# Questions from Homework

3 f) $3x-2,\ 3x-5,\ 3x-8,\ \underline{3x-11},\ \underline{3x-14}$

$a = 3x-2$

$d = -3$

$t_n = 3x-2+(n-1)(-3)$

$t_n = 3x-2-3n+3$

$\boxed{t_n = 3x-3n+1}$

g) $\frac{2}{x},\ \frac{4}{x},\ \frac{6}{x},\ \frac{8}{x},\ \frac{10}{x}$

$a = \frac{2}{x}$

$d = \frac{2}{x}$

$t_n = \frac{2}{x}+(n-1)\left(\frac{2}{x}\right)$

$t_n = \cancel{\frac{2}{x}}+\frac{2n}{x}-\cancel{\frac{2}{x}}$

$\boxed{t_n = \frac{2n}{x}}$

4 b) $a = \frac{1}{2}$

$d = -\frac{1}{3}$

$\frac{1}{2},\ \frac{1}{6},\ -\frac{1}{6}$

$t_2 = \frac{1}{2}+(2-1)\left(-\frac{1}{3}\right)$

$= \frac{1}{2}+(1)\left(-\frac{1}{3}\right)$

$= \frac{1}{2}-\frac{1}{3}$

$= \frac{3}{6}-\frac{2}{6}$

$= \boxed{\frac{1}{6}}$

$t_3 = \frac{1}{2}+(3-1)\left(-\frac{1}{3}\right)$

$= \frac{1}{2}+2\left(-\frac{1}{3}\right)$

$= \frac{1}{2}-\frac{2}{3}$

$= \frac{3}{6}-\frac{4}{6}$

$= \boxed{\frac{-1}{6}}$

# Geometric Sequences

Ex: 2, 4, 8, 16, 32

**Sequences of numbers that follow a pattern of multiplying a fixed number from one term to the next are called geometric sequences.**

- To find the next term, multiply the previous term by a common ratio.
- In the sequence 2, 4, 8, 16, 32 we are multiplying by 2.
- This common ratio is called **"r" ($r = t_2/t_1$).**
- The first term is still called **"a"** or **"$t_1$".**
- The second term is called **"$t_2$".**
- The last term or an indicated term is called **"$t_n$".** (general term)
- The position of a term or the number of terms is called **"n".**

# Geometric Sequences

Remember $r = t_2/t_1$

Find "r" and the next term!

1, 2, 4, 8,..., 16

$r = \frac{t_2}{t_1} = \frac{t_3}{t_2} = \frac{t_4}{t_3} = \boxed{2}$

16, -8, 4, -2, 1,... $-\frac{1}{2}$

$r = \frac{t_2}{t_1} = \frac{-8}{16} = \boxed{-\frac{1}{2}}$

0.01, $\overset{\times 6}{}$ 0.06, $\overset{\times 6}{}$ 0.36, $\overset{\times 6}{}$ 2.16, $\overset{\times 6}{}$ ... 12.96

$r = \frac{t_2}{t_1} = \frac{0.06}{0.01} = 6$

# Geometric Sequences

**To find any given term in a geometric sequence we use the following formula:**

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

## Examples

Find the indicated term

1. $3, 6, 12...$

$a=3 \quad r=2$

$t_7 = (3)(2)^{7-1}$

$= (3)(2)^6$

$= 3(64)$

$\boxed{= 192}$

2. $2, -1, \frac{1}{2}, \frac{-1}{4}...$

$a=2 \quad r=-\frac{1}{2}$

$t_9 = (2)\left(\frac{-1}{2}\right)^{9-1}$

$= (2)\left(-\frac{1}{2}\right)^8$

$= 2\left(\frac{1}{256}\right)$

$* \left(-\frac{1}{2}\right)^8 = \frac{(-1)^8}{(2)^8} = \frac{1}{256}$

$= \frac{2}{256}$

$= \boxed{\frac{1}{128}}$

**We can also determine the number of terms in the sequence.**

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

**How many terms are in the following sequences?**
**(Solve for "n")**

9, 27, 81,... 2187 $a=9$ $r=3$ $t_n=2187$

$$\frac{2187}{9} = \frac{(9)(3)^{n-1}}{9}$$

$$243 = 3^{n-1}$$

$$* \frac{\log 243}{\log 3} = 5$$

$$\cancel{3}^{\boxed{5}} = \cancel{3}^{n-1}$$

$$5 = n-1$$

$$\boxed{6 = n}$$

$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots \frac{1}{1024}$ $a=\frac{1}{2}$ $r=\frac{1}{2}$ $t_n=\frac{1}{1024}$

$$\frac{\frac{1}{1024}}{\frac{1}{2}} = \frac{\cancel{\left(\frac{1}{2}\right)}\left(\frac{1}{2}\right)^{n-1}}{\cancel{\frac{1}{2}}}$$

$$\frac{1}{512} = \left(\frac{1}{2}\right)^{n-1}$$

$$* \frac{\log\left(\frac{1}{512}\right)}{\log\left(\frac{1}{2}\right)} = 9$$

$$\left(\cancel{\frac{1}{2}}\right)^{\boxed{9}} = \left(\cancel{\frac{1}{2}}\right)^{n-1}$$

$$9 = n-1$$

$$\boxed{10 = n}$$

Geometric

**Find "a", "r", and "$t_n$" for the following sequences!**

$$t_2 = 12,\ t_5 = 768$$

$t_2 = ar^{2-1}$ $t_5 = ar^{5-1}$

$t_2 = ar$ $t_5 = ar^4$

$\boxed{ar = 12 \qquad ar^4 = 768}$ 2x2 system

$$\frac{ar^4 = 768}{ar = 12}$$

$r^3 = 64$

$\boxed{r = 4}$

$ar = 12$

$a(4) = 12$

$4a = 12$

$\boxed{a = 3}$

$t_n = ar^{n-1}$

$t_n = (3)(4)^{n-1}$

$$t_3 = 64,\ t_7 = 4$$

# Homework

#1- #6

Ex: of when you can simplify

$t_n = 2(8)^{n-1}$

$t_n = (2)(2^3)^{n-1}$ Express 8 with base 2

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

$t_n = 2^{1+3n-3}$ Since multiplying powers with the same base add your exponents.

$t_n = 2^{3n-2}$