

$$1) \sum_{n=0}^{\infty} \left(-\frac{1}{2}\right)^n \rightarrow \left(-1 \cdot \frac{1}{2}\right)^n \rightarrow \sum_{n=0}^{\infty} (-1)^n \cdot \left(\frac{1}{2}\right)^n \xrightarrow{\text{By AST, series converge}}$$

$$\downarrow$$

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

$$|r| < 1,$$

$$S = \frac{a_1}{1-r} = \frac{1}{1 - \left(-\frac{1}{2}\right)} = \frac{1}{1 + \frac{1}{2}} = \frac{1}{\frac{3}{2}} = \boxed{\frac{2}{3}}$$

$$\sum_{n=0}^{\infty} \left(-\frac{1}{2}\right)^n = \underbrace{1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8}}_{\text{...}} \left(\frac{1}{16}\right) - \frac{1}{32} \dots$$

$$S_1 = 1 - 0.5$$

$$S_2 = 0.5 + 0.25$$

$$S_3 = 0.75 - \frac{1}{8}$$

$$S_4 = 0.625 + \frac{1}{16}$$

$$S_5 = 0.6875$$

$$S_6 = 0.65625$$

$$S_7 = 0.671875$$

