

2.3

BUTUN SONLARNI KO'PAYTIRISH,
BO'LISH VA ULAR USTIDA AMALLAR

A Butun sonlarni ko'paytirish

Natural sonlar ko'paytmasini qo'shish amali bilan almashtirish mumkinligini o'rgangan edik. Masalan, $3 \times 4 = 4 + 4 + 4 = 12$.

Keling, algebraik tugmalar yordamida **butun sonlarni** qanday **ko'paytirish** mumkinligini ko'rib chiqamiz.



4-FAOLLASHTIRUVCHI MASHQ



TAYANCH ATAMALAR

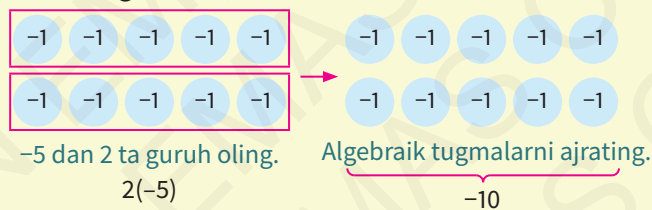
- butun sonlarni ko'paytirish
- teskari son
- butun sonlarni bo'lish
- amallarni bajarish tartibi
- algebraik kvadrat ildiz

Maqsad: algebraik tugmalar yordamida butun sonlarni ko'paytirish.

Musbat butun sonni manfiy butun songa ko'paytirish

Misol:

Hisoblang: $2 \times (-5)$.



$$\therefore 2 \times (-5) = -10$$

1) Hisoblang.

a) $5 \times (-2)$

b) $4 \times (-3)$

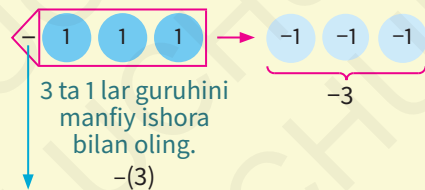
Manfiy butun sonni musbat butun songa ko'paytirish

Misollar:

1) Hisoblang: $(-1) \times 3$.

$(-1) \times 3$ ko'paytmasi $-(1 \times 3)$ bilan bir xil.

Algebraik tugmalarni aylantirish orqali $-(1 \times 3)$ ni 3 ta 1 ning qarama-qarshisidan iborat guruh ekanligini ko'rishimiz mumkin.



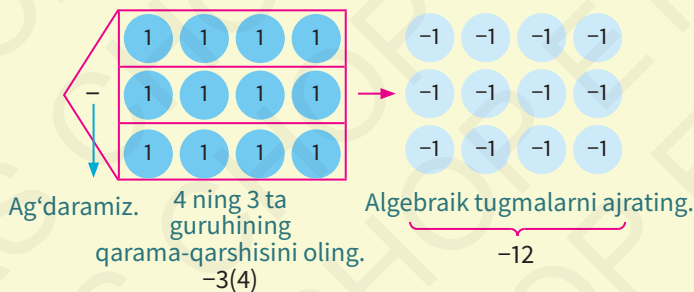
Bu shakl ichidagi barcha algebraik tugmalarni aylantirishni anglatadi.

$$\therefore (-1) \times 3 = -3$$

2) Hisoblang: $(-3) \times 4$.

$$(-3) \times 4 = -(3 \times 4)$$

4 ning 3 ta guruhining qarama-qarshisini ko'rsatish uchun algebraik tugmalarni aylantiring.



$$\therefore (-3) \times 4 = -12$$

2) Hisoblang.

a) $(-5) \times 2$

b) $(-2) \times 3$

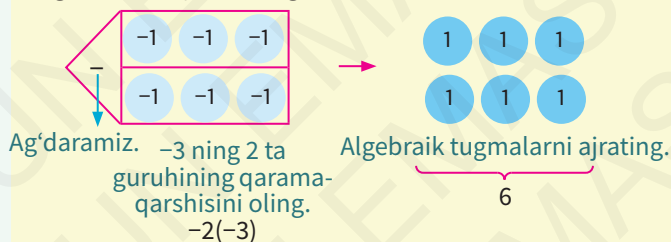
Ikkita manfiy butun sonni ko'paytirish

Misol:

Hisoblang: $(-2) \times (-3)$.

$$(-2) \times (-3) = -[2 \times (-3)]$$

(-3) ning 2 ta guruhining qarama-qarshisini ko'rsatish uchun algebraik tugmalarni aylantiring.



$$\therefore (-2) \times (-3) = 6$$



E'TIBOR BERING!

-3 ning qarama-qarshisini $-(-3) = 3$ kabi yozilishini yodga oling. Bu holatda quyidagicha ham yoza olamiz:

$$-(-3) = (-1) \times (-3) = 3.$$

3) Quyidagilarni hisoblang.

a) $(-3) \times (-2)$

b) $(-4) \times (-3)$

4) 1, 2 va 3-faollashtiruvchi mashqlarning natijalaridan foydalanib quyidagilarning musbat yoki manfiy bo'lishini aniqlang:

- a) ikkita musbat butun sonning ko'paytmasi;
- b) musbat butun sonning manfiy butun songa ko'paytmasi;
- d) manfiy butun sonning musbat butun songa ko'paytmasi;
- e) ikkita manfiy butun sonning ko'paytmasi.

5) Quyidagilarni hisoblang. Nimalarni payqadingiz?

- a) 2×5 va 5×2
- b) $2 \times (-5)$ va $(-5) \times 2$
- d) $(-3) \times (-6)$ va $(-6) \times (-3)$

4-faollashtiruvchi mashqdan ikkita butun sonning ko'paytmasiga oid quyidagilarni kuzatdik:

- Musbat butun son $\times$ musbat butun son = musbat butun son, masalan: $2 \times 3 = 6$.
- Musbat butun son $\times$ manfiy butun son = manfiy butun son, masalan: $2 \times (-3) = -6$.
- Manfiy butun son $\times$ musbat butun son = manfiy butun son, masalan: $(-2) \times 3 = -6$.
- Manfiy butun son $\times$ manfiy butun son = musbat butun son, masalan: $(-2) \times (-3) = 6$.
- Butun sonlarni ko'paytirish amali kommutativdir, masalan: $5 \times 2 = 2 \times 5$, $2 \times (-5) = (-5) \times 2$, $(-3) \times (-6) = (-6) \times (-3)$.

+	$\times$	+	=	+
+	$\times$	-	=	-
-	$\times$	+	=	-
-	$\times$	-	=	+

8 MISOL

Kalkulyatorsiz yoki algebraik tugmalarsiz quyidagilarning qiymatini toping.

- a) $(-6) \times 9$ b) $(-4) \times (-4)$
d) $(-2) \times (-2) \times (-2)$ e) $8 \times (-4) \times (-7)$

YECHISH

- a) $(-6) \times 9 = -(6 \times 9)$ Manfiy son $\times$ musbat son = manfiy son
 $= -54$ $(-) \times (+) \rightarrow (-)$
b) $(-4) \times (-4) = 4 \times 4$ Manfiy son $\times$ manfiy son = musbat son
 $= 16$ $(-) \times (-) \rightarrow (+)$
d) $(-2) \times (-2) \times (-2) = [(-2) \times (-2)] \times (-2)$
 $= 4 \times (-2)$ $(-) \times (-) \rightarrow (+)$
 $= -8$ $(+) \times (-) \rightarrow (-)$
e) $8 \times (-4) \times (-7) = (-32) \times (-7)$
 $= 32 \times 7$ $(+) \times (-) \rightarrow (-)$
 $= 224$ $(-) \times (-) \rightarrow (+)$



E'TIBOR BERING!

$(-4) \times (-4)$ ko'paytma $(-4)^2$ ko'rinishida ham yozilishi mumkin. 8b)-misoldan ko'rinib turibdiki, $(-4)^2$ musbat son bo'ladi.



E'TIBOR BERING!

8d) misoldan kelib chiqadiki, $\sqrt[3]{-8} = -2$, ya'ni manfiy sonning kub ildizi manfiy son bo'ladi.

8 MASHQ

Kalkulyator yoki algebraik tugmalarsiz quyidagilarning qiymatini toping.

- a) $(-12) \times 8$ b) $(-66) \times 0$
d) $(-7) \times (-7)$ e) $(-3) \times (-3) \times (-3)$
f) $(-4)^3$ g) $(-5) \times 6 \times (-4)$

9 MISOL

Kalkulyatordan foydalanmasdan quyidagilarning qiymatini toping:

- a) 36 ning kvadrat ildizi, b) -1000 ning kub ildizi.

TAHLIL

8b)-misolda 4 va -4 ikkalasi ham 16 ning kvadrat ildizi bo'ladi. Ular **algebraik kvadrat ildizlar** deb ataladi. Agar 36 ning algebraik kvadrat ildizi $\square$ bo'lsa, unda, $-\square$ ham 36 ning algebraik kvadrat ildizi bo'ladi.

YECHISH

$$\begin{aligned} \text{a)} \quad 36 &= 2 \times 2 \times 3 \times 3 \\ &= (2 \times 3) \times (2 \times 3) \\ &= (2 \times 3)^2 \end{aligned}$$

$$\begin{aligned} 36 \text{ ning algebraik} \\ \text{kvadrat ildizi} &= \pm\sqrt{36} \\ &= \pm\sqrt{(2 \times 3)^2} \\ &= \pm(2 \times 3) \\ &= \pm 6 \end{aligned}$$

$$\begin{aligned} \text{b)} \quad 1000 &= 2 \times 2 \times 2 \times 5 \times 5 \times 5 \\ &= (2 \times 5) \times (2 \times 5) \times (2 \times 5) \\ &= (2 \times 5)^3 \end{aligned}$$

$$\begin{aligned} -1000 &= -(2 \times 5)^3 \\ -1000 \text{ ning kub ildizi} &= \sqrt[3]{-1000} \\ &= \sqrt[3]{-(2 \times 5)^3} \\ &= -\sqrt[3]{(2 \times 5)^3} \\ &= -(2 \times 5) \\ &= -10 \end{aligned}$$

Eslatma: “±” bu “plyus minus” deb o‘qiladi.

BELGILASHLAR

8b)-misolda $(-4)^2 = 16$ ekanini ko‘rdik. Demak, -4 ham 16 ning algebraik kvadrat ildizi ekan. $\sqrt{\quad}$ yozuvi faqat musbat kvadrat ildizni anglatadi, ya‘ni $\sqrt{16} = 4$ deb yozmaslik lozim. Buning o‘rniga $\sqrt{16} = 4$ va $-\sqrt{16} = -4$ deb yozilishi lozim. 16 ning algebraik kvadrat ildizini $\pm\sqrt{16}$ kabi yozishimiz mumkin, ya‘ni $\pm\sqrt{16} = \pm 4$. 25 ning algebraik kvadrat ildizini qanday yozasiz?

BOSH G‘O‘YA

O‘YLAB KO‘RING

- 1) -16 ning kvadrat ildizi ma‘noga egami? Javobingizni tushuntiring.
- 2) a) Musbat va manfiy sonlarning ikkalasi ham kub ildizga egami?
b) Har bir sonning nechta kub ildizi bor? Tushuntirib bering.

9 MASHQ

Kalkulyatorsiz hisoblang.

- a) 64 ning kvadrat ildizi
- b) -64 ning kub ildizi
- d) $\sqrt{121}$
- e) $-\sqrt[3]{-125}$

B Butun sonlarni bo‘lish

Avvalroq $12 \div 3$ ifoda $12 \times \frac{1}{3}$ ko‘rinishida yozilishi mumkinligini o‘rgangan edik. Ikkala holda ham bir xil javob olinadi.

$$\begin{aligned} 12 \div 3 &= 12 \times \frac{1}{3} \\ &= 4 \end{aligned}$$

$\frac{1}{3}$ soni 3 ga **teskari son**, 3 soni esa $\frac{1}{3}$ ning **teskarisi** deyiladi.

Demak, **butun sonlarni bo‘lish** qoidalarini butun sonlarni ko‘paytirish qoidalariga asosida chiqarish mumkin.

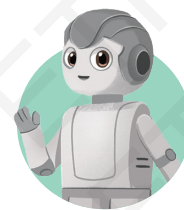
Misollar:

$4 \times 3 = 12$	$12 \div 3 = \frac{12}{3} = 12 \times \frac{1}{3} = 4$
$4 \times (-3) = -12$	$(-12) \div (-3) = \frac{-12}{-3} = (-12) \times \frac{1}{-3} = 4$
$(-4) \times 3 = -12$	$(-12) \div 3 = \frac{-12}{3} = (-12) \times \frac{1}{3} = -4$
$(-4) \times (-3) = 12$	$12 \div (-3) = \frac{12}{-3} = 12 \times \frac{1}{-3} = -4$



MUHOKAMA QILING!

$4 \div 0$ nimaga teng bo‘lishi mumkin?



10 MISOL

Hisoblang.

- a) $20 \div 5$ b) $(-42) \div (-7)$ d) $24 \div (-6)$ e) $(-36) \div 3$

YECHISH

- a) $20 \div 5 = \frac{20}{5} = 4$ b) $(-42) \div (-7) = \frac{-42}{-7} = 6$
- d) $24 \div (-6) = -\frac{24}{6} = -4$ e) $(-36) \div 3 = -\frac{36}{3} = -12$

10 MASHQ

Hisoblang.

- a) $16 \div 2$ b) $(-75) \div (-5)$
- d) $63 \div (-7)$ e) $(-54) \div 6$

D Butun sonlar ustida amallar

Bu bo'limda natural sonlarga oid **amallarni bajarish tartibini** barcha butun sonlar uchun quyidagicha kengaytiramiz:

- Dastlab qavs ichidagi amallarni bajaring, agar bir nechta juft qavs bo'lsa, ichki qavslardan boshlang. (Qavslar)
- So'ng daraja va ildizlarni hisoblang. (Daraja va ildizlar)
- Keyin chapdan o'ngga qarab ko'paytirish va bo'ling. (Ko'paytirish va bo'lish)
- Yakunda chapdan o'ngga qarab qo'shing va ayiring. (Qo'shish va ayirish)

11 MISOL

Quyidagilarning qiymatlarini kalkulyatordan foydalanmasdan toping.

- a) $23 - 56 \div (-8) + (-5)$
- b) $(-2)^3 \times 7 - [(-5) + (-1)]^2 \div (-4)$
- d) $(-11) - (-6)^3 \div [(-4) + (-8)] + (-5)^2$

YECHISH

- a) $23 - 56 \div (-8) + (-5)$
 $= 23 - [-(56 \div 8)] + (-5)$
 $= 23 - (-7) + (-5)$
 $= 23 + 7 - 5$
 $= 25$

Dastlab bo'lishni bajaring.

Chapdan o'ngga qarab qo'shing va ayiring.

$$\begin{aligned}
 \text{b)} \quad & (-2)^3 \times 7 - [(-5) + (-1)]^2 \div (-4) \\
 & = (-2)^3 \times 7 - (-6)^2 \div (-4) \\
 & = (-8) \times 7 - 36 \div (-4) \\
 & = -56 - (-9) \\
 & = -56 + 9 \\
 & = -47
 \end{aligned}$$

$$\begin{aligned}
 \text{d)} \quad & (-11) - (-6)^3 \div [(-4) + (-8)] + (-5)^2 \\
 & = (-11) - (-6)^3 \div (-12) + (-5)^2 \\
 & = (-11) - (-216) \div (-12) + 25 \\
 & = (-11) - 18 + 25 \\
 & = -11 - 18 + 25 \\
 & = -4
 \end{aligned}$$

Dastlab kvadrat qavslar ichidagi yig'indini toping.
Darajalarni hisoblang.
Ko'paytirish va bo'lishni bajaring.
Qo'shishni bajaring.

Dastlab kvadrat qavslar ichidagi yig'indini toping.
Darajalarni hisoblang.
Bo'lishni bajaring.
Chapdan o'ngga qarab qo'shing va ayiring.



MUHOKAMA QILING!

O'quvchi $33 + (-5)^2$ ni quyidagicha hisobladi:
 $33 + (-5)^2 = 33 - 25$
 $= 8$

O'quvchining hisobi to'g'rimi? Agar "yo'q" bo'lsa, to'g'ri javobni toping.



ESLANG!

$$\begin{aligned}
 (-2)^3 &= (-2) \times (-2) \times (-2) \\
 (-6)^2 &= (-6) \times (-6)
 \end{aligned}$$

11 MASHQ

Quyidagilarning qiymatlarini kalkulyatordan foydalanmasdan toping.

$$\begin{aligned}
 \text{a)} \quad & 15 - 5 \times (-2) - [30 - (1 - 3^2)] & \text{b)} \quad & (-6)^2 \div (-12) + [(-8) - (-3)]^2 \times (-2) \\
 \text{d)} \quad & (5 - 9)^2 \div [(-5) - (-3)]^3 - (-7) \times (-6) + (-20)
 \end{aligned}$$

2.3 MUSTAHKAMLASH MASHQI

BOSHLANG'ICH DARAJA

Kalkulyatordan foydalanmasdan hisoblang.

1 Hisoblang.

$$\begin{aligned}
 \text{a)} \quad & 8 \times (-9) & \text{b)} \quad & (-5) \times (-4) \\
 \text{d)} \quad & (-6) \times 7 & \text{e)} \quad & -3 \times 0 \\
 \text{f)} \quad & (-12)^2 & \text{g)} \quad & -(-4)^3 \\
 \text{h)} \quad & (-3)^2 \times (-5) & \text{i)} \quad & (-2)^3 \times (-9)
 \end{aligned}$$

2 Hisoblang.

$$\begin{aligned}
 \text{a)} \quad & (-38) \div (-2) & \text{b)} \quad & 132 \div (-11) \\
 \text{d)} \quad & 65 \div 5 & \text{e)} \quad & (-57) \div 3 \\
 \text{f)} \quad & \frac{0}{-7} & \text{g)} \quad & (-144) \div (-9) \\
 \text{h)} \quad & (-6)^3 & \text{i)} \quad & \frac{162}{(-3)^3}
 \end{aligned}$$

3 Hisoblang.

$$\begin{aligned}
 \text{a)} \quad & \sqrt{169} \\
 \text{b)} \quad & 361 \text{ ning kvadrat ildizi} \\
 \text{d)} \quad & \sqrt[3]{27} \\
 \text{e)} \quad & \sqrt[3]{-343}
 \end{aligned}$$

O'RTA DARAJA

4 Hisoblang.

$$\begin{aligned}
 \text{a)} \quad & (-6) \times 3 \times (-1) \\
 \text{b)} \quad & (-84) \div 7 \times 5 \\
 \text{d)} \quad & (-37) \times 0 - (-8) \\
 \text{e)} \quad & 63 \div (-9) + (-2) \times (-10) \\
 \text{f)} \quad & (-47) - 33 \div (-3) - 3 \times (-7) \\
 \text{g)} \quad & 196 \div [(-8) + (-6)] \times (-2) \\
 \text{h)} \quad & [(-23) + 14] \times (-2)^2 \\
 \text{i)} \quad & (-45) \times 6 \div (-3)^3 \\
 \text{j)} \quad & (-7) \times (-8) \times 0 \times 34 - 4 \times (-5)^2 \\
 \text{k)} \quad & (-6)^3 \div 3^2 \div [-9 - (-8)]^3
 \end{aligned}$$

5 Bahora fitnes klubga qatnay boshlagandan so'ng uning vazni 3 oy davomida har oy 2 kg dan kamayib bordi.

- Bahora vaznining har oyda kamayishini manfiy son orqali ifodalang.
- Bahoraning dastlabki vazni 65 kg bo'lsa, uning 3 oydan keyingi vaznini aniqlang.

- 6 Idishdagi suv har minutda 3 litrdan kamayib bormoqda. Soat 9:00 da idishda 120 litr suv bor edi. Suvning quyidagi vaqtlardagi hajmini toping.

a) 9:30 b) 8:50

- 7 To'liqin o'rtog'idan qarz oldi. U qarzni qaytarishni 7 oy oldin boshladi. To'liqin o'rtog'iga oyiga 40 000 so'm dan qaytardi. Hozir uning 250 000 so'm qarzi qoldi.

- a) To'liqin o'rtog'idan qancha qarz olgan?
b) 3 oydan keyin uning yana qancha qarzi qoladi?

- 8 Jamila yo'lak bo'ylab yugurmoqda. U uyidan 4 m/s tezlik bilan 20 minut shimolga qarab, so'ng 5 m/s tezlik bilan 15 minut janubga qarab va oxirida 3 m/s tezlik bilan 10 minut yana janubga qarab yugurdi. Jamilaning uyiga nisbatan oxirgi joylashuvini toping.

- 9 Hazrati Sulton cho'qqisi yer sathidan 4643 m balandda, Boybuloq g'orining eng chuqur joyi esa 1517 metr pastda joylashgan.

- a) Hazrati Sulton cho'qqisi va Boybuloq g'orining eng pastki joyi o'rtasidagi vertikal masofani toping.
b) Yer sathidan Hazrati Sulton cho'qqisi va Boybuloq g'orining eng pastki joyi o'rtasidagi vertikal masofaning yarmiga teng balandlikni toping.



- 10 Viktorina 5 ta "rost/yolg'on" savollaridan iborat. Baholash quyidagicha amalga oshirilmoqda:

— har bir to'g'ri javob uchun 3 ball;
— har bir noto'g'ri javob uchun -2 ball;
— javob berilmagan savol uchun 0 ball.

- a) Viktorinadagi eng yuqori ball qancha bo'ladi?
b) Viktorinadagi eng past ball qancha bo'ladi?
d) O'quvchi 3 ball olgan holat haqida yozing.
e) Qanday holatda o'quvchi -3 ball olishi mumkin?



- 11 a) Quyidagi jadvaldagi bir xil shakllarni bir xil butun sonlar bilan to'ldiring.

Chap tomon	O'ng tomon
$\square \times \bigcirc$	$\bigcirc \times \square$
$(\square \times \bigcirc) \times \hexagon$	$\square \times (\bigcirc \times \hexagon)$
$\square \div \bigcirc$	$\bigcirc \div \square$
$(\square \div \bigcirc) \div \hexagon$	$\square \div (\bigcirc \div \hexagon)$

- b) Har bir ifodani hisoblang va chap tomondagi natijalarni o'ng tomondagi natijalar bilan taqqoslang. Nimani angladingiz?