

Cambridge International AS & A Level

Mathematics 9709

Paper 1 Pure Mathematics 1

Topic 6-Series

Question No (1)

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Question No (1)

Each year a company gives a grant to a charity. The amount given each year increases by 5% of its value in the preceding year. The grant in 2001 was \$5000. Find

- (i) the grant given in 2011,
- (ii) the total amount of money given to the charity during the years 2001 to 2011 inclusive.

Solution

On Next page

① let the grant in the year 2001 be p

$$\therefore \text{grant in 2001: } p = 5000$$

$$\text{grant in 2002: } p + 5\% \text{ of } p$$

$$= p + \frac{5}{100} p$$

$$= p + 0.05p$$

$$= (1.05)p$$

$$\text{Grant in 2003} = (1.05)p + 5\% \text{ of } (1.05)p$$

$$= (1.05)p + \frac{5}{100} (1.05)p$$

$$= (1.05)p (1 + 0.05)$$

$$= (1.05)p (1.05)$$

$$\text{Grant in 2003} = (1.05)^2 p$$

As in 2003
power of
 $(1.05)^{10}$

$\therefore$ The grant in the year 2011

$$= (1.05)^{10} p$$

$$= (1.05)^{10} (5000)$$

$$= 8144$$

$$= \$8140 \text{ (3 sf)}$$

- (ii) Total grant to the charity from 2001 to 2011 inclusive is

$$P + (1.05)P + (1.05)^2 P + \dots + (1.05)^{10} P$$

Geometric sequence

$$a, ar, ar^2, ar^3, ar^4, \dots$$

Geometric progression

$$a + ar + ar^2 + ar^3 + \dots$$

Sum of Geometric progression

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

$$r > 1$$

$$\text{common ratio } r = \frac{\text{Second term}}{\text{First term}}$$

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

$$r < 1$$

which is GP with first term $a = P = 5800$,

$$\begin{aligned} \text{common ratio, } r &= \frac{\text{Second term}}{\text{First term}} \\ &= \frac{(1.05)P}{P} \\ &= 1.05 \end{aligned}$$

number of terms, $n = 11$

$\therefore$ using

$$S_n = \frac{a(r^n - 1)}{r - 1} \quad \text{where } r > 1$$

$$S_{11} = \frac{5000(1.05^{11} - 1)}{1.05 - 1}$$

$$= \frac{5000(0.7103391)}{0.05}$$

$$= 71033.91$$

$$\approx 71034$$

$\therefore$ total amount given during the year
2001 to 2011 is = \$71034