

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.

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

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

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

Press **MENU** 5 **GRAPH** **Y=** to display the equation entry screen.

Type $13.6 + 0.12(x - 1)$ and press **EXE** to enter the first equation as Y1.

Graph Func :Y=
 Y1=13.6+0.12(x-1[—]
 Y2: [—]
 Y3: [—]
 Y4: [—]
 Y5: [—]
 Y6: [—]
 [SELECT] [DELETE] [TYPE] [TOOL] [MODIFY] [DRAW]

To show the graph in an appropriate window.

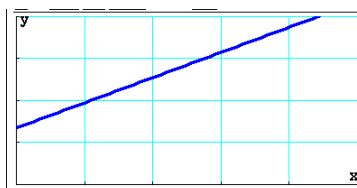
Set the axes to show $0 \leq x \leq 250$ with a scale of 50 and $0 \leq y \leq 40$ with a scale of 10. Leave the other items the same.

Press **EXIT** when you have finished.

View Window
 Xmin : 0
 max : 250
 scale: 50
 dot : 0.66137566
 Ymin : 0
 max : 40
 [INITIAL] [TRIG] [STANDARD] [V-MEM] [SQUARE]

Press **F6** **DRAW** to display the graph screen.

The GDC displays the graph in a suitable window.



You now need to Plot the line $y = 38$ on the same axes and find the intersection point.

Press **EXIT** to return to the equation entry screen.

Type 38 press **EXE** to enter the equation as Y2.

Graph Func :Y=
 Y1=13.6+0.12(x-1[—]
 Y2=38 [—]
 Y3: [—]
 Y4: [—]
 Y5: [—]
 Y6: [—]
 [SELECT] [DELETE] [TYPE] [TOOL] [MODIFY] [DRAW]

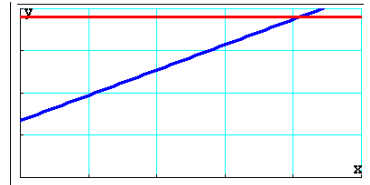
Chapter 4 / Example 14

Modelling with arithmetic sequences

Press **F6** DRAW. The GDC now displays both graphs:

$$Y1 = 13.6 + 0.12(x - 1)$$

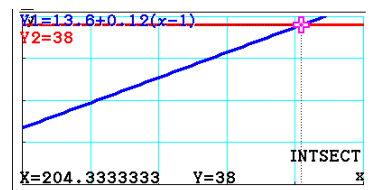
$$Y2 = 38$$



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

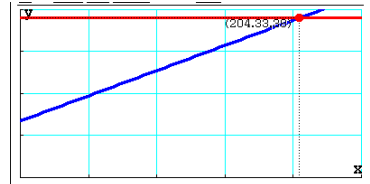
Press **EXE** to display the coordinates.

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 $(204.33, 38)$.

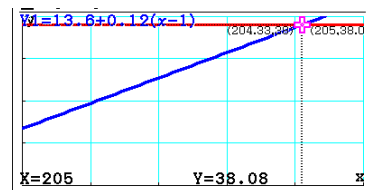
As n must be a whole number and the depth must be 38 m or more, you choose the next largest whole number, so $n = 205$.



To find the value of the function when $n = 205$ press **F1** Trace and type 205.

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 **MENU** 7 **TABLE**. Press **F5** SET and change the settings so that the table starts from 1 and ends at 250.

Press **EXIT**.

Table Setting		
X		
Start:	1	
End:	250	
Step:	1	

Press **F6** TABLE.

A table of values is displayed.

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

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

$Y1 = 13.6 + 0.12(x - 1)$		
X	Y1	Y2
203	37.84	38
204	37.96	38
205	38.08	38
206	38.2	38

38.08

[FORMULA] [DELETE] [ROW] [EDIT] [GPH-CON] [GPH-PLT]