

$$\textcircled{1} \text{ a) } 1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \dots$$

$$a = 1$$

$$r = \frac{1}{3}$$

$$S_n = \frac{a}{1-r}$$

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

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

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

$$= 1 \times \frac{3}{2} = \boxed{\frac{3}{2}}$$

$$\text{c) } \frac{1}{4} - \frac{5}{16} + \frac{25}{64} - \frac{125}{256} + \dots$$

$$a = \frac{1}{4}$$

Diverging

$$r = -\frac{5}{4}$$

$$\lim_{n \rightarrow \infty} \left(\frac{1}{4}\right) \left(-\frac{5}{4}\right)^{n-1} = \text{DNE}$$

$$t_n = \left(\frac{1}{4}\right) \left(-\frac{5}{4}\right)^{n-1}$$

$$\textcircled{2} \text{ b) } \sum_{n=1}^{\infty} \left(-\frac{2}{5}\right)^n$$

Series

$$\frac{-2}{5} + \frac{4}{25} - \frac{8}{125}$$

$$a = -\frac{2}{5}$$

$$r = -\frac{2}{5}$$

$$S_n = \frac{-\frac{2}{5}}{1 - \frac{2}{5}} = \frac{-\frac{2}{5}}{\frac{3}{5}} = -\frac{2}{3}$$

$$= -\frac{10}{35}$$

$$= \boxed{-\frac{2}{7}}$$