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- 2016 14 d** By summing the geometric series  $1 + x + x^2 + x^3 + x^4$ , or otherwise,  
find  $\lim_{x \rightarrow 1} \frac{x^5 - 1}{x - 1}$ .

**2**

For the geometric series,  $1 + x + x^2 + x^3 + x^4$ ,

$$a = 1, r = x, n = 5, S_n = \frac{a(r^n - 1)}{r - 1}:$$

$$S_5 = \frac{1(x^5 - 1)}{x - 1}$$

$$\therefore \frac{x^5 - 1}{x - 1} = (1 + x + x^2 + x^3 + x^4)$$

$$\begin{aligned} \therefore \lim_{x \rightarrow 1} \frac{x^5 - 1}{x - 1} &= \lim_{x \rightarrow 1} (1 + x + x^2 + x^3 + x^4) \\ &= 1 + 1 + 1 + 1 + 1 \\ &= 5 \end{aligned}$$

$$\begin{aligned} [\text{OR: } \lim_{x \rightarrow 1} \frac{x^5 - 1}{x - 1} &= \lim_{x \rightarrow 1} \frac{(x - 1)(x^4 + x^3 + x^2 + x + 1)}{x - 1} \\ &= \lim_{x \rightarrow 1} (x^4 + x^3 + x^2 + x + 1) \\ &= 5] \end{aligned}$$

State Mean:  
**0.90**

\* These solutions have been provided by [projectmaths](#) and are not supplied or endorsed by BOSTES.

### BOSTES: Notes from the Marking Centre

This information is released by BOSTES in late Term 1 2017.