RD Sharma Solutions Class 11 Maths Chapter 20 Ex 20.1

RD Sharma Class 11 Solutions Chapter 20 Geometric Progressions Ex 20.1 Q 1

(i) $4, -2, 1, -\frac{1}{2}, \ldots$

$$\frac{t_n}{t_{n-1}} = r = \text{common ratio} \qquad \text{---(i)}$$

$$\frac{t_2}{t_1} = \frac{-2}{4} = \frac{-1}{2}$$

$$\frac{t_3}{t_2} = \frac{1}{-2} = \frac{-1}{2}$$

(ii) $\frac{-2}{3}, -6, -54, \ldots$

Using (i)

$$\frac{t_2}{t_1} = \frac{-6}{\frac{-2}{3}} = \frac{18}{2} = 9$$

$$\frac{t_3}{t_2} = \frac{-54}{-6} = 9$$

$\therefore \qquad r = 9$

(iii) $a, \frac{3a^2}{4}, \frac{9a^3}{16}, \ldots$

Using (i)

$$\frac{t_3}{t_2} = \frac{\frac{9a^3}{16}}{\frac{3a^2}{4}} = \frac{9a^3}{16} \times \frac{4}{3a^2} = \frac{3a}{4}$$

$$\frac{t_2}{t_1} = \frac{\frac{3a^2}{4}}{a} = \frac{3a^2}{a}$$

$\therefore \qquad r = \frac{3}{4}a$

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(iii) $a, \frac{3a^2}{4}, \frac{9a^3}{16}, \ldots$

Using (i)

$$\frac{t_3}{t_2} = \frac{\frac{9a^3}{16}}{\frac{3a^2}{4}} = \frac{9a^3}{16} \times \frac{4}{3a^2} = \frac{3a}{4}$$

$$\frac{t_2}{t_1} = \frac{\frac{3a^2}{4}}{a} = \frac{3a^2}{a}$$

$$\therefore \quad r = \frac{3}{4}a$$

(iv) $\frac{1}{2}, \frac{1}{3}, \frac{2}{9}, \frac{4}{27} \ldots$

Using (i)

$$\frac{t_3}{t_2} = \frac{\frac{2}{9}}{\frac{1}{3}} = \frac{2}{3}$$

$$\frac{t_2}{t_1} = \frac{\frac{1}{3}}{\frac{1}{2}} = \frac{2}{3}$$

$$\therefore \quad r = \frac{2}{3}$$

RD Sharma Class 11 Solutions Chapter 20 Geometric Progressions Ex 20.1 Q 2

$an = \frac{2}{3n}, n \in N$

Put $n = 1, 2, 3\ldots$ because n is natural number

$$\frac{2}{3}, \frac{2}{3^2}, \frac{2}{3^3}, \ldots$$

$$\frac{t_3}{t_2} = \frac{\frac{2}{3^3}}{\frac{2}{3^2}} = \frac{1}{3}$$

$$\frac{t_2}{t_1} = \frac{\frac{2}{3^2}}{\frac{2}{3}} = \frac{1}{3}$$

Ratio of consecutive terms is solve

$\therefore \quad \frac{1}{3}$ is common ratio, Hence it is G.P $\forall n \in N$.

RD Sharma Class 11 Solutions Chapter 20 Geometric Progressions Ex 20.1 Q 3

(i) 9^{th} term of G.P $1, 4, 16, 64, \ldots$

$$t_1 = 1 = a$$
$$t_2 = 4$$

Because it is G.P

$$\frac{t_2}{t_1} = \text{common ratio} = r$$
$$r = \frac{4}{1} = 4$$
$$t_n = ar^{n-1}$$
$$t_9 = ar^8 = 1(4)^8 = 4^8$$

(ii) 10^{th} term of G.P $\frac{-3}{4}, \frac{1}{2}, \frac{-1}{3}, \frac{2}{4}, \ldots$

$$a = \frac{-3}{4}$$

Because it is G.P

$$\therefore \quad r = \frac{t_2}{t_1} = \frac{\frac{1}{2}}{\frac{-3}{4}} = \frac{-2}{3}$$
$$t_n = ar^{n-1}$$
$$t_{10} = ar^9 = \left(\frac{-3}{4}\right)\left(\frac{-2}{3}\right)^9 = \frac{1}{2}\left(\frac{2}{3}\right)^8$$

Solutions Of Geometric Progressions Ex 20.1 Q 3 i

(iv) 12^{th} term of G.P $\frac{1}{a^3x^3}, ax, a^5x^5, \ldots$

$$a = \frac{1}{a^3x^3}$$

$$r = \frac{t_n}{t_{n-1}} = \frac{t_2}{t_1} = \frac{ax}{\frac{1}{a^3x^3}} = a^4x^4$$

$$t_n = ar^{n-1}$$

$$t_{12} = ar^{11}$$

$$= \left(\frac{1}{a^3x^3}\right)\left(a^4x^4\right)^{11}$$

$$= (ax)^{41}$$

(v) n^{th} term of G.P $\sqrt{3}, \frac{1}{\sqrt{3}}, \frac{1}{3\sqrt{3}}, \ldots$

$$r = \frac{t_n}{t_{n-1}} = \frac{t_2}{t_1} = \frac{\frac{1}{\sqrt{3}}}{\sqrt{3}} = \frac{1}{3}$$

$$t_n = ar^{n-1}$$

$$t_n = \left(\sqrt{3}\right)\left(\frac{1}{3}\right)^{n-1}$$

(vi) 10^{th} term of G.P $\sqrt{2}, \frac{1}{\sqrt{2}}, \frac{1}{2\sqrt{2}}, \ldots$

$$a = \sqrt{2}$$

$$r = \frac{t_n}{t_{n-1}} = \frac{\frac{1}{\sqrt{2}}}{\sqrt{2}} = \frac{1}{2}$$

$$t_n = ar^{n-1}$$

$$t_{10} = ar^9$$

$$= \left(\sqrt{2}\right)\left(\frac{1}{2}\right)^9$$

$$= \frac{1}{\sqrt{2}}\left(\frac{1}{2}\right)^8$$

RD Sharma Class 11 Solutions Chapter 20 Geometric Progressions Ex 20.1 Q 4

$$\frac{2}{27}, \frac{2}{9}, \frac{2}{3}, \ldots .162$$

n^{th} term from the end

$$a_n = l\left(\frac{1}{r}\right)^{n-1}$$

$$l = 162, r = \text{common ratio} = \frac{t_2}{t_1}$$

$$= \frac{\frac{2}{9}}{\frac{2}{27}} = 3$$

$$n = 4$$

$$t_4 = (162)\left(\frac{1}{3}\right)^3$$

$$= \frac{162}{27}$$

$$= 6$$

Solutions Of Geometric Progressions Ex 20.1 Q 5

$0.004, 0.02, 0.1, \ldots$ is 12.5

Here,

$a = 0.004, \quad t_n = 12.5$

$r = \frac{t_2}{t_1} = \frac{0.02}{0.004} = 5$

$t_n = ar^{n-1}$

$12.5 = (0.004)(5)^{n-1}$

$\frac{12.5}{0.004} = (5)^{n-1}$

$\frac{125 \times 100}{4} = 5^{n-1}$

$5^5 = 5^{n-1}$

$= n - 1$

$n = 6$

Solutions Of Geometric Progressions Ex 20.1 Q 6

$\sqrt{2}, \frac{1}{\sqrt{2}}, \ldots$ is $\frac{1}{512\sqrt{2}}$

$t_n = ar^{n-1}$

$a = \sqrt{2}, \ r = \frac{t_n}{t_{n-1}} = \frac{t_2}{t_1} = \frac{\frac{1}{\sqrt{2}}}{\sqrt{2}} = \frac{1}{2}$

$t_n = \frac{1}{512\sqrt{2}}, \ n = ?$

$t_n = ar^{n-1}$

$\frac{1}{512\sqrt{2}} = (\sqrt{2})\left(\frac{1}{2}\right)^{n-1}$

$\frac{1}{512 \times \sqrt{2} \times \sqrt{2}} = \left(\frac{1}{2}\right)^{n-1}$

$\frac{1}{1024} = \left(\frac{1}{2}\right)^{n-1}$

$\left(\frac{1}{2}\right)^{10} = \left(\frac{1}{2}\right)^{n-1}$

$10 = (n - 1)$

$n = 11$

$\therefore$ term is 11^{th}.

Solutions Of Geometric Progressions Ex 20.1 Q 6 i

$2, 2\sqrt{2}, 4, \ldots$ is 128

$$a = 2,\ r = \frac{t_n}{t_{n-1}} = \frac{2\sqrt{2}}{2} = \sqrt{2},\ n = ?$$

$$t_n = 128$$

Also,

$$t_n = ar^{n-1}$$

$$128 = (2)\left(\sqrt{2}\right)^{n-1}$$

$$\frac{128}{2} = \left(\sqrt{2}\right)^{n-1}$$

$$64 = \left(\sqrt{2}\right)^{n-1}$$

$$(2)^6 = \left(\sqrt{2}\right)^{n-1}$$

$\Rightarrow$ $12 = n - 1$

$$n = 13$$

$\therefore$ 13^{th} term is 128.

Solutions Of Geometric Progressions Ex 20.1 Q 6 ii

$\sqrt{3}, 3, 3\sqrt{3}, \ldots, 729$

$$a = \sqrt{3},\ r = \frac{t_n}{t_{n-1}},\ n = ?,\ t_n = 729$$

Now,

$$t_n = ar^{n-1}$$

$$729 = \left(\sqrt{3}\right)(r)^{n-1}$$

Now,

$$r = \frac{t_2}{t_1} = \frac{3}{\sqrt{3}} = \sqrt{3}$$

$$729 = \left(\sqrt{3}\right)\left(\sqrt{3}\right)^{n-1}$$

$$729 = \left(\sqrt{3}\right)^n$$

$$(3)^6 = \left(\sqrt{3}\right)^n$$

$$\left(\sqrt{3}\right)^{12} = \left(\sqrt{3}\right)^n$$

$\Rightarrow$ $n = 12$

$\therefore$ 12^{th} term is 729.

Solutions Of Geometric Progressions Ex 20.1 Q 6 iii

$\frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \ldots, \frac{1}{19683}$

$$a = \frac{1}{3},\ r = \frac{t_n}{t_{n-1}} = \frac{t_2}{t_1} = \frac{\frac{1}{9}}{\frac{1}{3}} = \frac{1}{3},\ t_n = \frac{1}{19683},\ n = ?$$

Now,

$$t_n = ar^{n-1}$$

$$\frac{1}{19683} = \left(\frac{1}{3}\right)\left(\frac{1}{3}\right)^{n-1} = \left(\frac{1}{3}\right)^n$$

$$\left(\frac{1}{3}\right)^9 = \left(\frac{1}{3}\right)^n$$

$$\Rightarrow \quad n = 9$$

$\therefore$ 9^{th} term of G.P is $\frac{1}{19683}$.

Solutions Of Geometric Progressions Ex 20.1 Q 7

$18, -12, 8, \ldots$ is $\frac{512}{729}$

$$a = 18,\ n = ?,\ t_n = \frac{512}{729},\ r = \frac{t_{n-1}}{t_n}$$

$$r = \frac{t_2}{t_1} = \frac{-12}{18} = \frac{-2}{3}$$

Also,

$$t_n = ar^{n-1}$$

$$\frac{512}{729} = (18)\left(\frac{-2}{3}\right)^{n-1}$$

$$\frac{2^9}{36} \times \frac{1}{2 \times 3^2} = \left(\frac{-2}{3}\right)^{n-1}$$

$$\left(\frac{2}{3}\right)^8 = (-1)^{n-1}\left(\frac{2}{3}\right)^{n-1}$$

$$n = 9$$

Solutions Of Geometric Progressions Ex 20.1 Q 8

$\frac{1}{2}, \frac{1}{6}, \frac{1}{18}, \frac{1}{54}, \ldots, \frac{1}{4374}$

$$a = \frac{1}{2},\ l = \frac{1}{4374},\ r = \frac{t_n}{t_{n-1}} = \frac{t_2}{t_1} = \frac{\frac{1}{6}}{\frac{1}{2}} = \frac{1}{3}$$

Term from the end is

$$a_n = l\left(\frac{1}{r}\right)^{n-1}$$

$$t_4 = \left(\frac{1}{4374}\right)(3)^{n-1}$$

$$= \frac{1}{4374} \times 3^3$$

$$= \frac{1}{162}$$

$\therefore$ 4^{th} term from the end is $\frac{1}{162}$.

Solutions Of Geometric Progressions Ex 20.1 Q 9

$t_4 = 27$

$t_7 = 729$

We know that $t_n = ar^{n-1}$

$$t_4 = ar^3 = 27$$

$$t_7 = ar^6 = 729$$

Now,

$$\frac{t_7}{t_4} = \frac{ar^6}{ar^3} = r^3 = \frac{729}{27}$$

$$r^3 = \left(\frac{9}{3}\right)^3$$

$$r^3 = 3^3$$

$$r = 3$$

$$t_4 = ar^3 = 27$$

$$a(3)^3 = 27$$

$$a(27) = 27$$

$$a = 1$$

Now G.P is $a, ar, ar^2, \ldots$

$1, 3, 9, \ldots$

Solutions Of Geometric Progressions Ex 20.1 Q 10

$t_7 = 8t_4$

$t_5 = 48$

We know that $t_n = ar^{n-1}$

a = first term

r = common ratio

n = number of terms

$t_7 = ar^6 = 8\left(ar^3\right)$

$r^3 = 8$

$r = 2$

Also,

$t_5 = 48$

$ar^4 = 48$

$a(2)^4 = 48$

$a = \frac{48}{16} = 3$

$\therefore$ G.P is $a, ar, ar^2, \ldots$

$3, 6, 12, \ldots$

Solutions Of Geometric Progressions Ex 20.1 Q 11

$5, 10, 20, \ldots n$ term

$1280, 640, 320, \ldots, n$ terms.

Let t_n be the general term if first G.P and t_n' be general term of record G.P whose nth terms are equal.

a for first G.P = 5

a for second G.P = 1280

r for first G.P = $\frac{10}{5} = 2$

r for second G.P = $\frac{640}{1280} = \frac{1}{2}$

$t_n = ar^{n-1}$

Applying and equating for both G.P$_n$'

$(5)(2)^{n-1} = 1280\left(\frac{1}{2}\right)^{n-1}$

$(2)^{n-1} = \frac{1280}{5}\left(\frac{1}{2}\right)^{n-1}$

$= 256\left(\frac{1}{2}\right)^{n-1}$

$= 2^8\left(\frac{1}{2}\right)^{n-1}$

$\frac{(2)^{n-1}}{28} = \left(\frac{1}{2}\right)^{n-1} = 2^{n-1} = 2^{-n+1}$

$\Rightarrow$ $2n = 10$

$n = 5$

Solutions Of Geometric Progressions Ex 20.1 Q 12

We have

$$(a^2+b^2+c^2)p^2-2(ab+bc+cd)p+(b^2+c^2+d^2)\le 0$$

$$(a^2p^2-2abp+b^2)+(b^2p^2-2bcp+c^2)+(c^2p^2-2cdp+d^2)\le 0$$

$$(ap-b)^2+(bp-c)^2+(cp-d)^2\le 0$$

This is only possible when

$$ap-b=0\Rightarrow p=\frac{b}{a}$$

$$bp-c=0\Rightarrow p=\frac{c}{b}$$

$$cp-d=0\Rightarrow p=\frac{d}{c}$$

Thus

$$\frac{b}{a}=\frac{c}{b}=\frac{d}{c}$$

Hence a, b, c and d are in G.P

Solutions Of Geometric Progressions Ex 20.1 Q 13

$\frac{a+bx}{a-bx}=\frac{b+cx}{b-cx}=\frac{c+dx}{c-dx}$, two show that a,b,c,d are in G.P

$\Rightarrow$ to show $\frac{b}{a}=\frac{c}{b}=\frac{d}{c}$ ---(i)

Now,

$$\frac{a+bx}{a-bx}=\frac{b+cx}{b-cx} \text{ and } \frac{b+cx}{b-cx}=\frac{c+dx}{c-dx}$$

Cross multiplying

$$(a+bx)(b-cx)=(b+cx)(a-bx)$$

$$ab-acx+b^2x-bcx^2=ab-b^2x+acx-bcx^2$$

Cancelling ab and $-bcx^2$ on both sides

$$-acx+b^2x=-b^2x+acx$$

$$x(b^2-ac)=-x(b^2-ac)$$

$$2b^2x=2acx$$

$$2b^2=2ac=b^2=ac$$

From (i) $b^2=ac$

Also,

$\frac{cx+b}{b-cx}=\frac{c+dx}{c-dx}$, cross multiplying

$$c^2x-cdx^2+bc-bdx=bc+bdx-c^2x-cdx^2$$

$$2c^2x=2bdx$$

From (i) $c^2=bd$

Hence, a,b,c,d are in G.P.

Solutions Of Geometric Progressions Ex 20.1 Q 14

We have

$a_5 = p$

$a_8 = q$

$a_{11} = s$

We have to show that

$$q^2 = ps$$

$$\Rightarrow \quad \frac{q}{p} = \frac{s}{q}$$

Now, $q = ar^7$

$p = ar^4$

$s = ar^{10}$

$$\therefore \quad \frac{q}{p} = \frac{s}{q}$$

$$\Rightarrow \quad \frac{ar^7}{ar^4} = \frac{ar^{10}}{ar^7}$$

$$\Rightarrow \quad r^3 = r^3$$

Hence proved.

Solutions Of Geometric Progressions Ex 20.1 Q 15

Let a be the first term

then $a = -3$

Now we have

$$a_4 = (a_2)^2$$

$$\Rightarrow \quad ar^3 = (ar)^2$$

$$\Rightarrow \quad ar^3 = a^2r^2$$

$$\Rightarrow \quad r = a = -3$$

$$\therefore \quad a_7 = ar^6 = (-3)^7 = -2187$$

Solutions Of Geometric Progressions Ex 20.1 Q 16

Let the first term is a and the common ratio is r.

Then

$$ar^2 = 24 \quad ..... (1)$$

and $ar^5 = 192 \quad ..... (2)$

$(2) \div (1)$, we get

$$\frac{ar^5}{ar^2} = \frac{192}{24}$$

$$r^3 = 8$$

$$r = 2$$

Now

$$ar^2 = 24$$

$$a \cdot 2^2 = 24$$

$$a = 6$$

Thus the 10^{th} term will be: $ar^9 = 6 \cdot 2^9 = 3072$

Solutions Of Geometric Progressions Ex 20.1 Q 17

nth term of GP $= ar^{n-1}$

pth term $= q = a.r^{p-1}$

qth term $= p = a.r^{q-1}$

$$\frac{q}{p} = r^{p-q}$$

$$r = \left(\frac{q}{p}\right)^{\frac{1}{p-q}}$$

$$a = p\left(\frac{p}{q}\right)^{\frac{1-q}{p-q}}$$

$$p+q \text{ th term} = p\left(\frac{q}{p}\right)^{\frac{1-q}{p-q}}\left(\frac{q}{p}\right)^{\frac{p+q-1}{p-q}}$$

$$= p\left(\frac{q}{p}\right)^{\frac{1-q+p+q-1}{p-q}}$$

$$= p\left(\frac{q}{p}\right)^{\frac{p}{p-q}}$$

$$= \frac{q^{\frac{p}{p-q}}}{p^{\frac{p}{p-q}-1}}$$

$$= \frac{q^{\frac{p}{p-q}}}{p^{\frac{q}{p-q}}}$$

$$= \left(\frac{q^p}{p^q}\right)^{\frac{1}{p-q}}$$