#9. $1, -\frac{1}{2}, \frac{1}{4}, -\frac{1}{8}, \frac{1}{16}, -\frac{1}{32}, \ldots$

$r = -\frac{1}{2}$ $\qquad a_n = 1\left(-\frac{1}{2}\right)^{n-1} \Leftrightarrow y = ab^x$

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

arithmetic

$$a_n = 10 + 5(n-1)$$

$$\sum_{k=1}^{100} \left(10+5(n-1)\right)$$

$$= \frac{(10+505)}{2}(100)$$

Summing Geometric Series

$$\sum_{i=1}^{n} a_1 r^{i-1} = a_1 + a_1 r + a_1 r^2 + \cdots + a_1 r^{n-1}$$

$$S = a_1 + a_1 r + a_1 r^2 + \cdots a_1 r^{n-1}$$

$$(1-r)S = (1-r)\left[a_1 + a_1 r + a_1 r^2 + \cdots + a_1 r^{n-1}\right]$$

$$= (a_1 + a_1 r + a_1 r^2 + \cdots a_1 r^{n-1}) - a_1 r - a_1 r^2 - a_1 r^3 - \cdots - a_1 r^n$$

$$= a_1 - a_1 r^n = a_1(1 - r^n)$$

$$(1-r)S = a_1(1-r^n)$$

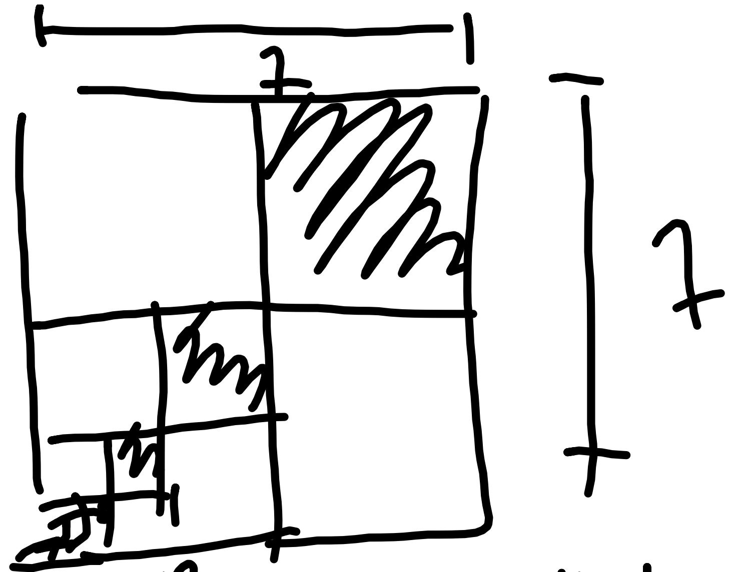
$$\boxed{\sum_{i=1}^{n} a_i = S = \frac{a_1(1-r^n)}{1-r}}$$

ex

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

$$\sum_{k=1}^{4} g_k = \frac{2(1-3^4)}{1-3} = \frac{2(-80)}{-2}$$

$$= 80$$



$$\frac{1}{3}=\frac{1}{4}+\frac{1}{16}+\frac{1}{64}+\frac{1}{256}$$

$$\Rightarrow a_n=\frac{1}{4}\left(\frac{1}{4}\right)^{n-1}$$

$$\sum_{K=1}^{B}\frac{1}{4}\left(\frac{1}{4}\right)^{K-1}=\frac{\frac{1}{4}\left(1-\frac{1}{4}^{B}\right)}{1-\frac{1}{4}}$$

$$=\frac{1}{4}\left(1-\frac{1}{4}^{B}\right)\cdot\frac{4}{3}$$

$$=$$

$$=\frac{1}{3}\left(1-\frac{1}{4}^{B}\right)$$

as $B\to\infty$

$S\to\frac{1}{3}$

$$\sum_{i=1}^{\infty} \frac{1}{4}\left(\frac{1}{4}\right)^{i-1} = \frac{1}{3}$$

general formula: $$\sum_{i=1}^{\infty} a_1 r^{i-1} = \frac{a_1}{1-r}$$

only work if $|r|<1$

$$\sum_{k=1}^{\infty} (2)^{n-1} = \frac{1}{1-2} = -1$$

$$= 1 + 2 + 4 + 8 + 16 + 32 + \cdots$$

converge

sums to

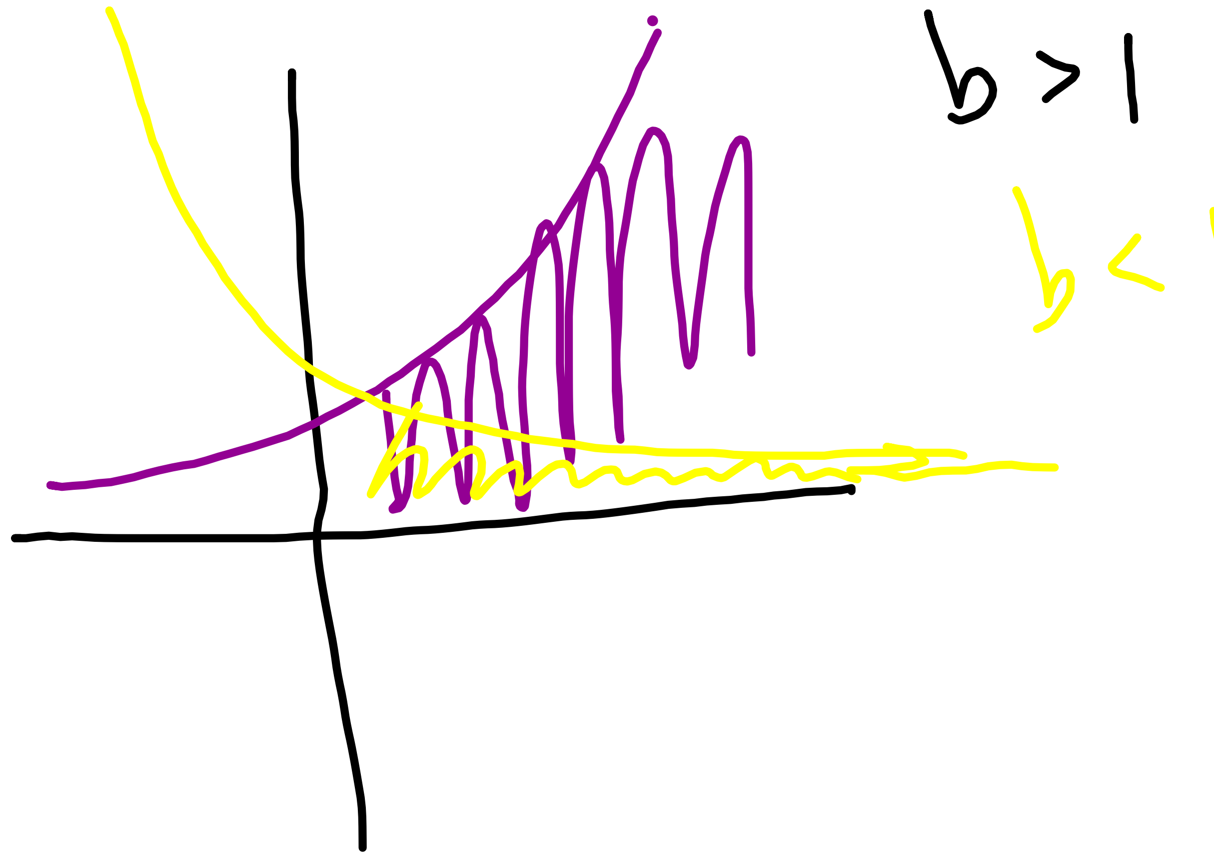
finite #

diverge

does not

sum to a finite

#


b > 1
b < 1

Xeno's Paradox

$$= \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \cdots$$

$$= \sum_{i=1}^{\infty} \frac{1}{2}\left(\frac{1}{2}\right)^{i-1} = \frac{\frac{1}{2}}{1-\frac{1}{2}} = 1$$

$$0.\overline{9} \neq 1$$

$$\boxed{0.\overline{9} = 1}$$

$$0.\overline{9} = .9 + .09 + .009 + \cdots$$

$$= \frac{9}{10} + \frac{9}{100} + \frac{9}{1000} + \frac{9}{10{,}000} + \cdots$$

$$= \frac{\frac{9}{10}}{1 - \frac{1}{10}} = 1$$

$$1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+\cdots$$

$$1+\frac{1}{4}+\frac{1}{9}+\frac{1}{16}+\frac{1}{25}+\frac{1}{36}+\cdots$$