Arithmetic and Geometric Sequences

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Warm Up:
Determine t_2, t_5 and t_{10} of each sequence.

a) $t_n = (3n + 4)^2$

$t_2 = (3(2)+4)^2$
$= 100$
$t_5 = (3(5)+4)^2$
$= 361$
$t_{10} = (3(10)+4)^2$
$= 1156$

b) $t_n = 2^{n+1}$

$t_2 = 2^{2+1}$
$= 8$
$t_5 = 2^{5+1}$
$= 64$
$t_{10} = 2^{10+1}$
$= 2048$

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Warm Up 2:

If $t_1 = 6$, $t_2 = 4$, $t_3 = 2$ and $t_n = (t_{n-3} + t_{n-2})t_{n-1}$ find t_5.

$t_4 = (t_{4-3} + t_{4-2})t_{4-1}$

$= (t_1 + t_2)t_3$

$= (6 + 4)(2)$

$= 20$

$t_5 = (t_{5-3} + t_{5-2})t_{5-1}$

$= (t_2 + t_3)(t_4)$

$= (4 + 2)(20) \quad = 120$

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Geometric Sequence

geometric sequence: a sequence where the **ratio of any term**, except the 1st one, to the previous term is r.

the general term of a geometric sequence is:

$$\mathbf{t_n = ar^{n-1}}$$

where,

a is the first term

n is the term #

r is the common ratio

where $r = \frac{t_n}{t_{n-1}}$

If r > 1 then the terms increase, if 0 < r < 1 then the terms decrease.

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Example

Find the formula for the n^{th} term and use it to find t_6.

2, 6, 18,...

$a = 2, \quad r = \frac{6}{2} = \frac{18}{6} = 3$

$t_n = a(r)^{n-1}$

$t_n = 2(3)^{n-1}$

$\Rightarrow t_6 = 2(3)^{6-1}$

$= 2(3)^5$

$= 486$

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Example

Find the number of terms in the following sequence:

3, 6, 12,..., 384

$a = 3, \quad r = \frac{6}{3} = \frac{12}{6} = 2$

$t_n = a(r)^{n-1}$

$t_n = 3(2)^{n-1}$

$\frac{384}{3} = \frac{3(2)^{n-1}}{3}$

$128 = (2)^{n-1}$

$2^7 = 2^{n-1}$

$\Rightarrow 7 = n-1 \quad \Rightarrow n = 8$

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Example

Find the general term given: $t_5 = 1875$ and $t_7 = 46875$

$t_5 = a(r)^{5-1}$ $\quad t_7 = a(r)^{7-1}$

$1875 = ar^4$ ① $\quad 46875 = ar^6$ ②

Dividing equation ② by ①

$\frac{46875}{1875} = \frac{ar^6}{ar^4}$

$25 = r^2$

$\sqrt{25} = r = 5$

Use $r = 5$ in ① to solve for a

$1875 = a(5)^4$

$\frac{1875}{625} = \frac{625a}{625}$

$3 = a$

$\Rightarrow t_n = 3(5)^{n-1}$

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Homework

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