CONVERSION FROM BINARY TO DECIMAL

To convert a binary number to decimal, multiply the digits of the binary number by 2^n, where **n** begins with 0 for the digit in unit's place and increases by 1 each time for the next digit in the left side. Finally add all these products.

The following examples show the method.

Example 1. $(101)_2 = (?)_{10}$

To convert binary number to decimal, follow the steps –

Step I Put the number in a table form and below each digit, put 2^n , where the rightmost value of n is 0.

Binary Number	**1**	**0**	**1**
Power of 2	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**0**	**1**
Power of 2	4	2	1
Product	0 x 4 = 0	1 x 2 = 2	1 x 1 = 1

Step III Add the products

Binary Number	**1**	**0**	**1**
Power of 2	4	2	1
Product	1 x 4 = 4	0 x 2 = 0	1 x 1 = 1
Sum of Products	4 + 0 + 1 = 5		

Final Answer: $\mathbf{(101)_2 = (5)_{10}}$

Example 2. $(1011)_2 = (?)_{10}$

Step I Put the number in a table form and below each digit, put 2^n, where the rightmost value of n is 0.

Binary Number	**1**	**0**	**1**	**1**
Power of 2	2^3	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**0**	**1**	**1**
Power of 2	8	4	2	1
Product	1 x 8 = 8	0 x 4 = 0	1 x 2 = 2	1 x 1 = 1

Step III Add the products

Binary Number	**1**	**0**	**1**	**1**
Power of 2	8	4	2	1
Product	1 x 8 = 8	0 x 4 = 0	1 x 2 = 2	1 x 1 = 1
Sum of Products	8 + 0 + 2 + 1 = 11			

Final Answer: $(1011)_2 = (11)_{10}$

Example 3. $(11010)_2 = (?)_{10}$

Step I Put the number in a table form and below each digit, put 2^n , where the rightmost value of n is 0.

Binary Number	**1**	**1**	**0**	**1**	**0**
Power of 2	2^4	2^3	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**1**	**0**	**1**	**0**
Power of 2	16	8	4	2	1
Product	1 x 16 = 16	1 x 8 = 8	0 x 4 = 0	1 x 2 = 2	0 x 1 = 0

Step III Add the products

Binary Number	**1**	**1**	**0**	**1**	**0**
Power of 2	16	8	4	2	1
Product	1 x 16 = 16	1 x 8 = 8	0 x 4 = 0	1 x 2 = 2	0 x 1 = 0
Sum of Products	16 + 8 + 0 + 2 + 0 = 26				

Final Answer: $(11010)_2 = (26)_{10}$

Example 4. $(1001001)_2 = (?)_{10}$

Step I Put the number in a table form and below each digit, put 2^n, where the rightmost value of n is 0.

Binary Number	**1**	**0**	**0**	**1**	**0**	**0**	**1**
Power of 2	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**0**	**0**	**1**	**0**	**0**	**1**
Power of 2	64	32	16	8	4	2	1
Product	1 x 64 = 64	0 x 32 = 0	0 x 16 = 0	1 x 8 = 8	0 x 4 = 0	0 x 2 = 0	1 x 1 = 1

Step III Add the products

Binary Number	**1**	**0**	**0**	**1**	**0**	**0**	**1**
Power of 2	64	32	16	8	4	2	1
Product	1 x 64 = 64	0 x 32 = 0	0 x 16 = 0	1 x 8 = 8	0 x 4 = 0	1 x 2 = 0	0 x 1 = 1
Sum of Products	64 + 0 + 0 + 8 + 0 + 0 + 1 = 73						

Final Answer: $(1001001)_2 = (73)_{10}$

Example 5. $(10111011)_2 = (?)_{10}$

Step I Put the number in a table form and below each digit, put 2^n, where the rightmost value of n is 0.

Binary Number	**1**	**0**	**1**	**1**	**1**	**0**	**1**
Power of 2	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**0**	**1**	**1**	**1**	**0**	**1**
Power of 2	64	32	16	8	4	2	1
Product	1 x 64 = 64	0 x 32 = 0	1 x 16 = 16	1 x 8 = 8	1 x 4 = 4	0 x 2 = 0	1 x 1 = 1

Step III Add the products

Binary Number	**1**	**0**	**1**	**1**	**1**	**0**	**1**
Power of 2	64	32	16	8	4	2	1
Product	1 x 64 = 64	0 x 32 = 0	1 x 16 = 16	1 x 8 = 8	1 x 4 = 4	0 x 2 = 0	1 x 1 = 1
Sum of Products	64 + 0 + 16 + 8 + 4 + 0 + 1 = 93						

Final Answer: $(1011101)_2 = (93)_{10}$

Example 6. $(11001101)_2 = (?)_{10}$

Step I Put the number in a table form and below each digit, put 2^n, where the rightmost value of n is 0.

Binary Number	**1**	**1**	**0**	**0**	**1**	**1**	**0**	**1**
Power of 2	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**1**	**0**	**0**	**1**	**1**	**0**	**1**
Power of 2	128	64	32	16	8	4	2	1
Product	1 x 128 = 128	1 x 64 = 64	0 x 32 = 0	0 x 16 = 0	1 x 8 = 8	0 x 4 = 0	0 x 2 = 0	1 x 1 = 1

Step III Add the products

Binary Number	**1**	**1**	**0**	**0**	**1**	**1**	**0**	**1**
Power of 2	128	64	32	16	8	4	2	1
Product	1 x 128 = 128	1 x 64 = 64	0 x 32 = 0	0 x 16 = 0	1 x 8 = 8	1 x 4 = 4	0 x 2 = 0	1 x 1 = 1
Sum of Prod-ucts	128 + 64 + 0 + 0 + 8 + 4 + 0 + 1 = 205							

Final Answer: $(11001101)_2 = (205)_{10}$

Example 7. $(10101010)_2 = (?)_{10}$

Step I Put the number in a table form and below each digit, put 2^n, where the rightmost value of n is 0.

Binary Number	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**
Power of 2	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**
Power of 2	128	64	32	16	8	4	2	1
Product	1 x 128 = 128	0 x 64 = 0	1 x 32 = 32	0 x 16 = 0	1 x 8 = 8	0 x 4 = 0	1 x 2 = 2	0 x 1 = 0

Step III Add the products

Binary Number	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**
Power of 2	128	64	32	16	8	4	2	1
Product	1 x 128 = 128	0 x 64 = 0	1 x 32 = 32	0 x 16 = 0	1 x 8 = 8	0 x 4 = 0	1 x 2 = 2	0 x 1 = 0
Sum of Prod-ucts	128 + 0 + 32 + 0 + 8 + 0 + 2 + 0 = 170							

Final Answer: $(10101010)_2 = (170)_{10}$

Example 8. $(10011001)_2 = (?)_{10}$

Step I Put the number in a table form and below each digit, put 2^n, where the rightmost value of n is 0.

Binary Number	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**1**
Power of 2	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Step II Multiply the columns

Binary Number	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**1**
Power of 2	128	64	32	16	8	4	2	1
Product	1 x 128 = 128	0 x 64 = 0	0 x 32 = 0	1 x 16 = 16	1 x 8 = 8	0 x 4 = 0	0 x 2 = 0	1 x 1 = 1

Step III Add the products

Binary Number	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**1**
Power of 2	128	64	32	16	8	4	2	1
Product	1 x 128 = 128	0 x 64 = 0	0 x 32 = 0	1 x 16 = 16	1 x 8 = 8	0 x 4 = 0	0 x 2 = 0	1 x 1 = 1
Sum of Prod-ucts	128 + 0 + 0 + 16 + 8 + 0 + 0 + 1 = 153							

Final Answer: $(10011001)_2 = (153)_{10}$