Class 9th Math Exercise No.8

Q. 1 Choose the correct option.
(i) Which of the following expressions is: often related to inductive
(a) Based on repeated reasoning? (b) If and only if experiments
(c) Statement is proven by theorem (d) Based on general principles °
(ii) Which of the following sentences describe deductive
(a) General conclusions from a limited number of observations.
(b)Based on repeated experiments
(c) Based on units of information that are accurate
(d) Draw conclusion from well-known facts
(iii) Which one of the following statements is true?
(a) The set of integers in finite
(b) The sum of the interior angles of any quadrilateral is always $180°$
(c) $\frac{22}{7} \notin Q'$
(d) All isosceles triangles are equilateral triangles.
(iv) Which of the following statements is the best to represent the negation of the statement "The stove is burning"?
(a) The stove is not burning. (b) The stove is dim
(c) The stove is turned to low heat (d) It is both burning and not burning
(v) The conjunction of two statements p and q is the true when:
(a) Both p and q are false (b) Both p and q are true (c) Only q is true
(d) Only p is true
(vi) A conditional is regarded as falso only when:
(a) Antecedent is true and consequent is false (b) Consequent is true and antecedent is false
(c) Antecedent is true only (d) Consequent is false only.
(vii) Contrapositive of $q \rightarrow p$ is:
(a) $q \rightarrow\sim p$ (b) $q \rightarrow\sim p$ (c) $\sim p \rightarrow\sim q$ (d) $\sim q \rightarrow\sim p$
(viii) The statement "Every integer greater than 2 is a sum of two prime numbers" is:
(a) theorem (b) conjecture (c) axiom (d) postulates
(ix) The statement "A straight line can be drawn between any two points" is: (a) theorem (b) conjecture (c) axiom (d) logic
(x) The statement "The sum of the interior angle of a triangle is $180°''$ is:
(a) converse (b) theorem (c) axiom (d) conditional

i	a	ii	d	iii	c	iv	a	v	b
vi	a	vii	c	viii	b	ix	c	x	b

Multiple Choice Questions (Additional)
Multiple Choice
1.Who is considered Father of formal logic?
(a)Aristotle (b) Alfred Noth (c) Bertrand Russell (d) Kurt Godel
2. The conjunction of two statements p and q is denoted by:
(a)$\mathrm{p} \wedge \mathrm{q}$ (b) $p \vee q$ (c) $\sim p \wedge\sim q$ (d) $\sim p \vee\sim q$
3. The disjunction of two statements p and q is denoted by:
(a)$\mathrm{p} \wedge \mathrm{q}$ (b) $p \vee q$ (c) $\sim p \wedge\sim q$ (d) $-p^{v}-q$
4. The conjunction of negations of two statements p and q is denoted by: 09308026
(a) $\mathrm{p} \wedge \mathrm{q}$ (b) $p \vee q$ (c) $\sim \mathrm{p} \wedge\sim \mathrm{q}$ (d) $\sim \mathrm{p} \vee\sim \mathrm{q}$
5. The disjunction of negation of two statements p and q is denoted by: 09308027
(a) $p \wedge q$ (b) $p \vee q$ (c) $\sim p \wedge\sim q$ (d) $\sim p \vee\sim q$
6. The negation of statement p is denoted by:
(a) $\wedge \mathrm{p}$ (b) $\vee \mathrm{p}$ (c) $\sim \mathrm{p}$ (d) $-p$
7. The conjunction p & q is True when p and q are
(a) T,T (b) T,F (c) F,T (d) F,F
8. The disjunction $p \vee q$ is False when p and q are
(a) T,T (b) T,F (c) F,T (d) F,F
4. Any conditional and it--------------are equivalent.
(a) negation (b) contrapositive (c) converse (d) Inverse
10. Which of the following is the odd number for $k \in \mathbb{N}$?
(a) $\mathrm{k}+1$ (b) 2 k (c) $2k+1$ (d) $2\mathrm{k}+2$
11. If $a=b, b=c$ then $a=c$ is an example of
(a) axiom (b) postulate (c) theorem (d) proof
12. The statement that has been proved true based on previously known facts is:
(a) axiom (b) postulate (c) theorem (d) proof
Answer Key

1	a	2	a	3	b	4	c	5	d	6	c	7	a	8	d	9	b	10	c
11	a	12	c																

Q. 2 Write the converse, inverse and contrapositive of the following conditionals:

(i) $\sim p \rightarrow q$

Solution:

$\sim p \rightarrow q$

Converse: $q \rightarrow \sim p$

Inverse: $p \rightarrow \sim q$

Contra positive: $\sim q \rightarrow p$

(ii) $q \rightarrow p$

solution:

$q \rightarrow p$

Converse: $p \rightarrow q$

Inverse: $\sim q \rightarrow \sim p$

Contra positive: $\sim p \rightarrow \sim q$

(iii) $\sim p \rightarrow \sim q$

Solution

$\sim p \rightarrow \sim q$

Converse: $\sim q \rightarrow \sim p$

Inverse: $p \rightarrow q$

Contra positive: $q \rightarrow p$

(iv) $\sim q \rightarrow \sim p$

Solution:

Converse: $\sim p \rightarrow \sim q$

Inverse: $q \rightarrow p$

Contrapositive: $p \rightarrow q$

Q. 3 Write the truth table of the following

(i) $\sim (p \vee q) \vee (\sim q)$

Solution:

p	q	$p \vee q$	$\sim (p \vee q)$	$\sim q$	$\sim (p \vee p) \vee (\sim q)$
T	T	T	F	F	F
T	F	T	F	T	T
F	T	T	F	F	F
F	F	F	T	T	T

(ii) $\sim (\sim q \vee \sim p)$
Solution:

p	q	$\sim p$	$\sim q$	$(\sim qv \sim p)$	$\sim (\sim qv \sim p)$
T	T	F	F	F	T
T	F	F	T	T	F
F	T	T	F	T	F
F	F	T	T	T	F

(iii) $(q \vee p) \leftrightarrow (p \wedge q)$
Solution:

p	q	pvq	$p \wedge q$	$(p \vee q) \leftrightarrow\rightarrow (p - p)$
T	T	T	T	T
T	F	T	F	F
F	T	T	F	F
F	F	F	F	T

Q. 4 Differentiate between Mathematical Statement and its proof and provide two examples.
Solution
A sentence or mathematical expression which may be true or false but not both is called a statement. This is correct so far as mathematics and other sciences are concerned. For instance, the statement $a = b$ can be either true or false.
We can think of a mathematical statement as a unit of information that is either accurate or inaccurate.
Here, we discuss some examples of mathematical statements are:
(i) For a non-zero real number x and integers m and n , we have: $\mathrm{x}^{\mathrm{m}} \cdot \mathrm{x}^{\mathrm{n}} = x^{\mathrm{m+n}}$.
integers m and n , we have: $\mathrm{x}^{\mathrm{m}} \cdot \mathrm{x}^{\mathrm{n}} = x$
(ii) The sum of the measures of the interior angles of a triangle is 180°
(iii) The circumference of a circle with radius r is $2\pi\mathrm{r}$.
(iv) $\mathrm{Q} \subseteq \mathrm{R}$ (The set of rational numbers is a subset of the set of real

numbers).

Mathematical Proof

A proof is a step-by-step logical explanation to establish the truth of a mathematiczal statement. It is a detailed and logical procedure which explains how the statement is true. The proof involves axioms, postulates theorems, and logical deductions.

Example

Proof involves the properties of parallel lines and alternate interior angles to show that the sum of the three angles is 180°.

(ii) Proof involves the properties of sum of angles on a point on the line is 180°.

Q. 5 What is the difference between an axiom and a theorem? Provide examples of each.

Solution:

A theorem is a mathematical statement that has been proved true based on previously known facts. For example, the following statements are theorem:

(1) Theorem: The sum of the interior angles of a quadrilateral is 360 degrees.

(ii) The fundamental Theorem of Arithmetic: Every integer greater than I can be uniquely expressed as a product of prime numbers up to the order of the factors:

An Axiom is a mathematical statement that we believe to be true without any evidence or requiring any proof. For example, the following are the statements of axioms.

Axiom: Through a given point, infinitely many lines can pass.

Euclid Axioms: A straight line can be drawn between any two points.

Q. 6 What is the importance of logical reasoning in mathematical proofs? Give an example to illustrate your point.

Solution.

Logic is a systematic method of reasoning that enables one to interpret the meanings of statements, examine their truth, and deduce new information from existing facts. Logic plays a role in problem-solving and decision-making.

We generally use logic in our daily life while engaging in mathematics. For example, we often draw general conclusion from a limited number of observations or experiences. A person gets a penicillin injection once or twice and experiences a reaction soon afterward. He generalizes that he is allergic to penicillin. This way of drawing conclusions is called induction. Inductive reasoning is helpful in natural sciences, where we must depend upon repeated experiments or observations. In fact greater part of our knowledge is based on induction.

(ii) Statement: "The sum of two odd numbers is always even."

Solution:

"The sum of two odd numbers is always even."

Proof: If m and n be any two numbers then 2m and 2n are even numbers. [multiple of 2] $2m+1$ and $2n+1$ are odd numbers [even+1 = odd]

Sum: $(2n+1)+(2n+1)$

$=2m+2n+2$

$=2(m+n+1)$

Being multiple of 2 the sum of even numbers.

Q. 7 Indicate each of the following whether it is an axiom, conjecture, or theorem, and explain your reasoning.

(i) "There is exactly one straight line through any two points."

Solution:

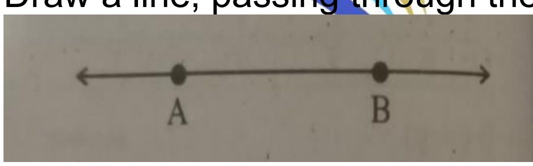
"Through any two points, there is exactly one straight line."

The statement is an Axiom.

Explanation

Take two points A and B in a plane.

Draw a line, passing through these points.



Now, try to pass any other lines through the same points A and B you will get the same straight line even after trying several times, so it is our common observation that through any two points, there is exactly one straight line". The statement is self evidence and there is no need to prove it mathematically.

(ii) "Every even number greater than 2 can be written as the sum of two prime numbers."

Solution:

"Every even number greater than 2 can be written as the sum of two prime numbers." The statement is conjecture.

Explanation

Take even numbers greater than 2. Like, 4, $6,8,10,12$ ....

$$4=2+2,6=3+3,8=3+5,10=3+7$$

$$12 = 5 + 7$$

On the base of empirical evidence, it appears to be true but this does not preclude the possibility that cannot be expressed as the sum of two primes. Since, there is need to prove the statement mathematically, so we can say that statement is not proved yet mathematical. So it is a conjecture.

(iii) "The sum of the angles in a triangle is 180 degrees."

Solution:

"The sum of the angles in a triangle is 180 degrees."

The statement is a theorem.

Explanation

The statement is the well known fact of geometry which has been proved mathematical. So it is a geometrical theorem.

Q. 8 Formulate Simple Deductive Proofs

For each of the following algebraic expressions, prove that the LHS is equal to the RHS:

(i) Prove that $(x-4)^2 + 9 = x^2 - 8x + 25$

Solution:

$(x-4)^2 + 9 = x^2 - 8x + 25$

Proof

L.H.S $= (x-4)^2 + 9$

expanding by identity $(a-b)^2 = a^2 - 2ab + b^2$

$= (x)^2 - 2(x)(4) + (4)^2 + 9$

$= x^2 - 8x + 16 + 9$

$= x^2 - 8x + 25$

L.H.S = R.H.S

Hence proved

(ii)Prove that $(x+1)^2 - (x-1)^2 = 4x$

Solution：

$(x+1)^2(x-1)^2 = 4x$

LHS $= (x+1)^2 - (x-1)^2$

$(a+b)^2 = a^2 + 2ab + b^2$

$(a-b)^2 = a^2 - 2ab + b^2$

$= [(x)^2 + (1)^2 + 2(x)(1)] - [(x)^2 + (1)^2 - 2(x)(1)]$

$= (x^2 + 1 + 2x) - (x^2 + 1 - 2x)$

$= x^2 + x + 2x - x^2 - x + 2x$

$= 2x + 2x$

$= 4x$

L.H.S = R.H.S. Hence $(x+1)^2-(x-1)^2=4x$

(iii)Prove that $(x+5)^2-(x-5)^2=20x$

Solution：

$(x+5)^2-(x-5)^2=20x$

L.H.S $=(x+5)^2-(x-5)^2$

$=[(x)^2+(5)^2+2(x)(5)]-[(x)^2+(5)^2-2(x)(5)]$

$=(x^2+25+10x)-(x^2+25-10x)$

$=x^2+25+10x-x^2-25+10x$

$=10x+10x$

L.H.S $=20x$

L.H.S = RH.S

Hence, $(x+5)^2-(x-5)^2=20x$

Q.9 Prove the following by justifying each step.

(i) $\dfrac{4+16x}{4}=1+4x$

Solution：

L.H.S $=\dfrac{4+16x}{4}=\dfrac{1}{4}(4+16x)\left(\dfrac{a}{b}=a\times\dfrac{1}{b}\right)$

$=\dfrac{1}{4}(1\times4+4\times4x)$ (Multiplicative identity)

$=\dfrac{1}{4}\times4(1+4x)$ (Dismibutive laws)

$=1(1+4x)$ (Multiplicative inverse)

$=1+4x$ ($\because$ Multiplicative identity)

L.H.S = R.H.S

Thus $\frac{4+16x}{4} = 1 + 4x$, hence proved.

(ii) $\frac{6x^2+18x}{3x^2-9} = \frac{2x}{x-3}$

Solution:

$$\frac{6x^2+18x}{3x^3-9}\frac{2x}{x-3}$$

$$\text{L.H.S } = \frac{6x^3+18x}{3x^2-3}$$

$$= \frac{6\times x^2+6\times 3x}{3\times x^2-3\times 1} \quad \text{Factorization}$$

$$= \frac{6x(x+3)}{3\left(x^2-9\right)} \quad (\text{ H Distributive law})$$

$$= \frac{1}{3}\times\frac{3\times 2x(x+3)}{x^2-3^2} \quad \text{"Factors of } 6x''$$

$$= \frac{1\times 2x(x+3)}{(x+3)(x-3)} \text{ (Multiplicative inverse)}$$

$$= \frac{2x(x+3)}{(x+3)(x-3)} \text{ (Multiplicative identity)}$$

$$= \frac{1(x+3)}{(x+3)}\times\frac{(2x)}{x-3} \quad (\,x\text{ - b}^2 = (a+\text{b})(a-\text{b})$$

$$= \frac{1}{(x+3)}\times(x+3)\times\frac{(2x)}{(x-3)} \text{ Multiplicative identity}$$

$$= \frac{1\times(2x)}{x-3} \text{ Multiplicative inverse}$$

$$= \frac{2x}{x-3} \quad \text{Multiplicative inverse}$$

$$\text{L.H.S } = \text{ R.H.S}$$

Thus $\frac{6x^2+18x}{3(x^2-9)} = \frac{2x}{x+3}$, hence proved

(iii) $\frac{x^2+7x+10}{x^2-3x-10} = \frac{x+5}{x-5}$

Solution:

$$\frac{x^2+7x+10}{x^2-3x-10}$$

$$\text{L.H.S } = \frac{x^2 + 2x + 5x + 10}{x^2 - 5x + 2x - 10}$$

$$= \frac{x(x+2) + 5(x+2)}{x(x-5) + 2(x-5)} (\because \text{ Distributive law })$$

$$= \frac{(x+2)(x+5)}{(x-5)(x+2)} \ (\because \text{ Distributive law })$$

$$= \frac{(x+2)(x+5)}{(x+2)(x-5)} \ \text{ (Commutative law)}$$

$$= \frac{1}{(x+2)} \times (x+2) \times \frac{(x+5)}{(x-5)} \left(\because \frac{a}{b} = a \times \frac{1}{b}\right)$$

$$= \frac{(x+5)}{(x-5)} \ \text{ (Multiplicative inverse)}$$

L.H.S = R.H.S Hence proved.

Q. 10 Suppose x is an integer. If x is odd then $9x + 4$ is odd.

Solution:

Proof:

Given expression $9x + 4$

If an integer x is odd then it can be written as:

x = 2k+| where $k \in$?

Put $x = 2\mathrm{k} + 1$ in given expression

$$9x + 4 = 9(2k + 1)$$
$$= 18k + 9 + 4$$
$$= 18k + 13$$
$$= 18k + 12 + 1$$
$$= 2(9k + 6) + 1$$

Being multiple of 2 the term $2(9k + 6)$ is clearly even.

$$9x + 4 = \text{ Even } + 1$$
$$9x + 4 = \text{ Odd } [\text{ Even } + 1 = \text{ Odd }]$$

Hence it is proved that if an integer x is odd the $9x + 4$ is an odd.

Q. 11 Suppose x is an integer. If x is odd then $7x + 5$ is even.

Solution:

Proof:

Given expression $= 7x + 5$

If an integer x is odd then it can be written as:

$x = 2\mathrm{k} + 1$ where $\mathrm{k} \in Z$

Put $x = 2\mathrm{k} + 1$ in given expression

$7x + 5 = 7(2k + 1) + 5$
$= 14k + 7 + 5$
$= 14k + 12$
$= 2(7k + 6)$
$7x + 5 =$ Even
(Multiple of 2)
Since k is an integer therefore $7k + 6$ is also an integer and being a multiple of 2 the result $2(7k + 6)$ is even.
Hence it is proved that if an integer x is odd the $7x + 5$ is an Even.
Q. 12 Prove the following statement:
(a) If x is an odd integer then show that $x^2 - 4x + 6$ is odd.
Proof:
Given expression $= x^2 - 4x + 6$
If an integer x is odd then it can be written as:
$t = 2\mathrm{k} + 1$ where $\mathrm{k} \in \mathrm{Z}$
Put $x - 2\mathrm{k} + 1$ in given expression
$x^2 - 4x + 6 = (2k + 1)^2 - 4(2k + 1) + 6$
$= (2k)^2 + (1)^2 + 2(2k)(1) - 8k - 4 + 6$
$= 4k^2 + 1 + 4k - 8k + 2$
$= 4k^2 - 4k + 2 + 1$
$= 2(2k^2 - 2k + 1) + 1$
Being multiple of 2 the expression $2(2k^2 - 2k + 1)$ is an even for any integer k.
$x^2 - 4x + 6 =$ Even $+1$
Since adding 1 to even number forms Odd number so,
$x^2 - 4x + 6 = 0$ Odd
Hence proved if x is an odd integer then $x^2 - 4x + 6$ is odd.
(b) If x is an even integer then show that $x^2 + 2x + 4$ is even.
Proof:
Given expression $= x^2 + 2x + 4$
If an integer x is odd then it can be written as:
$x = 2\mathrm{k}$ where $\mathrm{k} \in \mathrm{Z}$
Put $x = 2\mathrm{k}$ in given expression
$x^2 + 2x + 4 = (2k)^2 + 2(2k) + 4$
$= 4k^2 + 4k + 4$
$= 4k^2 + 4k + 4$
$= 2(2k^2 + 2k + 2)$

Being multiple of 2 the expression $2(2k^2 + 2k + 2)$ is an even for any integer k. $x^2 + 2x + 4 =$ Even

Hence proved if x is an even integer then $x^2 + 2x + 4$ is even.

Q. 13 Prove that for any two non-empty set A and $B, (A \cap B)' = A' \cup B'$.

Solution:

Proof:

Let $x \in (A \cap B)$

$\Rightarrow x \notin (\mathrm{A} \cap \mathrm{B})$

$\Rightarrow x \notin \mathrm{A}$ or $x \notin \mathrm{B}$

$\Rightarrow x \in \mathrm{A}$ or $x \in \mathrm{B}'$

$\Rightarrow x \in (\mathrm{A} \cup \mathrm{B}')$

But $x \in (A \cap B)$ is an arbitrary element.

Therefore $(A \cap B) \subseteq (A \cup B)$

Let $y \in (A \cup B)$

$\Rightarrow y \in A$ or $y \in B$

$\Rightarrow y \notin A$ or $y \notin B$

$\Rightarrow y \notin (A \cap B)$

$\Rightarrow y \in (A \cap B)$

$\Rightarrow (A \cup B) \subseteq (A \cap B)$

From equation (i) and (ii) we conclude that $(A \cap B) = A \cup B$.

Hence proved

Alternate Method:

$(A \cap B)' = A' \cup B'$

The logical form of the theorem is:

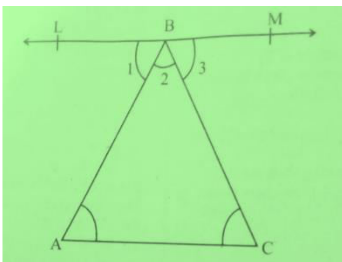
$$\sim (p \wedge q) = \sim p \vee q$$

p	q	$\sim p$	$\sim q$	$(p \wedge q)$	$\sim (p \wedge q)$	$\sim p \vee \sim q$
T	T	F	F	T	F	F
T	F	F	T	F	T	T
F	T	T	F	F	T	T
F	F	T	T	F	T	T

From the last two columns of the truth table we observe that $\sim (p \wedge q) = \sim p \vee \sim q$

Hence, $(A \cap B)' = A' \cup B'$

Q. 14 If x and y are positive real numbers and $x^2 < y^2$ then $x < y$.
Solution:
$x^2 < y^2$ then $x < y$
$x^2 < y^2$
Given that $\mathrm{x} > 0, \mathrm{y} > 0$ square is defined for positive numbers.
$\Rightarrow \sqrt{x^2} < \sqrt{y^2}$
$\Rightarrow x < y$
Q. 15 The sum of the interior angle of a triangle is $180°$
Solution:
triangle is 180
Given: $\triangle ABC$



To prove
$\mathrm{m}\angle \mathrm{A} + \mathrm{m}\angle \mathrm{B} + \mathrm{m}\angle \mathrm{C} = 180$
construction
Passing through vertex B , draw $\overline{\mathrm{LM}} \| \overline{\mathrm{AC}}$.
Proof.

$\mathrm{m}\angle 1 + \mathrm{m}\angle 2 + \mathrm{m}\angle 3 = 180°$ ..... (i)	Sum of st. Line angles
$\mathrm{m}\angle 1 + \mathrm{m}\angle \mathrm{A}$ .... (ii)	Alternate angles are equal.
$\mathrm{m}\angle 2 = \mathrm{m}\angle \mathrm{ABC}$ (iii)	From figure
$\mathrm{m}\angle 3 = \mathrm{m}\angle \mathrm{C}$ ... (iv)	Alternate angles are equal.
Now (i) can be written as	
$\mathrm{m}\angle \mathrm{A} + \mathrm{m}\angle \mathrm{ABC} + \mathrm{m}\angle \mathrm{C} = 180°$	From (i), (ii), (iii) and (iv)
$\mathrm{m}\angle \mathrm{A} + \mathrm{m}\angle \mathrm{B} + \mathrm{m}\angle \mathrm{C} = 180°$	$\mathrm{m}\angle \mathrm{ABC} = \mathrm{m}\angle \mathrm{B}$

Hence, the sum of the interior angles of a triangle is $180°$.
Q. 16 If a, b and c are non-zero real numbers prove that:
(a) $\frac{a}{b} = \frac{c}{d} \Leftrightarrow ad = bc$
Solution:

$\frac{a}{b} = \frac{c}{d}$
Multiplying sides by bd
$\frac{a}{b}(bd) = \frac{c}{d}(bd)$
By commutative property $\mathrm{bd} = \mathrm{db}$
$\frac{a \cdot 1}{b}(bd) = \frac{c \cdot 1}{d}(db)$
By associative property
$a\left(\frac{1}{\mathrm{b}} \cdot \ \mathrm{b}\right)\mathrm{d} = \mathrm{c}\left(\frac{1}{\mathrm{d}} \cdot \ \mathrm{d}\right)\mathrm{b}$
$a(1)\mathrm{d} = \mathrm{c}(1)\mathrm{b}$ (Multiplicative inverse)

$ad = cb$
$ad =$ bc
Again.
ad=bc
Multiplicative identity
$(\ cb = bc)$

Multiplying B.S by $\left(\frac{1}{b}, \frac{d}{d}\right)$
$ad\left(\frac{1}{b}, \frac{1}{d}\right) = bc\left(\frac{1}{b}, \frac{1}{d}\right)$
By associative property.
a. $\frac{\mathrm{l}}{\mathrm{b}} \times \mathrm{d}, \frac{\mathrm{l}}{\mathrm{d}} = \mathrm{b}, \frac{\mathrm{l}}{\mathrm{b}} \times \mathrm{c}, \frac{\mathrm{l}}{\mathrm{d}} =$
$\frac{a}{b} \times \mathrm{I} - \mathrm{l} \times \frac{c}{d}$ (Multiplicative inverse)
$\frac{a}{b} = \frac{c}{d}$ (Multiplicative identity)
(b) $\frac{a}{\mathrm{b}} \cdot \frac{\mathrm{c}}{\mathrm{d}} = \frac{ac}{\mathrm{bd}}$
Solution:
$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$
L.H.S $= \frac{a}{b}, \frac{c}{d}$
$= \left(a \times \frac{1}{b}\right) \times \left(e \times \frac{1}{d}\right)$ (Multiplicative rule)
$= (a \times c) \times \left(\frac{1}{b} \times \frac{1}{d}\right)$ (Associative property)
$= ac \times \frac{1}{bd}$
$= \frac{ac}{bd}$ (Multiplication rule)

L.H.S $=$ R.H.S

(c) $\frac{a}{b} + \frac{c}{b} = \frac{a+c}{b}$

Solution:

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

L.H.S $= \frac{a}{b} + \frac{c}{b}$

L.H.S $= a \times \frac{1}{b} \times c \times \frac{1}{b}$ (Multiplicative rule)

L.H.S $= (a+c) \times \frac{1}{b}$ (Right distributive property)

L.H.S $= \frac{a+c}{b}$

(Multiplication rule)

L.H.S = R.H.S