

EXERCISE 1.6

Verify the property: $x \times y = y \times x$ by taking:

(i) $x = -1/3, y = 2/7$

Solution:

By using the property

$$x \times y = y \times x$$

$$-1/3 \times 2/7 = 2/7 \times -1/3$$

$$(-1 \times 2)/(3 \times 7) = (2 \times -1)/(7 \times 3)$$

$$-2/21 = -2/21$$

Hence, the property is satisfied.

(ii) $x = -3/5, y = -11/13$

Solution:

By using the property

$$x \times y = y \times x$$

$$-3/5 \times -11/13 = -11/13 \times -3/5$$

$$(-3 \times -11)/(5 \times 13) = (-11 \times -3)/(13 \times 5)$$

$$33/65 = 33/65$$

Hence, the property is satisfied.

(iii) $x = 2, y = 7/-8$

Solution:

By using the property

$$x \times y = y \times x$$

$$2 \times 7/-8 = 7/-8 \times 2$$

$$(2 \times 7)/-8 = (7 \times 2)/-8$$

$$14/-8 = 14/-8$$

$$-14/8 = -14/8$$

Hence, the property is satisfied.

(iv) $x = 0, y = -15/8$

Solution:

By using the property

$$x \times y = y \times x$$

$$0 \times -15/8 = -15/8 \times 0$$

$$0 = 0$$

Hence, the property is satisfied.

2. Verify the property: $x \times (y \times z) = (x \times y) \times z$ by taking:

(i) $x = -7/3, y = 12/5, z = 4/9$

Solution:

By using the property

$$x \times (y \times z) = (x \times y) \times z$$

$$-7/3 \times (12/5 \times 4/9) = (-7/3 \times 12/5) \times 4/9$$

$$(-7 \times 12 \times 4) / (3 \times 5 \times 9) = (-7 \times 12 \times 4) / (3 \times 5 \times 9)$$

$$-336/135 = -336/135$$

Hence, the property is satisfied.

(ii) $x = 0, y = -3/5, z = -9/4$

Solution:

By using the property

$$x \times (y \times z) = (x \times y) \times z$$

$$0 \times (-3/5 \times -9/4) = (0 \times -3/5) \times -9/4$$

$$0 = 0$$

Hence, the property is satisfied.

(iii) $x = 1/2, y = 5/-4, z = -7/5$

Solution:

By using the property

$$x \times (y \times z) = (x \times y) \times z$$

$$1/2 \times (5/-4 \times -7/5) = (1/2 \times 5/-4) \times -7/5$$

$$(1 \times 5 \times -7) / (2 \times -4 \times 5) = (1 \times 5 \times -7) / (2 \times -4 \times 5)$$

$$-35/-40 = -35/-40$$

$$35/40 = 35/40$$

Hence, the property is satisfied.

(iv) $x = 5/7, y = -12/13, z = -7/18$

Solution:

By using the property

$$x \times (y \times z) = (x \times y) \times z$$

$$5/7 \times (-12/13 \times -7/18) = (5/7 \times -12/13) \times -7/18$$

$$(5 \times -12 \times -7) / (7 \times 13 \times 18) = (5 \times -12 \times -7) / (7 \times 13 \times 18)$$

$$420/1638 = 420/1638$$

Hence, the property is satisfied.

3. Verify the property: $x \times (y + z) = x \times y + x \times z$ by taking:

(i) $x = -3/7, y = 12/13, z = -5/6$

Solution:

By using the property

$$x \times (y + z) = x \times y + x \times z$$

$$-3/7 \times (12/13 + -5/6) = -3/7 \times 12/13 + -3/7 \times -5/6$$

$$-3/7 \times ((12 \times 6) + (-5 \times 13))/78 = (-3 \times 12)/(7 \times 13) + (-3 \times -5)/(7 \times 6)$$

$$-3/7 \times (72 - 65)/78 = -36/91 + 15/42$$

$$-3/7 \times 7/78 = (-36 \times 6 + 15 \times 13)/546$$

$$-1/26 = (196 - 216)/546$$

$$= -21/546$$

$$= -1/26$$

Hence, the property is verified.

(ii) $x = -12/5, y = -15/4, z = 8/3$

Solution:

By using the property

$$x \times (y + z) = x \times y + x \times z$$

$$-12/5 \times (-15/4 + 8/3) = -12/5 \times -15/4 + -12/5 \times 8/3$$

$$-12/5 \times ((-15 \times 3) + (8 \times 4))/12 = (-12 \times -15)/(5 \times 4) + (-12 \times 8)/(5 \times 3)$$

$$-12/5 \times (-45 + 32)/12 = 180/20 - 96/15$$

$$-12/5 \times -13/12 = 9 - 32/5$$

$$13/5 = (9 \times 5 - 32 \times 1)/5$$

$$= (45 - 32)/5$$

$$= 13/5$$

Hence, the property is verified.

(iii) $x = -8/3, y = 5/6, z = -13/12$

Solution:

By using the property

$$x \times (y + z) = x \times y + x \times z$$

$$-8/3 \times (5/6 + -13/12) = -8/3 \times 5/6 + -8/3 \times -13/12$$

$$-8/3 \times ((5 \times 2) - (13 \times 1))/12 = (-8 \times 5)/(3 \times 6) + (-8 \times -13)/(3 \times 12)$$

$$-8/3 \times (10 - 13)/12 = -40/18 + 104/36$$

$$-8/3 \times -3/12 = (-40 \times 2 + 104 \times 1)/36$$

$$2/3 = (-80 + 104)/36$$

$$= 24/36$$

$$= 2/3$$

Hence, the property is verified.

(iv) $x = -3/4, y = -5/2, z = 7/6$

Solution:

By using the property

$$x \times (y + z) = x \times y + x \times z$$

$$-3/4 \times (-5/2 + 7/6) = -3/4 \times -5/2 + -3/4 \times 7/6$$

$$-3/4 \times ((-5 \times 3) + (7 \times 1))/6 = (-3 \times -5)/(4 \times 2) + (-3 \times 7)/(4 \times 6)$$

$$-3/4 \times (-15 + 7)/6 = 15/8 - 21/24$$

$$-3/4 \times -8/6 = (15 \times 3 - 21 \times 1)/24$$

$$-3/4 \times -4/3 = (45 - 21)/24$$

$$1 = 24/24$$

$$= 1$$

Hence, the property is verified.

4. Use the distributivity of multiplication of rational numbers over their addition to simplify:

(i) $3/5 \times ((35/24) + (10/1))$

Solution:

$$3/5 \times 35/24 + 3/5 \times 10$$

$$1/1 \times 7/8 + 6/1$$

By taking LCM for 8 and 1 which is 8

$$7/8 + 6 = (7 \times 1 + 6 \times 8)/8$$

$$= (7 + 48)/8$$

$$= 55/8$$

(ii) $-5/4 \times ((8/5) + (16/5))$

Solution:

$$-5/4 \times 8/5 + -5/4 \times 16/5$$

$$-1/1 \times 2/1 + -1/1 \times 4/1$$

$$-2 + -4$$

$$-2 - 4$$

$$-6$$

(iii) $2/7 \times ((7/16) - (21/4))$

Solution:

$$2/7 \times 7/16 - 2/7 \times 21/4$$

$$1/1 \times 1/8 - 1/1 \times 3/2$$

$$1/8 - 3/2$$

By taking LCM for 8 and 2 which is 8

$$1/8 - 3/2 = (1 \times 1 - 3 \times 4)/8$$

$$= (1 - 12)/8$$
$$= -11/8$$

(iv) $3/4 \times ((8/9) - 40)$

Solution:

$$3/4 \times 8/9 - 3/4 \times 40$$

$$1/1 \times 2/3 - 3/1 \times 10$$

$$2/3 - 30/1$$

By taking LCM for 3 and 1 which is 3

$$2/3 - 30/1 = (2 \times 1 - 30 \times 3)/3$$

$$= (2 - 90)/3$$

$$= -88/3$$

5. Find the multiplicative inverse (reciprocal) of each of the following rational numbers:

(i) 9

(ii) -7

(iii) $12/5$

(iv) $-7/9$

(v) $-3/-5$

(vi) $2/3 \times 9/4$

(vii) $-5/8 \times 16/15$

(viii) $-2 \times -3/5$

(ix) -1

(x) $0/3$

(xi) 1

Solution:

(i) The reciprocal of 9 is $1/9$

(ii) The reciprocal of -7 is $-1/7$

(iii) The reciprocal of $12/5$ is $5/12$

(iv) The reciprocal of $-7/9$ is $9/-7$

(v) The reciprocal of $-3/-5$ is $5/3$

(vi) The reciprocal of $2/3 \times 9/4$ is

Firstly solve for $2/3 \times 9/4 = 1/1 \times 3/2 = 3/2$

∴ The reciprocal of $3/2$ is $2/3$

(vii) The reciprocal of $-5/8 \times 16/15$

Firstly solve for $-5/8 \times 16/15 = -1/1 \times 2/3 = -2/3$

∴ The reciprocal of $-2/3$ is $3/-2$

(viii) The reciprocal of $-2 \times -3/5$

Firstly solve for $-2 \times -3/5 = 6/5$

∴ The reciprocal of $6/5$ is $5/6$

(ix) The reciprocal of -1 is -1

(x) The reciprocal of $0/3$ does not exist

(xi) The reciprocal of 1 is 1

6. Name the property of multiplication of rational numbers illustrated by the following statements:

(i) $-5/16 \times 8/15 = 8/15 \times -5/16$

(ii) $-17/5 \times 9 = 9 \times -17/5$

(iii) $7/4 \times (-8/3 + -13/12) = 7/4 \times -8/3 + 7/4 \times -13/12$

(iv) $-5/9 \times (4/15 \times -9/8) = (-5/9 \times 4/15) \times -9/8$

(v) $13/-17 \times 1 = 13/-17 = 1 \times 13/-17$

(vi) $-11/16 \times 16/-11 = 1$

(vii) $2/13 \times 0 = 0 = 0 \times 2/13$

(viii) $-3/2 \times 5/4 + -3/2 \times -7/6 = -3/2 \times (5/4 + -7/6)$

Solution:

(i) $-5/16 \times 8/15 = 8/15 \times -5/16$

According to commutative law, $a/b \times c/d = c/d \times a/b$

The above rational number satisfies commutative property.

(ii) $-17/5 \times 9 = 9 \times -17/5$

According to commutative law, $a/b \times c/d = c/d \times a/b$

The above rational number satisfies commutative property.

(iii) $7/4 \times (-8/3 + -13/12) = 7/4 \times -8/3 + 7/4 \times -13/12$

According to given rational number, $a/b \times (c/d + e/f) = (a/b \times c/d) + (a/b \times e/f)$

Distributivity of multiplication over addition satisfies.

(iv) $-5/9 \times (4/15 \times -9/8) = (-5/9 \times 4/15) \times -9/8$

According to associative law, $a/b \times (c/d \times e/f) = (a/b \times c/d) \times e/f$

The above rational number satisfies associativity of multiplication.

(v) $13/-17 \times 1 = 13/-17 = 1 \times 13/-17$

Existence of identity for multiplication satisfies for the given rational number.

(vi) $-11/16 \times 16/-11 = 1$

Existence of multiplication inverse satisfies for the given rational number.

(vii) $2/13 \times 0 = 0 = 0 \times 2/13$

By using $a/b \times 0 = 0 \times a/b$

Multiplication of zero satisfies for the given rational number.

(viii) $-3/2 \times 5/4 + -3/2 \times -7/6 = -3/2 \times (5/4 + -7/6)$

According to distributive law, $(a/b \times c/d) + (a/b \times e/f) = a/b \times (c/d + e/f)$

The above rational number satisfies distributive law.

7. Fill in the blanks:

(i) The product of two positive rational numbers is always...

(ii) The product of a positive rational number and a negative rational number is always....

(iii) The product of two negative rational numbers is always...

(iv) The reciprocal of a positive rational numbers is...

(v) The reciprocal of a negative rational numbers is...

(vi) Zero has Reciprocal.

(vii) The product of a rational number and its reciprocal is...

(viii) The numbers ... and ... are their own reciprocals.

(ix) If a is reciprocal of b, then the reciprocal of b is.

(x) The number 0 is ... the reciprocal of any number.

(xi) reciprocal of $1/a$, $a \neq 0$ is ...

(xii) $(17 \times 12)^{-1} = 17^{-1} \times \dots$

Solution:

(i) The product of two positive rational numbers is always positive.

(ii) The product of a positive rational number and a negative rational number is always negative.

(iii) The product of two negative rational numbers is always positive.

(iv) The reciprocal of a positive rational numbers is positive.

- (v) The reciprocal of a negative rational numbers is negative.
- (vi) Zero has no Reciprocal.
- (vii) The product of a rational number and its reciprocal is 1.
- (viii) The numbers 1 and -1 are their own reciprocals.
- (ix) If a is reciprocal of b, then the reciprocal of b is a.
- (x) The number 0 is not the reciprocal of any number.
- (xi) reciprocal of $1/a$, $a \neq 0$ is a.
- (xii) $(17 \times 12)^{-1} = 17^{-1} \times 12^{-1}$

8. Fill in the blanks:

(i) $-4 \times 7/9 = 7/9 \times \dots$

Solution:

$$-4 \times 7/9 = 7/9 \times -4$$

By using commutative property.

(ii) $5/11 \times -3/8 = -3/8 \times \dots$

Solution:

$$5/11 \times -3/8 = -3/8 \times 5/11$$

By using commutative property.

(iii) $1/2 \times (3/4 + -5/12) = 1/2 \times \dots + \dots \times -5/12$

Solution:

$$1/2 \times (3/4 + -5/12) = 1/2 \times 3/4 + 1/2 \times -5/12$$

By using distributive property.

(iv) $-4/5 \times (5/7 + -8/9) = (-4/5 \times \dots) + -4/5 \times -8/9$

Solution:

$$-4/5 \times (5/7 + -8/9) = (-4/5 \times 5/7) + -4/5 \times -8/9$$

By using distributive property.