

The first term of a geometric series is 10. The sum to infinity is 50.

a) Find the common ratio

The  $n$ th term is  $U_n$

b) Find the value of  $\sum_1^{20} U_n$

a)  $U_1 = 10$   
 $S_\infty = 50$

$$S_\infty = \frac{U_1}{1-r}$$

$$50 = \frac{10}{1-r}$$

$$50(1-r) = 10$$

$$1-r = \frac{10}{50}$$

$$1-r = \frac{1}{5}$$

$$1 - \frac{1}{5} = r$$

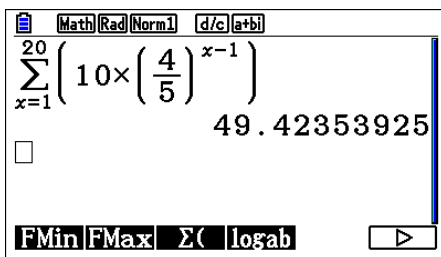
$$r = \frac{4}{5}$$

b)

$$U_n = 10 \left(\frac{4}{5}\right)^{n-1}$$

$$\sum_1^{20} 10 \left(\frac{4}{5}\right)^{n-1}$$

We can use our calculators to work this out



A screenshot of a calculator interface. The display shows the expression  $\sum_{x=1}^{20} \left( 10 \times \left( \frac{4}{5} \right)^{x-1} \right)$  and the result  $49.42353925$ . The calculator has buttons for Math, Rad, Norm, d/c, and a+b. At the bottom, there are buttons for FMin, FMax, Σ, log, and ab, along with a right arrow button.

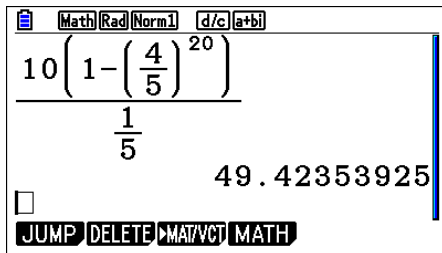
$$\sum_1^{20} U_n = 49.4$$

We can also use the formula

$$S_n = \frac{U_1(1 - r^n)}{1 - r}$$

$$S_{20} = \frac{10(1 - (\frac{4}{5})^{20})}{1 - \frac{4}{5}}$$

$$S_{20} = \frac{10(1 - (\frac{4}{5})^{20})}{\frac{1}{5}}$$



A screenshot of a calculator interface. The display shows the fraction  $\frac{10(1 - (\frac{4}{5})^{20})}{\frac{1}{5}}$  and the decimal result 49.42353925. The calculator has a menu bar with options: Math, Rad, Norm1, d/c, a+bi. Below the display are buttons for JUMP, DELETE, MAT/VCT, and MATH.

$$\sum_{1}^{20} U_n = 49.4$$