# Binary Numbers ‘Pre-Work’

## Mini Lesson 1.1

$10^0$ =1
$10^1$= 10
$10^2$ =100
$10^3$ =1,000
$10^4$ = 10,000

Do you see a pattern?

$2^0$ = 1
$2^1$= 2
$2^2$ = 4
$2^3$ = 8
$2^4$ = 16
$2^5$ = 32

Do you see a pattern?

## Mini Lesson 1.2

$2^2/2^2$ = 4/4 =1

$N^x$ / $N^y$ = $N^{(X-Y)}$

$2^2/2^2$ = $2^{(2-2)}$ = $2^{(0)}$ = 1

$N^0$ = 1

# Mini Lesson 1.3

**11 (Deconstruct 11 number into powers of 2, see Lesson 1.1)**

$11 = 8 + 3$

$11 = 8 + 2 + 1$

$11 = 2^3 + 2^1 + 2^0$

---

9

$9 = 8 + 1$

$9 = 8 + 1$

$9 = 2^3 + 2^0$

---

4

$4 = 4$

$4 = 2^2$

---

5

$5 = 4 + 1$

$4 = 2^2 + 2^0$

---

1
$1 = 2^0$

---

$0 = 0$ [Identity]

---

23

$23 = 16 + 4 + 2 + 1$

$23 = 2^4 + 2^2 + 2^1 + 2^0$

## Lesson 1.4

## ‘Counting in a two [$2^x$] (binary) digit world of 1 and 0’

Since 0 = 0

{zero} 0 is 0!

Since $2^0$ is 1

{one} 1 is one!

So what is $2^1$ ? What was $10^1$ ? [10 ! ]

{ two } 10 Is binary has the value of 2 [ since the first ‘place value can only be a 0 or a 1 and that was taken by the values 0 and 1, 2 must be expressed in another ‘place’ using either a 0 or a 1 and since 00 would be 0 then it is expressed as 10!)

So how is the value of three expressed in binary = $2^1 + 2^0$ = ?

{ 3 } 3= 2 + 1 or $2^1 + 2^0$ or 10 + 1 = 11 = the value for three [3]

{4} 4 = $2^2$ = 100

{5} 5 = 4 + 1 or $2^2 + 2^0$ or 100 + 1 or 101

{6} 6 = 4 + 2 or $2^2 + 2^1$ or 100 + 10 or 110

{7} 6 = 4 + 2 + 1 or $2^2 + 2^1 + 2^0$ or 100 + 10 + 1 or 111

{8} 8 = $2^3$ or 1000