# Assignment 9 Problem Three

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**3. For each of the following series, write out the first few terms of each series to show how the series starts. Then, find the sum of the series.**

(a)$\Sigma_{n=2}^{\infty}\frac{1}{4^n}$

$a_n = \left\{\frac{1}{16}, \frac{1}{64}, \frac{1}{256}, \cdots\right\}$

$s_n = \Sigma ar^k = \Sigma_{n=0}^{\infty}(\frac{1}{16})(\frac{1}{4})^n = \frac{\frac{1}{16}}{1-\frac{1}{4}} = \frac{1}{12}$

(b)$\Sigma_{n=0}^{\infty}(\frac{1}{2^n} + \frac{(-1)^n}{5^n})$

$a_n = \left\{2, \frac{3}{10}, \frac{29}{100}, \frac{117}{1000}, \cdots\right\}$

First we will split the series up into two separate series and sum the separate parts.

$= \Sigma_{n=0}^{\infty}\frac{1}{2^n} + \Sigma_{n=0}^{\infty}\frac{(-1)^n}{5^n}$

Note that the series $\Sigma_{n=0}^{\infty}\frac{(-1)^n}{5^n}$ is of the form $\left\{1, -\frac{1}{5}, \frac{1}{25}, -\frac{1}{125}, \cdots\right\}$

Which could also be written as $\Sigma_{n=0}^{\infty}(\frac{1}{25})^n - \Sigma_{n=0}^{\infty}(-\frac{1}{5})(\frac{1}{25})^n$

Thus evaluating all 3 geometric series together we have:

$\frac{1}{1-\frac{1}{2}} + \frac{1}{1-\frac{1}{25}} - \frac{\frac{1}{5}}{1-\frac{1}{25}} = 2 + \frac{25}{24} - \frac{5}{24} = \frac{17}{6}$

*Realized I did this in an overly complicated way initially. Can be simplified to just:

$= \frac{1}{1-\frac{1}{2}} + \frac{1}{1-(-\frac{1}{5})} = 2 + \frac{5}{6} = \frac{17}{6}$