

Answer on Question #75319 – Math – Algebra

Question

A CNC machine has been programmed to drill 10 blind holes in a piece of flat plate. Each hole has a depth which increments from the previous one by an amount derived from an arithmetic progression (AP). Hole 1 has a depth of 2 mm. Hole 10 has a depth of 29 mm. Calculate, using an analytical method, the common difference of the hole depths. Ignoring the pull back and repositioning times, calculate the total time spent cutting metal if the spindle feed rate is set at 2 mm/sec.

Solution

If the initial term of an arithmetic progression is a_1 and the common difference of successive members is d , then the n th term of the sequence (a_n) is given by:

$$a_n = a_1 + (n - 1)d$$

the common difference:

$$d = \frac{a_n - a_1}{n - 1} = \frac{a_{10} - a_1}{9} = \frac{29 - 2}{9} = 3$$

To calculate the total time spent cutting metal, you need to calculate the total depth of drilling (L):

$$L = a_1 + a_2 + \dots + a_{10} = \sum_{i=1}^{10} a_i = \frac{a_1 + a_{10}}{2} \cdot 10 = 155 \text{ (mm)}$$

Then the total time (t) for metal cutting ($v=2\text{mm/sec}$ is the feed rate of the spindle):

$$t = \frac{L}{v} = \frac{155}{2} = 77.5 \text{ (sec)}$$

Answer: the common difference of the hole depths is 3mm and the total time taken to cut the metal is 77.5 sec.