.

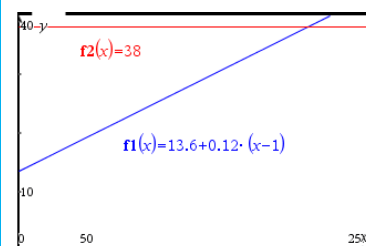
Type 38 and press **[enter]**.



The GDC now displays both straight-line graphs:

$$f1(x) = 13.6 + 0.12(x - 1)$$

$$f2(x) = 38$$

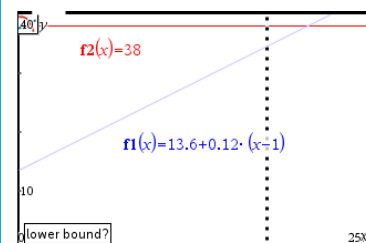


Press **[menu]** 6:Analyse Graph | 4:Intersection.

To find the intersection you need to give the lower and upper bounds of the region that includes the intersection.

The GDC shows a line and asks you to set the lower bound. Move the line using the touchpad and choose a position to the left of the intersection.

Click the touchpad.

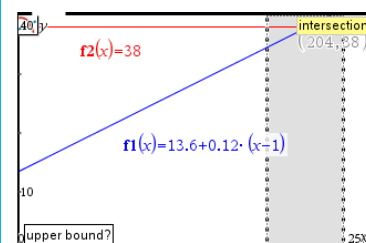


The GDC shows another line and asks you to set the upper bound.

Use the touchpad to move the line so that the region between the lower and upper bounds contains the intersection.

When the region contains the intersection, the calculator will display the word 'intersection' in a box.

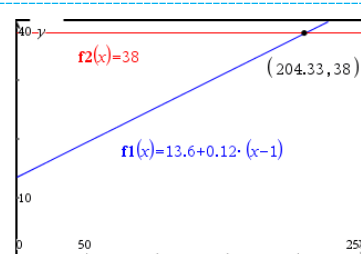
Click the touchpad.



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The GDC displays the intersection of the two straight lines at the point $(204.33, 38)$.

As n must be a whole number and the depth must be 38 m or more, you choose the next largest whole number, so $n = 205$.



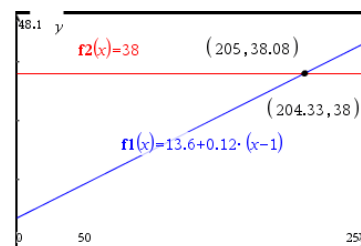
To find the value of the function when $n = 205$ press **menu** 5:Trace | 1:Graph Trace.

Press 205 **enter** to change the x coordinate to 205.

Press **enter** again and then press **esc** to leave the graph trace mode.

The GDC displays the coordinates of the point $(205, 38.08)$.

$$u_{205} = 38.08.$$



Alternatively, you can use a table of values to find this information.

Press **ctrl** **T**.

A table of values is displayed alongside the graph.

You can scroll through the table using **▲** and **▼** on the touchpad.

From the table, you can see that the first term which is greater than 38 is 38.08 when $u = 205$.

