MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

BINARY OPERATIONS

Solved Examples

1. Show that the operation * on Z define by

a* b =a+b+1 for all a,b in Z

Satisfies (i) the closure property (ii) the associative law and (iii) the commutative law ltrbgt (iv) find the identity element in Z

(v) what is the inverse iof an element a in Z ?

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2. Show that the opeation * on Q -{1} defined gby a*b=a+b-ab for all a, b $\in$ Q- {1}

Satifies (i) the closure property (ii) the associative law

(iii) the commutative alw

(iv) what is the identity element ?

(v)for each `a in Q-{1} find the inverse of a

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3. On the set N of all natural numbers define the

ooperation * on N by

m*n = gcd (m,n) for all m,n $\in$ N

Show at * is commutative as well as associative

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4. Let A = {1,2,3,4,5} Define on operation v by

$a \vee b = \max \{a, b\}$

Prepare its compostion table

Show that a is closed for the given operation and that the given operation is commutative

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Exercise 3 A

1. Let * be a binary operation defined by $a \cdot b = 3a + 4b - 2$. Find 4*5.

A. 20

B. 25

C. 30

D. 0

Answer: C

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2. The binary operation $\cdot : R \times R \to R$ is defined as $a \cdot b = 2a + b$. Find $(2 \cdot 3) \cdot 4$.

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3. Let * be a binary operation, on the set of all-zero real numbers, given by a*b=$\frac{a.\,b}{5}$ for all

$a, bR - \{0\}$. Find the value of x given that 2*(x*5)=10.

A. 25

B. 30

C. 20

D. 15

Answer: A

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4. Let * $R \times R \rightarrow R$ be a binary operation given by $a \cdot b = a + 4b^2$ Then compute (-5)*(2*0)

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5. Let * be a binary operation on the set Q of all rational number given as a*b=$(2a - b)^2$ for all a,b $\in$ Q find 3*5 and 5*3 Is 3*5=5*3?

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6. Let * be a binary operation on N given by a*b =Lcm of a and b find the value of 20*16

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7. If the binary operation * on the set Z of integers is defined by $a \cdot b = a + 3b^2$, find the value of $2 \cdot 4$.

A. 10

B. 30

C. 50

D. 40

Answer: C

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8. Show that * on Z^+ defined by a*b=|a-b| is not binary operation

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9. Let * be a binary operation on N defined by a*b = a^b for all a,b $\in$ N show that * is neither commutative nor associative

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10. Let a* b =1cm (a,b) for all values of a,b $\in$ N

(i) Find (12*16)

(ii) Show that * is commutative on N

(iii) Find the identity element in N

(iv) Find all invertible elements in N

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11. Let Q^+ be the set of all positive rational numbers

(i) show theat the operation * on Q^+ defined by $a^* b = \frac{1}{2}(a+b)$ is binary operation

(ii) show that * is commutative

(iii) show that * is not associative

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12. Show that the set A ={-1,0,1} is not closed for addition

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13. Show that * on R-{-1} defined by (a*b) $=\frac{a}{b+1}$ is neither commutative nor associative

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14. For all a,b $\in$ R we define a*b =|a-b| Show tha t* commutative but not associative

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15. For all a,b $\in$ N we define a*b =$a^3 + b^3$

Show that * is commutative but not associative

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16. Let x be a nonempty set and * be a binary operation on P(X) the power set of X defiend by A*B =`A cap B for all A,B in P(x) ltrbgt (i)Find the identity element in P(x)

(ii) show that X is the only inveritiable element in P(x)

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17. A binary operation * on the set {0,1,2,3,4,5} is defined as

a*b =

$\{(a+b, \quad \text{if} \quad a+b<6), (a+b-6 \quad \text{if} \quad a+b \geq 6)$

Show that 0 is the identity for this operation and each element a has an inverse(6-a)

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Exercise 3 B

1. Define * on N by m*n =1cm (m,n)

Show that * is a binary operaitn which is commutative as well as associative

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2. Define * on Z by a*b =a-b+ab

show that * is a binary operation operation on z which is neither commutative nor associative

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3. Define * on Z by a*b =a+b-ab

Show that * is a binary operation on Z which is commutative as well as associative

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4. Consider a binary operation on Q -{1} define by a*b =a+b-ab

(i) Find the identity element in Q-{1}

(ii) Show that each a $\in$ Q-{1} has its invese

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5. Let Q_0 be the set of all nonzero reational numbers Let * be a binary operation on Q_0 defined by a*b =$\frac{ab}{4}$ for all a,b $\in Q_0$

(i) Show that * is commutative and associative

(ii) Find the identity element in Q_0

(iii) Find the inverse of an element a in Q_0

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6. On the set Q^+ of all positive rational number define an operation * on Q^+ by a*b = $\frac{ab}{2} \forall a, b \in Q^+$

Show that

(i) * is a binary operation on Q^+

(ii) * is commutative

(iii)* is associative

Find the identify element in Q^+ for *

Whast is the inverse of $a \in Q^+$?

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7. Let $A = N \times N$ Define * on A by

(a,b)*(c,d)=(a+c,b+d)

Show that

(i) A is closed for *

(ii) * is commutative

(iii) * is associative

(iv) identify element does not exist in A

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8. Let A={1,-1,I,-i} hbe the set of four 4th roots of unity prepare the commposition table for multiplication on A and show that ltrbgt (i) A is closed for multiplication

(ii) multiplication is associative on A

(iii) multiplication is commutative on A

(iv) 1 is the multiplicative identity

(v) every element in A has its multiplicative iverse

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