MATHS

BOOKS - PEARSON IIT JEE FOUNDATION

MODULAR ARITHMETIC

Example

1. Construct Caley's table for A = {1,2,3} under addition modulo 5.

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2. Construct Caley's table for the set {0,1,2,3,4} under multiplication modulo 6.

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Test Your Concepts Very Short Answer Type Questions

1. $15 \equiv -3$ (mod 9). (True/False)

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2. $5 \equiv 2 \pmod 4$. (True/False)

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3. $4 \otimes_3 9$ = _____.

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4. The 19th hour of the day is equivalent to hour.

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5. $6 \otimes_4 7$ = _____.

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6. In a certain month, the first Sunday falls on the fifth day of the month. In the same month,

the fourth Sunday falls on the _____day.

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7. In a certain non-leap year, Ist February is Wednesday. Then the last day of the month is also Wednesday. (True/False)

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8. If $63 \equiv 2 \pmod{a}$ and $a > 1$, then a is _____.

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9. If x belongs to the set of residues modulo 4 and $2 + x \equiv 5 \pmod 4$, then x = _____.

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10. If $x \equiv y \pmod m$, then $6x - 5 \equiv 6y - 5 \pmod m$. (True/False).

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11. In the set of integers modulo 5, $16 \otimes_5 7$ = _____.

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12. In te set of integers modulo 6, $35 \otimes_6 5$ = _____.

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13. If $a + 2 \equiv 3 \pmod 6$, then a is _____.

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14. If $6x \equiv 5 \pmod 7$, then find x.

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15. If $x - 4 \equiv 8 \pmod 5$, then x is _____.

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Short Answer Type Questions

1. If x belongs to the set of residues modulo 6 and $5 + x \equiv 3 \pmod 6$, then find x.

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2. If x belongs to the set of residues modulo 4 and $6x - 3 \equiv -1 \pmod 4$, then find x.

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3. If $46 \equiv 11 \pmod a$, and a is a prime number, then find the greatest possible value of a.

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4. If Ist July 2006 was a Saturday, then what day of the week will be 18th July, 2007 ?

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5. If you were born on March 8, 1990 and the day of the week was a Thursday, then on what day of the week did your birthday fall in 1991?

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6. Find the remainder when $(26)^{31}$ is divided by 31.

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7. Find the remainder when 8^{15} is divided by 5.

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8. If A = {0,1,2,3,4,5,6,7,8,9,10}, then list out all the pairs of distinct numbers from set A which are congruent to each other under modulo 5.

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Essay Type Questions

1. Find the remainder when 3^{31} is divided by 31.

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2. If $a \otimes_m b = 1$, then b is called the reciprocal of under modulo m. Find the reciprocal of 8 under modulo 17.

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3. How many two digit numbers satisfy the equations $3x \equiv 5 \pmod 7$?

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Level 1

1. In the set of integers modulo 6, $28 \otimes_8 2$ =_____.

A. 0

B. 1

C. 2

D. 3

Answer: A

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2. If $25 \equiv 4 \pmod{p}$, where p is a prime number, then p is_____.

A. 3

B. 5

C. 7

D. Either (a) or (c)

Answer: D

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3. Solve for x, if $5x \equiv 0 \pmod 4$.

A. 0

B. 3

C. 2

D. 4

Answer: A

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4. In the set of integers modulo 12, $38 \oplus_{12} 28$ =____.

A. 0

B. 3

C. 2

D. 4

Answer: A

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5. The largest single-digit number that satisfies $14x \equiv 4 \pmod 3$ is_____.

A. 5

B. 7

C. 8

D. 9

Answer: C

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6. If 8-8-2009 is a Saturday, then 15-8-2010 falls on_____.

A. Saturday

B. Sunday

C. Wednesday

D. Thursday

Answer: B

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7. If $23 \equiv 7 \pmod{x}$, then which of the following cannot be the value of x?

A. 4

B. 6

C. 8

D. 16

Answer: B

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8. Find the remainder when 13^{15} is divided by 5.

A. 4

B. 3

C. 2

D. 1

Answer: C

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9. Now the time is $1:30$ pm. If I woke up 8 hours ago, then I woke up at_____.

A. $4:30$ pm

B. $5:30$ pm

C. $3:30$ pm

D. $6:30$ pm

Answer: B

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10. If $37 \equiv 18 \pmod{p}$, where p is a prime number then find p.

A. 3

B. 7

C. 19

D. 18

Answer: C

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11. If $15 \equiv 3 \pmod{x}$, then which of the following cannot be the value of x?

A. 3

B. 4

C. 6

D. 8

Answer: D

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12. Find the remainder when 5^{18} is divided by 19.

A. 1

B. 4

C. 11

D. 17

Answer: A

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13. The largest two-digit number that satisfies $5x \equiv 6 \pmod 4$ is _____.

A. 96

B. 97

C. 98

D. 99

Answer: C

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14. If yoy were born on 15-4-1993 which was a Tuesday, then on which day of the week did your birthday fall in 1994 ?

A. Tuesday

B. Wednesday

C. Thursday

D. Monday

Answer: B

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15. Find the remainder when 11^{12} is divided by 7.

A. 0

B. 1

C. 3

D. 5

Answer: B

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Level 2

1. If $a \equiv b$ (mod m) and the remainder obtained when 'a' is divided by m is 2, then find the remainder when 'b' divided by m.

A. 2

B. 1

C. 0

D. 3

Answer: A

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2. If $x \equiv y \pmod 2$, then which of the following are correct ?

(A) x is even and y is odd.

(B) Both x and y are odd.

(C) Both x and y are even.

A. Only (C)

B. Only (A)

C. Both (B) and (C)

D. Both (A) and (B)

Answer: C

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3. If 1-1-2010 is a Friday, then the fifth Sunday of January, 2011 will fall on_____.

A. 26th day

B. 27th day

C. 29th day

D. 30th day

Answer: D

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4. Anand started a work on Sunday at 9:30 am. He finished the work after 87 hours. Then the finished the work on_____.

A. Wednesday at 11 : 30 pm

B. Thursday at 0 : 30 pm

C. Wednesday at 0 : 30 am

D. Thursday at 11 : 30 pm

Answer: B

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5. Which of the following are the common solutions of $3x \equiv 0 \pmod 6$ and $2x \equiv 0 \pmod 4$?

(A) 0 (B) 2 (C) 4

A. Both (A) and (B)

B. Both (A) and (C)

C. Both (B) and (C)

D. All of (A), (B) and (C)

Answer: D

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6. If $5x \equiv 2 \pmod{3}$, then which of the following is a possible value of x?

A. 3

B. 315

C. 0

D. None of these

Answer: D

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7. Which of the following is a common solutions for $6x \equiv 0 \pmod{8}$ and $8x \equiv 0 \pmod{10}$?

A. 0

B. 4

C. 6

D. 8

Answer: A

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8. Fin dthe remainder when 2^{24} is divided by 35.

A. 2

B. 31

C. 1

D. 29

Answer: C

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9. Which of the following is correct ?

A. $5 \oplus_3 2 \equiv 3 \otimes_3 6 \pmod 4$

B. $4 \oplus_3 2 \equiv 3 \otimes_4 5 \pmod 6$

C. $5 \oplus_5 3 \equiv 6 \otimes_8 9 \pmod 3$

D. $5 \oplus_5 3 \equiv 6 \otimes_8 9 \pmod 4$

Answer: C

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10. Which of the following is/are correct ?

A. $5 \oplus_4 3 \equiv 7 \otimes_9 8 \pmod 5$

B. $10 \oplus_5 4 \equiv 9 \otimes_{11} 9 \pmod{11}$

C. $14 \oplus_8 8 \equiv 15 \otimes_{16} 12 \pmod 4$

D. $10 \oplus_5 4 \equiv 9 \otimes_{11} 9 \pmod{10}$

Answer: B

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11. If x belongs to the set of residues modulo 10, then the common solution of $5 + x \equiv 0 \pmod 3$ and $6 + x \equiv 0 \pmod 5$ is _____.

A. 1

B. 2

C. 4

D. 5

Answer: C

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12. By which of the following numbers should 3^5 be divided to obtain a remainder 3 ?

A. 7

B. 11

C. 5

D. 3

Answer: C

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13. Find the remainder when $6^{11} - 6$ is divided by 11.

A. 5

B. 1

C. 0

D. None of these

Answer: C

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14. Find x, if $9x \equiv 2 \pmod{7}$.

A. 1

B. 2

C. 3

D. 4

Answer: A

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15. Find the remainder when 3^{19} is divided by 19.

A. 3

B. 15

C. 16

D. 19

Answer: A

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16. In the set of integers modulo 9, $15 \otimes_9 10$ = _____.

A. 3

B. 6

C. 0

D. 1

Answer: B

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17. If $7x \equiv 1 \pmod{5}$,then which of the following is a possible value of x?

A. 10

B. 11

C. 12

D. None of these

Answer: D

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18. In the set of integers modulo, 17, $19 \oplus_{17} 15$ = _____.

A. 0

B. 1

C. 2

D. 3

Answer: A

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19. In order to enter her name in the Guinness Book of world records, Sangeeta started singing on Monday at 10.30 am. If the sings continuously for 36 hours then she will finish her singing on

A. Tuesday at 10.30 am

B. Wednesday at 10.30 am

C. Tuesday at 10.30 pm

D. Wednesday at 10.30 pm

Answer: C

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20. Which of the following is a common solution of $3x \equiv 2 \pmod 5$ and $4x \equiv 0 \pmod 6$?

A. 9

B. 4

C. 6

D. 3

Answer: A

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Level 3

1. Find the remainder when 3^{215} is divided by 43.

A. 35

B. 28

C. 33

D. 30

Answer: B

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2. Kishore reached his school on Monday at 8:30 am, and them immediately started on a tour to GOA. After $106\frac{1}{2}$ hours, he reached his house. Then, Kishore reached his home on

A. Saturday at 7 pm.

B. Friday at 6pm.

C. Saturday at 6 pm.

D. Friday at 7 pm.

Answer: D

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3. If 1-8-2012 is Wednesday, then find the day on which we shall celebrate our Independence Day in the year 2015.

A. Saturday

B. Sunday

C. Friday

D. Thursday

Answer: A

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4. Find the remainder when 5^{97} is divided by 97.

A. 5

B. 97

C. 92

D. 100

Answer: A

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5. If $a \equiv b \pmod{m}$, then which of the following is not always true ?

A. $a^2 \equiv b^2 \pmod{m}$

B. $a + m \equiv b + m \pmod{2m}$

C. $am \equiv bm \pmod{m^2}$

D. $a + m \equiv b - m \pmod{2m}$

Answer: B

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6. If $x^3 \equiv x \pmod 3$, then x can be _____.

A. 2

B. 5

C. 4

D. All of these

Answer: D

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7. A part of Caley's table for $\otimes_6$ is given below. Find the values of x, y and z.

$\otimes_6$	0	1	2	3	4
0	0	0	0	0	0
1	0	1	2	3	4
2	0	2	4	0	2
3	0	3	0	y	0
4	0	4	z	0	x

A. x =4, y = 3, z =2

B. x =2, y = 4, z =3

C. x = 3, y =4, z =2

D. x =4, y =2, z =3

Answer: A

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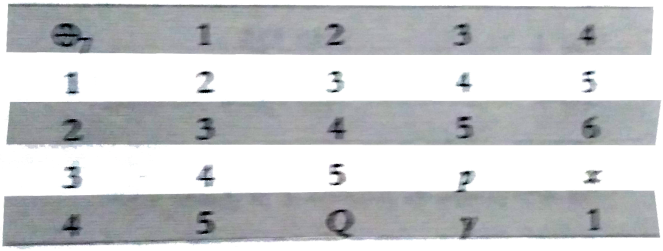
8. A part of Caley's table for $\otimes_7$ is given below. Find the value of p, q, x and y.



$\otimes_7$	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	p	x
4	5	Q	y	1

A. x = y = 0, p = q = 5

B. x = y = 1, p = q = 6

C. $x = y = 3, p = q = 4$

D. $x = y = 0, p = q = 6$

Answer: D

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9. The Indendence Day of India in 2007 was celebrated on a Wednesday, then Children's day in 2008 was celebrated on a _____.

A. Friday

B. Saturday

C. Sunday

D. Monday

Answer: A

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10. If $13 \equiv 3$ (mod p), then p can be

A. 2

B. 5

C. 10

D. All of these

Answer: D

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11. If the 1st January of a certain year, which was not a leap year, was a Thursday, then what day of the week was the 31st December of that year ?

A. Monday

B. Thursday

C. Sunday

D. Saturday

Answer: B

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12. If $x + 10 \equiv 1 \pmod{8}$, then x can be _____.

A. 1

B. 0

C. 6

D. 7

Answer: D

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13. If x belongs to the set of residues modulo 6 and $3 + x \equiv 2 \pmod 6$, then x = _____.

A. 1

B. 3

C. 4

D. 5

Answer: D

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14. The 2-1-2009 is a Friday. The fourth Sunday of January 2010 falls on the _____.

A. 23rd day

B. 24th day

C. 25th day

D. 26th day

Answer: B

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15. Which of the following is/are correct ?

A. $5 \oplus_2 4 \equiv 17 \otimes_5 3 \pmod 7$

B. $6 \oplus_4 7 \equiv 19 \otimes_9 3 \pmod 3$

C. $9 \oplus_7 3 \equiv 8 \otimes_7 9 \pmod 9$

D. $5 \oplus_2 4 \equiv 17 \otimes_5 3 \pmod 5$

Answer: A

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