Decimal Value	**Range**	128	64	32	16	8	4	2	1
Bits	**Bits**	1	1	1	1	1	1	1	1
Decimal Value + Bits To Left	**Subnet Mask**	128	192	224	240	248	252	254	255
2^N	**Subnets**	2	4	8	16	32	64	128	256

Bits	**2^n = x (subtract 2 for useable hosts)**
1	$2^1 = 2$
2	$2^2 = 4$
3	$2^3 = 8$
4	$2^4 = 16$
5	$2^5 = 32$
6	$2^6 = 64$
7	$2^7 = 128$
8	$2^8 = 256$
9	$2^9 = 512$
10	$2^{10} = 1,024$
11	$2^{11} = 2,048$
12	$2^{12} = 4,096$
13	$2^{13} = 8,192$
14	$2^{14} = 16,384$
15	$2^{15} = 32,768$
16	$2^{16} = 65,536$
17	$2^{17} = 131,072$
18	$2^{18} = 262,144$
19	$2^{19} = 524,288$
20	$2^{20} = 1,048,576$
21	$2^{21} = 2,097,152$
22	$2^{22} = 4,194,304$
23	$2^{23} = 8,388,608$
24	$2^{24} = 16,777,216$

Subnet Classes		
Class	**High Order Bits in First Octet**	**First Octet Range**
A	0	1-127
B	10	128-191
C	110	192-223

Subnetting Fundamentals:

1. **Subnetting creates smaller networks out of large networks** by borrowing host bits to create the subnet field, which made up of the borrowed bits

2. **Subnetting increases network efficiency and security** by decreasing the size of broadcast domains

3. **Routers are used to create subnets** because OSI Layer 3 addressing (IP addresses) is used for subnetting

4. Students should be familiar with **network math and binary numbers** to do subnetting, and be able to **convert decimal numbers to binary numbers to at least 16 bits (two bytes)**

5. The formula **2^n=x** will calculate the **number of subnets created** when **n** equals the number of *host bits borrowed* to create the subnet field

6. The formula **2^n-2=x** will calculate the **number of hosts per subnet** created when **n** equals the *number of remaining host bits* after creating the subnet field

7. **Class A, Class B, and Class C networks can be subnetted**; Class D networks do not use a network ID, so the do not need to be subnetted; Class E networks are experimental

8. **Two host bits must remain after borrowing host bits to create subnets**, so the maximum number of host bits that can be borrowed in a Class A network is 22, in a Class B network is 14, and in a Class C network is 6

9. The **incremental value of subnets** is the decimal value of the last host bit borrowed to create the subnet field

10. **Magic Number Method**: subtracting the “non-255” number in the subnet mask from 256 to get the incremental value

11. When **expanding the subnet address ranges**, the first address will be the subnet address and the last address will be the broadcast address for that subnet; the useable host addresses will be the second address through the next to last address

12. **Incrementing subnets always starts in the octet of the last borrowed bit**; on a Class C network it is always in the fourth octet, on a Class B network incrementing can be in the third or fourth octet depending on which octet the last borrowed bit was in; on a Class A network incrementing can be in the second, third, or fourth octet depending on which octet the last borrowed but was in