8.1 Arithmetic and Geometric Sequences

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Arithmetic Sequences

$4, 7, 10, 13, \ldots$ (+3) $d = 3$

$a_1 = 4$ $a_2 = 7$ a_3 a_4

Use + or − to get the next term

Geometric Sequences

$2, 10, 50, 250, \ldots$ (·5) $r = 5$

$a_1 = 2$ $a_2 = 10$ a_3 a_4

Use · or ÷ to get the next term

$a_1 = 1^{st}$ term $a_2 = 2^{nd}$ term

$a_n = n^{th}$ term $n =$ # of term

d = difference between terms

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

a_n: the value of the n^{th} term; a_1: value of the 1st term; n: # of term; d: difference between terms

r = ratio between terms

$$a_n = a_1 \cdot r^{(n-1)}$$

a_n: the value of the n^{th} term; a_1: value of the 1st term; r: ratio between terms

ex Continue the sequence.

$2, 8, 14, 20, 26, 32, \ldots$ (+6)

$3, -6, 12, -24, 48, -96, \ldots$ (·−2)

ex Identify the first four terms.

$a_1 = 10$, $d = -4$: $10, 6, 2, -2, \ldots$ (−4)

$a_1 = 1$, $r = 3$: $1, 3, 9, 27, \ldots$ (·3)

ex Find the value of the n^{th} term.

$-3, 2, 7, \ldots$ (+5) $a_1 = -3$ $d = 5$

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

$a_{200} = 992$: the value of the 200th term ($n = 200$)

$5, 10, 20, \ldots$ (·2) $a_1 = 5$ $r = 2$

$a_n = a_1 \cdot r^{(n-1)}$

$a_{12} = 10{,}240$: the value of the 12th term ($n = 12$)

$a_n = a_1 + (n-1)\cdot d$ — 200th term ($n = 200$)

$a_{200} = -3 + (200-1)\cdot 5 = 992$

ex Find a_1.

$a_{50} = 162 \quad d = 12$

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

$162 = a_1 + (50-1)\cdot 12$

$162 = a_1 + 588$

$-588 \qquad -588$

$-426 = a_1$

ex Write a rule in terms of n.

$a_1 = 15 \quad d = 8$

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

$a_n = 15 + (n-1)\cdot 8$

$a_n = 15 + 8n - 8$

$a_n = 8n + 7$

$n = 500$

$a_{500} = 4007$

$a_n = a_1 \cdot r^{(n-1)}$ — 12th term ($n = 12$)

$a_{12} = 5 \cdot 2^{(12-1)} = 10{,}240$

$a_{10} = 1{,}572{,}864 \quad r = 4$

$a_n = a_1 \cdot r^{(n-1)}$

$1572864 = a_1 \cdot 4^{(10-1)}$

$\frac{1572864}{262{,}144} = a_1 \cdot \frac{262{,}144}{262{,}144}$

$6 = a_1$

$a_1 = 3 \quad r = 5$

$a_n = a_1 \cdot r^{(n-1)}$

$a_n = 3 \cdot 5^{(n-1)}$

$a_n = 3 \cdot 5^{(n-1)}$