

Unit 7 Discrete Functions

Discrete Variables have values that are counted and are distinct and separate. They can only take particular values. Examples include:

Shoe size, number of blocks in a pattern or number of stars given as an energy rating.

Continuous Variables have measured values. Values may take on any value within an interval. Examples include:

Height, time and temperature

Dates: Wed. June 1 - Inquiry (Thinking evaluation)

Wed. June 8 - Unit Test

Thurs/Friday June 9/10th - Summative preparation

Monday June 13th

Tuesday June 14th > Performance task (10% of final 30%)

Monday June 27th - Exam

(20% of final 30%)
- 2 hours

7.1 Arithmetic Sequences

A sequence is a discrete function where the domain is the set of natural numbers, $\mathbb{N} = \{1, 2, 3, \dots\}$ and the range is the set of all terms in the sequence. Arithmetic Sequences occur when a pattern of numbers has a common difference (ie. linear)

In general $t_n = a + (n-1)d$ ← general formula

where $a = t_1$ (the first term in the sequence)
 n is the term number, t_n is the n th term, and d is the common difference.

A recursive sequence uses the previous term(s) to find the next term:

arithmetic sequence recursive formula → $t_n = t_{n-1} + d$, where $n > 1$

An arithmetic sequence written as a discrete linear function is:

$$f(n) = dn + b, \text{ where } b = t_0$$

$$t_0 = t_1 - d$$

or $t_0 = a - d$

In the above formulas
 $n \in \mathbb{N}$

Examples

① a) Find the general formula for the n^{th} term, t_n , for the sequence:

10, 15, 20, ...

$$\begin{aligned} a &= \underline{\underline{10}} \\ d &= 15 - 10 \\ &= \underline{\underline{5}} \end{aligned}$$

$$\begin{aligned} t_n &= a + (n-1)d \\ &= 10 + (n-1)5 \\ &= 10 + 5n - 5 \end{aligned}$$

$$\therefore t_n = 5n + 5$$

b) Determine the value of the 31st term.

$$\begin{aligned} \text{let } n=31 &\rightarrow t_{31} = 5(31) + 5 \\ &= 155 + 5 \end{aligned}$$

$$\therefore \underline{\underline{t_{31} = 160}}$$

② How many terms are there in the following sequences?

a) -4, 2, 8, ..., 164

$$\begin{aligned} a &= \underline{\underline{-4}} \\ d &= 2 - (-4) \\ &= \underline{\underline{6}} \end{aligned}$$

$$\begin{aligned} t_n &= a + (n-1)d \\ &= -4 + (n-1)6 \\ &= -4 + 6n - 6 \\ t_n &= 6n - 10 \end{aligned}$$

$$\text{let } t_n = 164 \rightarrow 164 = 6n - 10$$

$$174 = 6n$$

$$n = 29$$

\therefore There 29 terms in the sequence

③ In an arithmetic sequence, $t_9 = 19$ and $t_{15} = 37$. Find the general formula for t_n and list the first four terms in the sequence.

$$t_n = a + (n-1)d$$

$$t_{15} = a + (15-1)d$$

$$\underline{t_{15} = 37} \rightarrow 37 = a + 14d \quad \textcircled{1}$$

$$t_9 = a + (9-1)d$$

$$\underline{t_9 = 19} \rightarrow 19 = a + 8d \quad \textcircled{2}$$

① - ②

$$37 = a + 14d \quad \textcircled{1}$$

$$19 = a + 8d$$

$$\hline 18 = 6d$$

$$\underline{d = 3}$$

$$\text{sub } d=3 \text{ into } \textcircled{1} \rightarrow 37 = a + 14(3)$$

$$37 = a + 42$$

$$\underline{a = -5}$$

$$t_n = -5 + (n-1)3$$

$$= -5 + 3n - 3$$

$\therefore \underline{t_n = 3n - 8}$ is the general formula

The first 4 terms are $-5, -2, 1, 4$

Homework : p424 #1, 2, 5, 9, 13, 16