Sequence 1

$\{2,4,6,8,10\}$

Pattern, the next term is two greater than the previous term

arithmetically, there is a common difference of 2 and an initial term of 2

$a_1=2$ d = 2

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

(this is the "general rule" for ALL arithmetic sequences provided that n = positive integer)

$a_n=2+(n-1)(2)$

(this is the specific rule for THIS arithmetic sequence provided that n = positive integer)

Since we want the 6th, 7th, and 8th terms in the sequence let n = 6, 7, and 8

$a_6=2+(6-1)(2)=2+(5)(2)=12$

$a_7=2+(7-1)(2)=2+(6)(2)=14$

$a_8=2+(8-1)(2)=2+(7)(2)=16$

$a_{20}=2+(20-1)(2)=2+(19)(2)=40$

Sequence 2

$\{20,26,32,38\}$

Pattern, the next term is six greater than the previous term

arithmetically, there is a common difference of six and an initial term of 20

$a_1=20$ $d = 6$

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

(this is the "general rule" for ALL arithmetic sequences provided that n = positive integer)

$a_n=20+(n-1)(6)$

(this is the specific rule for THIS arithmetic sequence provided that n = positive integer)

Since we want the 5th, 6th, and 7th terms in the sequence let n = 5, 6, and 7

$a_5=20+(5-1)(6)=20+(4)(6)=44$

$a_6=20+(6-1)(6)=20+(5)(6)=50$

$a_7=20+(7-1)(6)=20+(6)(6)=56$

$a_{20}=20+(20-1)(6)=20+(19)(6)=134$

Sequence 3

$\{1,8,27,64\} = \{1^3, 2^3, 3^3, 4^3\}$

note: there is NO common difference $8-1=7$ $27-8=19$ $64-27=37$

Pattern, the next term is the next perfect cube

$a_1=1$ $a_n=n^3$

Since we want the 5th, 6th, and 7th terms in the sequence let n = 5, 6, and 7

$a_5=5^3=125$

$a_6=6^3=216$

$a_7=7^3=343$

$a_{20}=20^3=8000$

Sequence 4

$\{9,25,49,81,121\} = \{3^2,5^2,7^2,9^2,11^2\} ▸ \{9,25,49,81,121\}$

$\{9,9+16,25+24,49+32,81+40\} ▸ \{9,25,49,81,121\}$

note: there is NO common difference $25-9 = 16$ $49-25 = 24$ $81-49 = 32$ $121-81 = 40$

$8\cdot 2 ▸ 16$ $8\cdot 3 ▸ 24$ $8\cdot 4 ▸ 32$ $8\cdot 5 ▸ 40$

Pattern, the next term is the next ODD perfect square

$a_1=9$ $a_n=(2n+1)^2$ for $n \geq 2$

Since we want the 6th, 7th, and 8th terms in the sequence let n = 6, 7, and 8

$a_6=(2\cdot 6+1)^2 = 13^2 = 169$

$a_7=(2\cdot 7+1)^2 = 15^2 = 225$

$a_8=(2\cdot 8+1)^2 = 17^2 = 289$

$a_{20}=(2\cdot 20+1)^2 = 41^2 = 1681$

Second rule $a_1=9$ $a_n=a_{n-1}+8n$ for $n \geq 2$ test $a_9=289+8\cdot 9 = 361$ NOTE: $19^2 = 361$

$a_{10}=361+8\cdot 10 ▸ 441$ NOTE: $21^2 = 441$

Sequence 5

$\{2,5,10,17\} = \{2, 2+3, 5+5, 10+7\} \blacktriangleright \{2,5,10,17\}$

note: there is NO common difference $5-2=3$ $10-5=5$ $17-10=7$

Pattern, Add the next odd number to the next term

$a_1=2$ $a_n=a_{n-1}+(2n-1)$ for $n \geq 2$

Since we want the 5th, 6th, and 7th terms in the sequence let n = 5, 6, and 7

$a_5=17+(2\cdot 5-1)=17+9=26$

$a_6=26+(2\cdot 6-1)=26+11=37$

$a_7=37+(2\cdot 7-1)=37+13=50$

First 20 terms of sequence 5

$\{2,5,10,17,26,37,50,65,82,101,122,145,170,197,226,257,290,325,362,401\}$

$a_1=2$ $a_n=a_{n-1}+(2n-1)$ for $n \geq 2$

Sequence 6

$$\left\{\frac{1}{3},\frac{2}{9},\frac{4}{27},\frac{8}{81}\right\}$$

note: there is NO common difference $\frac{2}{9}-\frac{1}{3}=\frac{^{-}1}{9}$ $\frac{4}{27}-\frac{2}{9}=\frac{^{-}2}{27}$ $\frac{8}{81}-\frac{4}{27}=\frac{^{-}4}{81}$

note: there is a common ratio $\frac{\frac{2}{9}}{\frac{1}{3}}=\frac{2}{3}$ $\frac{\frac{4}{27}}{\frac{2}{9}}=\frac{2}{3}$ $\frac{\frac{8}{81}}{\frac{4}{27}}=\frac{2}{3}$

Pattern, Multiply the numerator by 2 and the denominator by 3

$a_1=\frac{1}{3}$ $a_n=a_1 r^{n-1}$ $a_n=\frac{1}{3}\cdot\left(\frac{2}{3}\right)^{n-1}$

$a_{20}=\frac{1}{3}\cdot\left(\frac{2}{3}\right)^{20-1}$ ▸ $\frac{524288}{3486784401}$

Sequence 6

$$\left\{\frac{1}{3},\frac{2}{9},\frac{4}{27},\frac{8}{81}\right\}$$

Pattern, Multiply the numerator by 2 and the denominator by 3

$a_1=\frac{1}{3}$ $\quad a_n=a_1r^{n-1}$ $\quad a_n=\frac{1}{3}\cdot\left(\frac{2}{3}\right)^{n-1}$

Since we want the 5th, 6th, and 7th terms in the sequence let n = 5, 6, and 7

$$a_5=\frac{1}{3}\left(\frac{2}{3}\right)^{5-1}=\frac{1}{3}\cdot\left(\frac{2}{3}\right)^{4}=\frac{16}{243}$$

$$a_6=\frac{1}{3}\left(\frac{2}{3}\right)^{6-1}=\frac{1}{3}\cdot\left(\frac{2}{3}\right)^{5}=\frac{32}{729}$$

$$a_7=\frac{1}{3}\left(\frac{2}{3}\right)^{7-1}=\frac{1}{3}\cdot\left(\frac{2}{3}\right)^{6}=\frac{64}{2187}$$

Sequence 6

$$\left\{\frac{1}{3},\frac{2}{9},\frac{4}{27},\frac{8}{81}\right\}=\left\{\frac{2^{1-1}}{3^{1}},\frac{2^{2-1}}{3^{2}},\frac{2^{3-1}}{3^{3}},\frac{2^{4-1}}{3^{4}}\right\} \blacktriangleright \left\{\frac{1}{3},\frac{2}{9},\frac{4}{27},\frac{8}{81}\right\}$$

Pattern, raise the numerator to one less than you raise the denominator

$$a_1=\frac{1}{3} \quad a_n=a_1 r^{n-1} \quad a_n=\frac{1}{3}\cdot\left(\frac{2}{3}\right)^{n-1} \quad =\frac{2^{n-1}}{3^{1}\cdot 3^{n-1}}=\frac{2^{n-1}}{3^{n}}$$

Since we want the 5th, 6th, and 7th terms in the sequence let n = 5, 6, and 7

$$a_5=\frac{2^{5-1}}{3^{5}}=\frac{2^{4}}{3^{5}}=\frac{16}{243}$$

$$a_6=\frac{2^{6-1}}{3^{6}}=\frac{2^{5}}{3^{6}}=\frac{32}{729}$$

$$a_7=\frac{2^{7-1}}{3^{7}}=\frac{2^{6}}{3^{7}}=\frac{64}{2187}$$

Sequence 7

$\{-2, 4, -8, 16\}$

note: there is NO common difference $4 - -2 = 6$ $-8 - 4 = -12$ $16 - -8 = 24$

note: there is a common ratio $\frac{4}{-2} = -2$ $\frac{-8}{4} = -2$ $\frac{16}{-8} = -2$

Pattern, Multiply by −2

$a_1 = -2$ $a_n = a_1 r^{n-1}$ $a_n = -2 \cdot (-2)^{n-1}$

Since we want the 5th, 6th, and 7th terms in the sequence let n = 5, 6, and 7

$a_5 = -2(-2)^{5-1} = -2 \cdot (-2)^4 = -32$

$a_6 = -2 \cdot (-2)^{6-1} = -2 \cdot (-2)^5 = 64$

$a_7 = -2 \cdot (-2)^{7-1} = -2 \cdot (-2)^6 = -128$

$a_{20} = -2 \cdot (-2)^{20-1} = -2 \cdot (-2)^{19} = 1048576$

Sequence 7

$\{^-2, 4, ^-8, 16\}$

note: there is NO common difference $4 - {}^-2 = 6$ $\;{}^-8 - 4 = {}^-12$ $\quad 16 - {}^-8 = 24$

note: there is a common ratio $\frac{4}{^-2} = {}^-2$ $\;\frac{^-8}{4} = {}^-2$ $\;\frac{16}{^-8} = {}^-2$

Pattern, Multiply by −2

$a_1 = -2$ $\quad a_n = a_1 r^{n-1}$ $\quad a_n = -2 \cdot (-2)^{n-1}$ $\quad = -2^1 \cdot (-2)^{n-1} = (-2)^n$

Since we want the 5th, 6th, and 7th terms in the sequence let n = 5, 6, and 7

$a_5 = (^-2)^5 = (^-2)^5 = {}^-32$

$a_6 = (^-2)^6 = (^-2)^6 = 64$

$a_7 = (^-2)^7 = (^-2)^7 = {}^-128$

Sequence 8

$\{1,1,2,3,5,8,13,21\}$

note: there is NO common difference

$1-1=0$ $2-1=1$ $3-2=1$ $5-3=2$ $8-5=3$ $13-8=5$ $21-13=8$

note: there is NO common ratio

$\frac{1}{1}=1$ $\frac{2}{1}=2$ $\frac{3}{2}=\frac{3}{2}$ $\frac{5}{3}=\frac{5}{3}$ $\frac{8}{5}=\frac{8}{5}$ $\frac{13}{8}=\frac{13}{8}$ $\frac{21}{13}=\frac{21}{13}$

Pattern, After the first term, add the previous terms to get next term

$a_1=1$ $a_n=a_{n-2}+a_{n-1}$

Since we want the 9th, 10th, and 11th terms in the sequence let n = 9, 10, and 11

Note: $a_7=13$ $a_8=21$

$a_9=a_{n-2}+a_{n-1}=a_7+a_8=13+21=34$

$a_{10}=a_8+a_9=21+34=55$

$a_{11}=a_9+a_{10}=34+55=89$

first twenty terms of sequence 8 (Fibonacci's Sequence)

$\{1,1,2,3,5,8,13,21,34,55,89,144,233,377,610,987,1597,2584,4181,6765\}$

Sequence 1

$\{2,4,6,8,10\}$

This sequence can be written two different ways

Geometrically, there is a common ratio of 2 and an initial term of 2

$a_1=2 \quad r = 2$

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

$a_n=2 \cdot 2^{n-1}$

Since we want the 6th, 7th, and 8th terms in the sequence let n = 6, 7, and 8

$a_6=2 \cdot 2^{6-1} = 2 \cdot 2^{5}$

$a_7=2+(7-1)(2)=2+(6)(2)=2+(7-1)\cdot 2$

$a_8=2+(8-1)(2)=2+(7)(2)=2+(8-1)\cdot 2$