What is modulus?

You learned about the remainder long ago.

10 divided by 7 equals 1 with a remainder of 3

or 7 goes into 10, 1 time with 3 left over

examples of modulus

a) 10 % 2 = 0
b) 10 % 3 = 1
c) 10 % 4 = 2
→ d) 4 % 10 = 4
e) 0 % 10 = 0
f) 10 % 0 = error

a) $10 \div 2 = 5$ exactly
b) $10 \div 3 = 3.3$ $3 \times 3 = 9$ $10 - 9 = 1$
c) $10 \div 4 = 2.5$ $4 \times 2 = 8$ $10 - 8 = 2$
d) $4 \div 10 = 0.4$ $10 \times 0 = 0$ $4 - 0 = 4$
e) $0 \div 10 = 0$ $10 \times 0 = 0$ $0 - 0 = 0$
f) $10 \div 0$ = error

```
int x,y
consider x % y
if (x < y)
 x % y = x
```

1st # is smaller than 2nd

1st # is smaller than 2nd

5 % 2 = 5

2 % 5 = 2

what are all the possible remainders for

n % 5?

(0, 1, 2, 3, 4)

what are all possible remainders for

a % b

(0, 1, 2, ... b-1)

Java Arithmetic
First understand integer division (assumed by Java)

some examples of integer division

(5) 10/2 = 5
(3.3) 10/3 = 3
(2.5) 10/4 = 2
(0.4) 4/10 = 0

now double division (Real) (same answer as calc.)

* 10.0/2 = 5.0
10.0/3 = 3.3333
10/4.0 = 2.5
* 10.0/5.0 = 2.0

Casting
To change one data type to another put the new type in parenthesis in front of the type you want to change, as follows:

int n = 6;
(double)n turns n into 6.0

10/4 evaluates to 2 (integer division)
but
(double)10/4 10.0/4 = 2.5
10/(double)4 10/4.0 = 2.5
BUT BE CAREFUL OF ORDER OF OPERATIONS
Casting comes before all operations EXCEPT ()

(double)(10/4) = (double)(2) = 2.0 ((double)10)/4 = 2.5

int x,y;
(double)(x/y) → not the same as (double)x/y or x/(double)y

When you cast to an int you lose precision by truncating: *Not often*
(int) 10.7 / 5
= 10/5
= 2