

**Operations on Rational Numbers**

We know how to add, subtract, multiply and divide integers as well as fractions. Let us now study these basic operations on rational numbers.

1. **Addition**

While adding rational numbers with same denominators, we add the numerators keeping the denominators same.

**Problem: Find the sum:**

**(i) 5/4 + (-11/4)       (ii) 5/3 + 3/5**

**Solution:**

(i) 5/4 + (-11/4) = 5/4 – 11/4 = (5 - 11)/4 = -6/4 = -3/2

(ii) 5/3 + 3/5 = (5 \* 5)/(3 \* 5) + (3 \* 3)/(5 \* 3)

                        = 25/15 + 9/15

                        = (25 + 9)/15

                        = 34/15 = 2

In the case of rational numbers which do not have same denominator, we first find the LCM of the two denominators. Then, we find the equivalent rational numbers of the given rational numbers with this LCM as the denominator. Then, add the two rational numbers.

**Problem: Find the sum:**

**(i) -9/10 and 22/15                                (ii) -3/(-11) and 5/9**

**Solution:**

**(i)** Given rational numbers are -9/10 and 22/15

LCM of 10 and 15 is 30

Now, -9/10 = (-9 \* 3)/(10 \* 3) = -27/30

22/15 = (22 \* 2)/(15 \* 2) = 44/30

-9/10 + 22/15 = -27/30 + 44/30

                          = (-27 + 44)/30

                          = 17/30

**(ii)** Given rational numbers are -3/-11 and 5/9 = 3/11 and 5/9

LCM of 11 and 9 is 99

Now, 3/11 = (3 \* 9)/(11 \* 9) = 27/99

And 5/9 = (5 \* 11)/(9 \* 11) = 55/99

Now, 3/11 + 5/9 = 27/99 + 55/91

                              = (27 + 55)/91

                              = 82/91

1. **Subtraction**

We do the same process as the addition of two rational numbers but instead of addition, we do the subtraction here.

**Find:**

**(i) 7/24 – 17/36   (ii) 5/63 – (-6)/21  (iii) -6/13 – (-7/15)**

**(iv) -3/8 – 7/11    (v) -2  – 6**

**Solution:**

**(i)** 7/24 – 17/36 = (7 \* 3 – 17 \* 2)/72                 [LCM of 24 and 26 are 72]

                             = (21 - 34)/72

                             = -13/72

**(ii)** 5/63 – (-6)/21 = 5/63 + 6/21                          [LCM of 63 and 21 are 63]

                                = (5 \* 1 + 6 \* 3)/63

                                = (5 + 18)/63

                                = 23/63

**(iii)** -6/13 – (-7/15) = -6/13 + 7/15

                                  = (-6 \* 15 + 7 \* 13)/195      [LCM of 13 and 15 is 195]

                                  = (-90 + 91)/195

                                  = 1/195

**(iv)** -3/8 – 7/11 = (-3 \* 11 – 7 \* 8)/88                 [LCM of 8 and 11 is 88]

                            = (-33 - 56)/88

                            = -89/88

                            = -1

**(v)** -2  – 6 = -19/9 – 6/1

                    = (-19 \* 1 – 6 \* 9)/9                        [LCM of 9 and 1 is 9]

                    = (-19 - 54)/19

                     = -73/9

                      =-8

1. **Multiplication**

**(i)** We find that while multiplying a rational number by a positive integer, we multiply the numerator by that integer, keeping the denominator unchanged.

**(ii)** In the case of fractions, we multiply two rational numbers in the following way:

**Step 1**: Multiply the numerators of the two rational numbers.

**Step 2:** Multiply the denominators of the two rational numbers.

**Step 3:** Write the product as Result of Step 1/Result of Step 2

**Problem: Find the product:**

**(i) 9/2 \* (-7/4) (ii) 3/10 \* (-9)  (iii) -6/5 \* 9/11**

**(iv) 3/7 \* (-2/5)  (v) 3/11 \* 2/5   (vi) 3/(-5) \* 5/3**

**Solution:**

(i) 9/2 \* (-7/4) = {9 \* (-7)}/(2 \* 4) = -63/8 = -7

(ii) 3/10 \* (-9) = {3 \* (-9)}/10 = -27/10 = -2

(iii) -6/5 \* 9/11 = (-6 \* 9)/(5 \* 11) = -54/55

(iv) 3/7 \* (-2/5) = {3 \* (-2)}/(7 \* 5) = -6/35

(v) 3/11 \* 2/5 = (3 \* 2)/(11 \* 5) = 6/55

(vi) 3/(-5) \* (-5/3) = (-3/5) \* (-5/3) = {(-3) \* (-5)}/(5 \* 3) = 15/15 = 1

1. **Division**

To divide one rational number by the other rational numbers we multiply the rational number by the

reciprocal of the other.

**Problem: Find the value of:**

**(i) (-4) ÷ 2/3   (ii) -3/5 ÷ 2   (iii) -4/5 ÷ (-3)   (iv)-1/8 ÷ 3/4**

**(v) -2/13 ÷ 1/7 (vi) -7/12 ÷ (-2/13)  (vii) 3/13 ÷ (-4/65)**

**Solution:**

(i) (-4) ÷ 2/3 = (-4) \* 3/2 = -12/2 = -6

(ii) -3/5 ÷ 2 = -3/5 \* 1/2 = (-3 \* 1)/(5 \* 2) = -3/10

(iii) -4/5 ÷ (-3) = -4/5 \* 1/(-3) = -4/5 \* (-1)/3 = (-4 \* -1)/(5 \* 3) = 4/15

(iv) -1/8 ÷ 3/4 = -1/8 \* 4/3 = (-1 \* 4)/(8 \* 3) = -4/24 = -1/6

(v) -2/13 ÷ 1/7 = -2/13 \* 7/1 = (-2 \* 7)/(13 \* 1) = -14/13 = -1

(vi) -7/12 ÷ (-2/13) = -7/12 \* 13/(-2) = (-7 \* 13)/{12 \* (-2)} = -91/-24 = 91/24 = 3

(vii) 3/13 ÷ (-4/65) = 3/13 ÷ 65/(-4) = (3 \* 65)/{13 \* (-4)} = 195/(-52) = -15/4 = -3