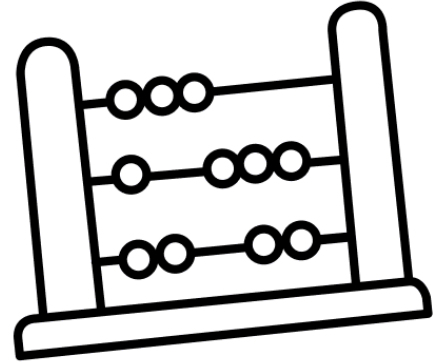


Aqoonsiga isku xigxiga joomatari (geometric sequences)



Maths

Cutub: Xiriirrada aan tooska ahayn (non-linear relationships)

Natiijo

Waxaan aqoonsan karaa isku xigxig joomatari (geometric sequence).

Erayada muhiimka ah

Isku xigxig joomatari (geometric sequence) waa isku xigxig leh xiriir isku dhufasho (multiplicative relationship) joogto ah oo u dhexeeya xubnaha isku xiga.

Saami guud (common ratio) waa sifo muhiim u ah isku xigxiga joomatari. Isku dhufashada joogtada ah ee u dhexeeya xubnaha isku xiga waxaa loo yaqaan saamiga guud (common ratio).

Qaabka casharka

Aqoonsiga isku xigxiga joomatari (geometric sequences)



Helista saamiga guud (common ratio)



Isticmaalka saamiga guud (common ratio)

Helista saamiga guud (common ratio)

Isku xigxig joomatari (geometric sequence) dhexdiisa, waxaa jira xiriir isku dhufasho (multiplicative relationship) oo joogto ah oo u dhexeeya xubnaha.

$$2, 6, 18, 54, 162, \dots$$

$\times 3$ $\times 3$ $\times 3$ $\times 3$

$$162 \div 54 = 3$$

$$54 \div 18 = 3$$

$$18 \div 6 = 3$$

$$6 \div 2 = 3$$

Si loo hubiyo in isku xigxigu yahay joomatari (geometric), waxaan qaadan karnaa xuban kasta oo u qaybin karnaa xubantii hore si aan u hubinno inuu jiro isku dhufasho (multiplier) guud.

Helista saamiga guud (common ratio)

Isku dhufashadan guud waxaa loo yaqaan saamiga guud (common ratio).

$$2, 6, 18, 54, 162, \dots$$

$\times 3$ $\times 3$ $\times 3$ $\times 3$

Waxaad arki kartaa sababta loogu yeedho saami guud (common ratio), sababtoo ah lammaane kasta oo xubno ah waa isku saami.

$$\div 3 \left(\begin{array}{c} 2 : 6 \\ 1 : 3 \end{array} \right) \div 3$$

$$\div 6 \left(\begin{array}{c} 6 : 18 \\ 1 : 3 \end{array} \right) \div 6$$

$$\div 18 \left(\begin{array}{c} 18 : 54 \\ 1 : 3 \end{array} \right) \div 18$$

$$\div 54 \left(\begin{array}{c} 54 : 162 \\ 1 : 3 \end{array} \right) \div 54$$

Ka jar saami kasta (ratio) qaabkiisa ugu fudud.

Si loo helo saamiga guud (common ratio) ee isku xigxiga joomatari (geometric sequence), waa inaad ...

a

isku dhufo xubnaha isku xiga.



b

ka jartaa xubintii hore xuban kasta.



c

u qaybiso xuban kasta xubintii hore.



Helista saamiga guud (common ratio)



Raadi saamiga guud (common ratio) ee taxanahan joometeriga (geometric sequence).

$$22, \quad 242, \quad 2662, \quad 29\,282, \quad 322\,102, \quad \dots$$

$\times 11$ $\times 11$ $\times 11$ $\times 11$

$$322\,102 \div 29\,282 = 11$$

$$29\,282 \div 2662 = 11$$

$$2662 \div 242 = 11$$

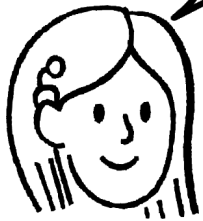
$$242 \div 22 = 11$$

Adigoo u qaybinaya eray kasta eraygii hore waxaan helnaa saami guud (common ratio) oo ah 11.

Suad iyo Caasha waxay eegayaan taxane kale.

80, 200, 500, 1250, 3125, ...

Taxanahan ma noqon karo joometeri (geometric) sababtoo ah 80 ma aha qaybiyaha (factor) 200, 200-na ma aha qaybiyaha 500.



Tijaabi. Qaado eray kasta oo u qaybi eraygii hore. Haddii aad hesho xiriir isku dhufasho oo guud (common multiplicative relationship) oo u dhexeeya eray kasta, taxanuhu waa joometeri (geometric).



Suad iyo Caasha waxay eegayaan taxane kale.

80, 200, 500, 1250, 3125, ...

$\times 2.5$ $\times 2.5$ $\times 2.5$ $\times 2.5$

$$200 \div 80 = 2.5$$

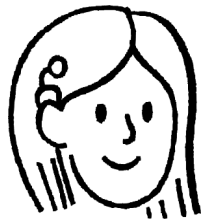
$$500 \div 200 = 2.5$$

$$1250 \div 500 = 2.5$$

$$3125 \div 1250 = 2.5$$

Tijaabi. Qaado eray kasta oo u qaybi eraygii hore. Haddii aad hesho xiriir isku dhufasho oo guud (common multiplicative relationship) oo u dhexeeya eray kasta, taxanuhu waa joometeri (geometric).

Taxanahan waa joometeri (geometric)! Wuxuu leeyahay saami guud (common ratio) oo jajab tobanle (decimal).



Suad iyo Caasha waxay eegayaan taxane kale.

$$80, 200, 500, 1250, 3125, \dots$$

$$\begin{array}{cccc} \times \frac{5}{2} & \times \frac{5}{2} & \times \frac{5}{2} & \times \frac{5}{2} \end{array}$$

$$200 \div 80 = 2.5$$

$$500 \div 200 = 2.5$$

$$1250 \div 500 = 2.5$$

$$3125 \div 1250 = 2.5$$

Waxaa fiican in loo fikiro sidii tiro isku dhufasho jajab leh (fractional multiplier). $2.5 =$

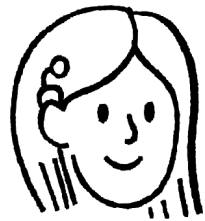
$$\frac{5}{2}$$

$$\frac{200}{80} = \frac{5}{2}$$

$$\frac{1250}{500} = \frac{5}{2}$$

$$\frac{500}{200} = \frac{5}{2}$$

$$\frac{3125}{1250} = \frac{5}{2}$$



Taxanahan waa joometeri (geometric)! Wuxuu leeyahay saami guud (common ratio) oo jajab tobanle (decimal).



Cabdi wuxuu isku dayayaa inuu helo erayga 5aad (5th term) ee taxanahan joometeriga (geometric sequence).

162, 216, 288, 384, ? , ...

Maxay tahay talada aad u malaynaysid in
Caasha siin doonto Cabdi iyo sababta?

$$216 \div 162 = 1.33 \text{ (ilaa 2 d.p.)}$$

$$288 \div 216 = 1.33 \text{ (ilaa 2 d.p.)}$$

$$384 \div 288 = 1.33 \text{ (ilaa 2 d.p.)}$$



Saamiga guud (common ratio) waa 1.33, marka
erayga xiga waa $384 \times 1.33 = 510.72$



Helista saamiga guud (common ratio)

Cabdi wuxuu isku dayayaa inuu helo 5-aad (5th term) ee taxanahan joomatari (geometric sequence).

$$162, 216, 288, 384, 512, \dots$$

$\times \frac{4}{3}$ $\times \frac{4}{3}$ $\times \frac{4}{3}$ $\times \frac{4}{3}$

$$216 \div 162 = 1.33 \text{ (ilaa 2 tiro jajab tobanle)}$$

$$288 \div 216 = 1.33 \text{ (ilaa 2 tiro jajab tobanle)}$$

$$384 \div 288 = 1.33 \text{ (ilaa 2 tiro jajab tobanle)}$$

Uga tag saamiga guud (common ratio) qaab jajab (fraction) si sax ah oo hufan. Xisaabiyahaagu wuxuu ku caawin doonaa.

fx-570/991CW

CASIO

$$384 \times \frac{4}{3}$$

512

CLASSWIZ



Saamiga guud (common ratio) waa 1.33, markaa xiga waa $384 \times 1.33 = 510.72$

Cabdi wuxuu isku dayayaa inuu helo 5-aad (5th term) ee taxanahan joomatari (geometric sequence).

$$162, 216, 288, 384, 512, \dots$$

$\times \frac{4}{3}$ $\times \frac{4}{3}$ $\times \frac{4}{3}$ $\times \frac{4}{3}$



Mahadsanid Caasha!

Uga tag saamiga guud (common ratio) qaab jajab (fraction) si sax ah oo hufan. Xisaabiyahaagu wuxuu ku caawin doonaa.

fx-570/991CW

CASIO

$$384 \times \frac{4}{3}$$

512

CLASSWIZ



Cabdi iyo Caasha waxay heleen taxanahan.

5, 10, 30, 120, 600, ...

$\times 2$ $\times 3$ $\times 4$ $\times 5$

Waxaan ku raaxaysanayaa taxanaha joomatari (geometric sequences). Kan wuxuu leeyahay qaab aad u yaab leh!



Taxane joomatari (geometric sequence) waa inuu yeesho xiriir isku dhufasho (multiplicative) joogto ah oo u dhexeeya xubnaha.

Xusuusnow, waa inuu ahaadaa xiriir isku dhufasho (multiplicative) guud oo u dhexeeya xubin kasta si taxanuho u noqdo joomatari (geometric). Isku dhufashadaadu (multiplier) way isbeddeshaa taxanahaaga, markaa ma aha joomatari (geometric).



Helista saamiga guud (common ratio)

Kee ka mid ah kuwan waa taxane joomatari (geometric sequences)?

a 71, 213, 639, 1917, 5751, ... ✓ Xiriir isku dhufasho (multiplicative) joogto ah - Joomatari (Geometric)



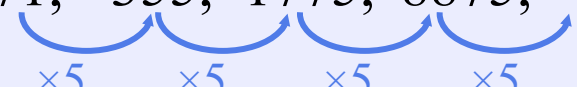
b 71, 142, 426, 852, 2556, ... ✗ Ma aha isku dhufasho (multiplier) joogto ah - Ma aha joomatari (Geometric)



c 71, 142, 568, 4544, 72 704, ... ✗ Ma aha isku dhufasho (multiplier) joogto ah - Ma aha joomatari (Geometric)



d 71, 355, 1775, 8875, 44 375, ... ✓ Xiriir isku dhufasho (multiplicative) joogto ah - Joomatari (Geometric)



1) U qaybi eray kasta eraygii hore si aad u hesho saamiga guud (common ratio) ee mid kasta oo ka mid ah taxanahan joometeriga (geometric sequences).

a) $15, 105, 735, 5145, 36\,015, \dots$

b) $0.08, 0.72, 6.48, 58.32, 524.88, \dots$

c) $567, 189, 63, 21, 7, \dots$

d) $\frac{1}{4}, \frac{3}{8}, \frac{9}{16}, \frac{27}{32}, \frac{81}{64}, \dots$

2) a) Taxanahan waa joometeri (geometric). Muuji inuu yahay oo qor jumlad ku caddaynaysa sababta.

768, 576, 432, 324, 243, ...

b) Taxanahan ma aha joometeri. Muuji inuusan ahayn oo qor jumlad ku caddaynaysa sababta.

756, 252, 126, 42, 21, ...

Hawsha A Helista saamiga guud (common ratio)

1) U qaybi eray kasta eraygii hore si aad u hesho saamiga guud (common ratio) ee mid kasta oo ka mid ah taxanahan joometeriga (geometric sequences).

a) 15, 105, 735, 5145, 36 015, ...



$$36\ 015 \div 5145 = 7$$

$$5145 \div 735 = 7$$

$$735 \div 105 = 7$$

$$105 \div 15 = 7$$

b) 0.08, 0.72, 6.48, 58.32, 524.88, ...



$$524.88 \div 58.32 = 9$$

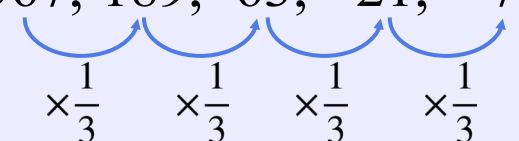
$$58.32 \div 6.48 = 9$$

$$6.48 \div 0.72 = 9$$

$$0.72 \div 0.08 = 9$$

1) U qaybi eray kasta eraygii hore si aad u hesho saamiga guud (common ratio) ee mid kasta oo ka mid ah taxanahan joometeriga (geometric sequences).

c) 567, 189, 63, 21, 7, ...



$\times \frac{1}{3}$ $\times \frac{1}{3}$ $\times \frac{1}{3}$ $\times \frac{1}{3}$

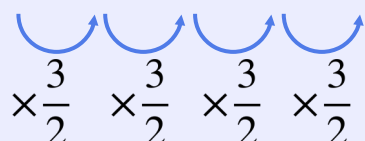
$$7 \div 21 = \frac{1}{3}$$

$$21 \div 63 = \frac{1}{3}$$

$$63 \div 189 = \frac{1}{3}$$

$$189 \div 567 = \frac{1}{3}$$

d) $\frac{1}{4}, \frac{3}{8}, \frac{9}{16}, \frac{27}{32}, \frac{81}{64}, \dots$



$\times \frac{3}{2}$ $\times \frac{3}{2}$ $\times \frac{3}{2}$ $\times \frac{3}{2}$

$$\frac{81}{64} \div \frac{27}{32} = \frac{3}{2}$$

$$\frac{9}{16} \div \frac{3}{8} = \frac{3}{2}$$

$$\frac{27}{32} \div \frac{9}{16} = \frac{3}{2}$$

$$\frac{3}{8} \div \frac{1}{4} = \frac{3}{2}$$

2) a) Taxanahan waa joometeri (geometric). Muuji inuu yahay oo qor jumlad ku caddaynaysa sababta.

768, 576, 432, 324, 243, ...

$$\begin{array}{ccccccc} & \text{↖} & & \text{↖} & & \text{↖} & & \text{↖} \\ & \times \frac{3}{4} & & \times \frac{3}{4} & & \times \frac{3}{4} & & \times \frac{3}{4} \end{array}$$

Taxanahu wuxuu leeyahay saami guud (common ratio)
oo u dhexeeya erayaasha is xiga, sidaa darteed waa
joometeri (geometric).
 $\frac{3}{4}$

$$243 \div 324 = \frac{3}{4}$$

$$324 \div 432 = \frac{3}{4}$$

$$432 \div 576 = \frac{3}{4}$$

$$576 \div 768 = \frac{3}{4}$$

2) a) Taxanahan waa joometeri (geometric). Muuji inuu yahay oo qor jumlad ku caddaynaysa sababta.

768, 576, 432, 324, 243, ...

Waxaa laga yaabaa inaad sidoo kale tidhi...

Taxanahu wuxuu leeyahay saami joogto ah (constant ratio) 4 : 3 oo u dhexeeya erayaasha is xiga, sidaa darteed waa joometeri (geometric). Xusuusnow in saamiga guud (common ratio) la bixiyo sida hal qiime (single value).

$$\begin{array}{ccc} \div 192 & \left(\begin{array}{cc} 768 & : & 576 \\ 4 & : & 3 \end{array} \right) & \div 192 \end{array}$$

$$\begin{array}{ccc} \div 144 & \left(\begin{array}{cc} 576 & : & 432 \\ 4 & : & 3 \end{array} \right) & \div 144 \end{array}$$

$$\begin{array}{ccc} \div 108 & \left(\begin{array}{cc} 432 & : & 324 \\ 4 & : & 3 \end{array} \right) & \div 108 \end{array}$$

$$\begin{array}{ccc} \div 81 & \left(\begin{array}{cc} 324 & : & 243 \\ 4 & : & 3 \end{array} \right) & \div 81 \end{array}$$

2) b) Taxanahan ma aha joometeri. Muuji inuusan ahayn oo qor jumlad ku caddaynaysa sababta.

756, 252, 126, 42, 21, ...

$$\begin{array}{cccc} \text{---} & \text{---} & \text{---} & \text{---} \\ \times \frac{1}{3} & \times \frac{1}{2} & \times \frac{1}{3} & \times \frac{1}{2} \end{array}$$

Taxanahu wuxuu leeyahay xiriir isku dhufasho (multiplicative relationship) oo u dhexeeya qaar ka mid ah erayaasha iyo oo u dhexeeya kuwa kale, sidaa darteed ma aha joometeri (not geometric).

$$\begin{array}{c} \times \frac{1}{3} \\ \times \frac{1}{2} \end{array}$$

$$21 \div 42 = \frac{1}{2}$$

$$42 \div 126 = \frac{1}{3}$$

$$126 \div 252 = \frac{1}{2}$$

$$252 \div 756 = \frac{1}{3}$$

2) b) Taxanahan ma aha joometeri. Muuji inuusan ahayn oo qor jumlad ku caddaynaysa sababta.

756, 252, 126, 42, 21, ...

Waxa laga yaabaa inaad sidoo kale tidhi...

Taxanuhu wuxuu leeyahay saami (ratio) 3 : 1 inta u dhaxaysa qaar ka mid ah xubnaha iyo 2 : 1 inta u dhaxaysa kuwa kale, sidaas darteed ma aha geometric.

$$\begin{array}{ccc} \div 252 & \left(\begin{array}{cc} 756 & : & 252 \\ & 3 & : & 1 \end{array} \right) & \div 252 \end{array}$$

$$\begin{array}{ccc} \div 126 & \left(\begin{array}{cc} 252 & : & 126 \\ & 2 & : & 1 \end{array} \right) & \div 126 \end{array}$$

$$\begin{array}{ccc} \div 42 & \left(\begin{array}{cc} 126 & : & 42 \\ & 3 & : & 1 \end{array} \right) & \div 42 \end{array}$$

$$\begin{array}{ccc} \div 21 & \left(\begin{array}{cc} 42 & : & 21 \\ & 2 & : & 1 \end{array} \right) & \div 21 \end{array}$$

Aqoonsiga taxanaha geometric (geometric sequences)

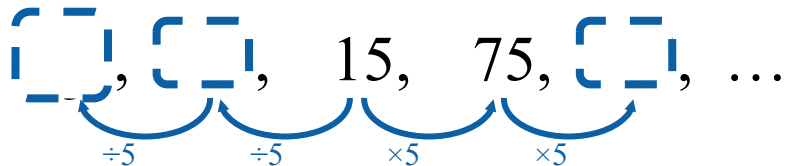


Helista saamiga guud (common ratio)



Isticmaalka saamiga guud (common ratio)

Saciid iyo Yacquub waxay eegayaan xubnaha maqan.



Kani waa taxane geometric (geometric sequence) oo leh saami guud (common ratio) 5
Ma heli kartaa xubnaha maqan ee kan?



$$75 \times 5 = 375$$

$$15 \div 5 = 3$$

$$3 \div 5 = \frac{3}{5}$$

Haa! Waxaan ku dhufanayaa 5 si aan u helo xubinta 5aad, ka dibna waxaan sameeyaa rogaalka (inverse) ee $\div 5$ si aan u helo xubnaha hore.



Saciid iyo Yacquub waxay eegayaan xubnaha maqan.

$$\frac{3}{5}, 3, 15, 75, 375, \dots$$

Diagram showing the sequence $\frac{3}{5}, 3, 15, 75, 375, \dots$ with blue curved arrows indicating multiplication by 5 between consecutive terms: $\frac{3}{5} \times 5 = 3$, $3 \times 5 = 15$, $15 \times 5 = 75$, and $75 \times 5 = 375$.

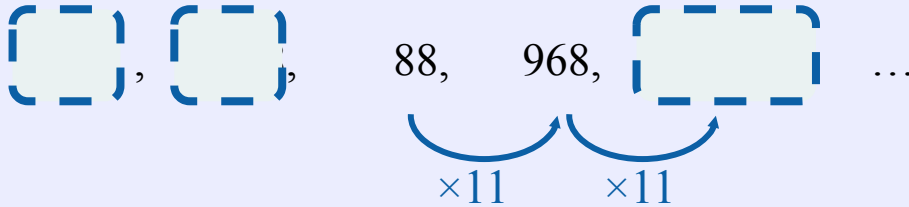
Waan hubiyay.
Waxaad sax tahay Yacquub!

Haa! Waxaan ku dhufanayaa 5 si aan u helo xubinta 5aad, ka dibna waxaan sameeyaa rogaalka (inverse) ee $\div 5$ si aan u helo xubnaha hore.



Isticmaalka saamiga guud (common ratio)

Waa maxay xubinta 5aad ee taxanahan geometric (geometric sequence)?



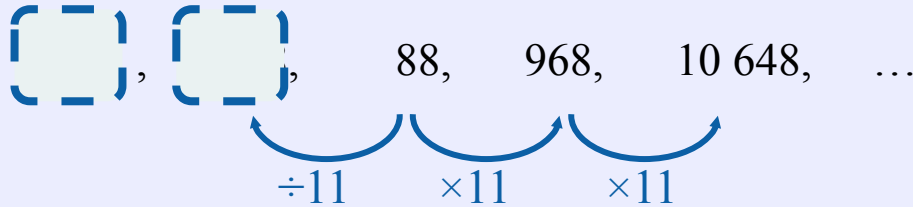
$$968 \div 88 = 11$$

Saamiga guud (common ratio) ee u dhaxeeya xubnaha isku xigxiga waa 11

$$968 \times 11 = 10\,648$$

Isticmaalka saamiga guud (common ratio)

Waa maxay xubinta 2aad ee taxanahan geometric (geometric sequence)?



Rogaalka (inverse) ee $\times 11$ waa $\div 11$

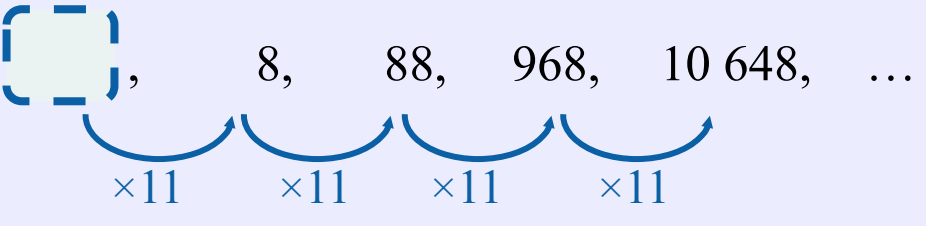
$$88 \div 11 = 8$$

Isticmaalka saamiga guud (common ratio)

Waa maxay ereyga 1aad ee taxanahan joomatari (geometric sequence)?

a 88 ✗

Si aan u helno erey hore waxaan u baahanahay inaan samayno rogaal celinta (inverse) ee $\times 11$



b 0.727 ✗

$8 \div 11 = 0.727272\dots$ laakiin markaad soo wareejiiso waxaad lumisaa saxnaanta (accuracy).

c $\frac{8}{11}$ ✓

$8 \div 11$ waxaa si sax ah oo kooban loogu gudbiyaa jajab (fraction).

Isticmaalka saamiga guud (common ratio)

1aad	2aad	3aad	4aad	5aad
	2		8	

$8 \div 2 = 4$ marka saamiga guud (common ratio) waa inuu ahaadaa 4

Nuur ma saxna. Sidee ku ogaatay?

Ereyga 3aad: $2 \times 4 = 8$

Ereyga 4aad: $8 \times 4 = 32$



Isticmaalka saamiga guud (common ratio)

1aad	2aad	3aad	4aad	5aad
	2		8	


 $\times r$ $\times r$

Waan hubiyay. Saamiga guud (common ratio) ma noqon karo 4. Waa inay tahay wax isku dhufanaya laba jeer si loo helo 4



$$2 \times r \times r = 8$$

$$2 \times r^2 = 8$$

$$r^2 = 4$$

Isticmaalka saamiga guud (common ratio)

1aad	2aad	3aad	4aad	5aad
	2		8	



Waa 2

Markaad laba jibaaranto (square) 2 waxaad heleysaa 4



$$2 \times r \times r = 8$$

$$2 \times r^2 = 8$$

$$r^2 = 4$$

$$r = 2$$

Isticmaalka saamiga guud (common ratio)

1aad	2aad	3aad	4aad	5aad
1	2	4	8	16



Aad ayaan ugu faanaa nafteyda!



1aad	2aad	3aad	4-aad	5-aad
	2		8	



Ha u dabaaldegina goor hore. Dhab ahaantii waxaa jira laba xal oo dhibaatan.



Isticmaalka saamiga guud (common ratio)

$$r^2 = 4$$

$$r = 2 \text{ ama } -2$$

Wax kale oo labajibbaaran (squared)
siinaya 4?

Waan helay! Tabane
2 (Negative 2)



1-aad	2-aad	3-aad	4-aad	5-aad
	2		8	

$\times r$ $\times r$

Ha u dabaalgelin goor hore. Waxaa jira laba xal
(solutions) oo dhibaatan ah.



Isticmaalka saamiga guud (common ratio)

$$r^2 = 4$$

$$r = 2 \text{ ama } -2$$

1-aad	2-aad	3-aad	4-aad	5-aad
	2		8	

$\times -2$ $\times -2$ $\times -2$ $\times -2$

Waa ku mahadsan tahay Nuur. Waxaad heshay labada taxane (sequences) ee suurtoogalka ah.



Waa maxay saami guud (common ratio) ee taxanahan joomatari (geometric sequence)?

a 3 ✓

b -3 ✓

c 9 ✗

1aad	2aad	3aad	4aad	5aad
	6		54	

$\times 3$ $\times 3$ $\times 3$ $\times 3$

1aad	2aad	3aad	4aad	5aad
	6		54	

$\times -3$ $\times -3$ $\times -3$ $\times -3$

1) Raadi xubnaha (terms) ka maqan ee taxanahan joomatari (geometric sequences).

a) $\boxed{}, \boxed{}, 51, 153, \boxed{}, \dots$

b) $\boxed{}, 225, 45, \boxed{}, \boxed{}, \dots$

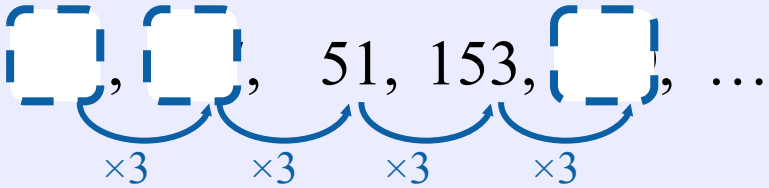
c) $\boxed{}, 0.14, 2.8, \boxed{}, \boxed{}, \dots$

d) $\boxed{}, \boxed{}, \frac{28}{27}, \frac{56}{81}, \boxed{}, \dots$

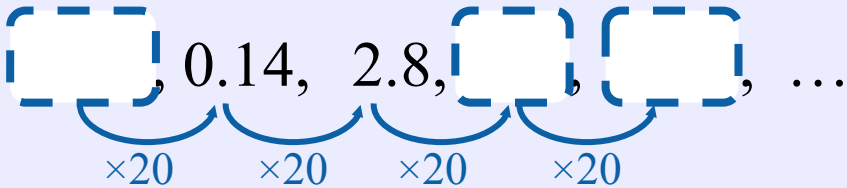
2) Raadi labada taxane joomatari (geometric sequences) ee suurto galka ah, marka la eego xubnahan (terms) ka maqan, ee aan isku xigxin.

1aad	2aad	3aad	4aad	5aad
4		100		

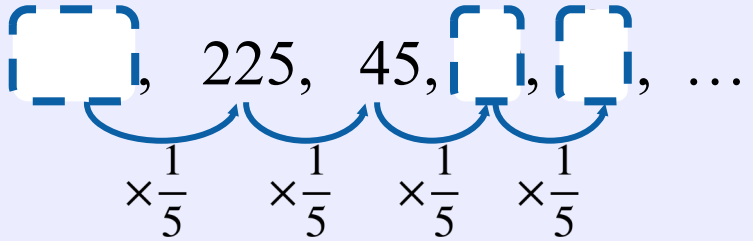
1) Raadi xubnaha (terms) ka maqan ee taxanahan joomatari (geometric sequences).

a)  ...

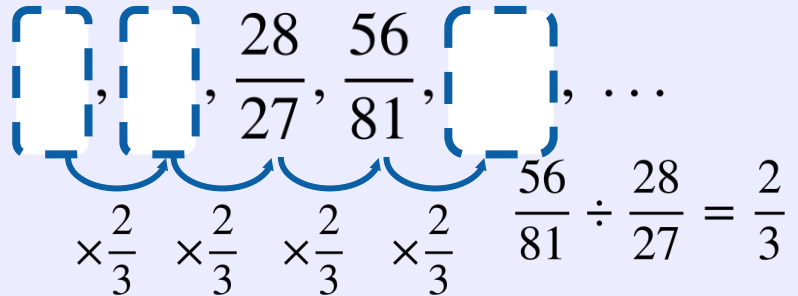
$$153 \div 51 = 3$$

c)  ...

$$2.8 \div 0.14 = 20$$

b)  ...

$$45 \div 225 = \frac{1}{5}$$

d)  ...

$$\frac{56}{81} \div \frac{28}{27} = \frac{2}{3}$$

2) Soo hel labada isku xigxig (geometric sequences) ee suurtoogalka ah marka la eego erayadan maqan, ee aan isku xigxignayn.

1aad	2aad	3aad	4aad	5aad
4		100		

$\times 5$ $\times 5$ $\times 5$ $\times 5$

1aad	2aad	3aad	4aad	5aad
4		100		

$\times -5$ $\times -5$ $\times -5$ $\times -5$

$$4 \times r \times r = 100$$

$$4 \times r^2 = 100$$

$$r^2 = 25$$

$$r = 5 \text{ ama } -5$$

Waxaan aqoonsan karaa isku xigxiga joomatari (geometric sequences) anigoo helaya saami guud (common ratio) oo u dhexeeya erayada isku xigxiga.

Tusaale ahaan, 7, 14, 28, 56, ... waa joomatari (geometric) sababtoo ah waxay leedahay saami guud (common ratio) oo ah 2 oo u dhexeeya erayada isku xigxiga.