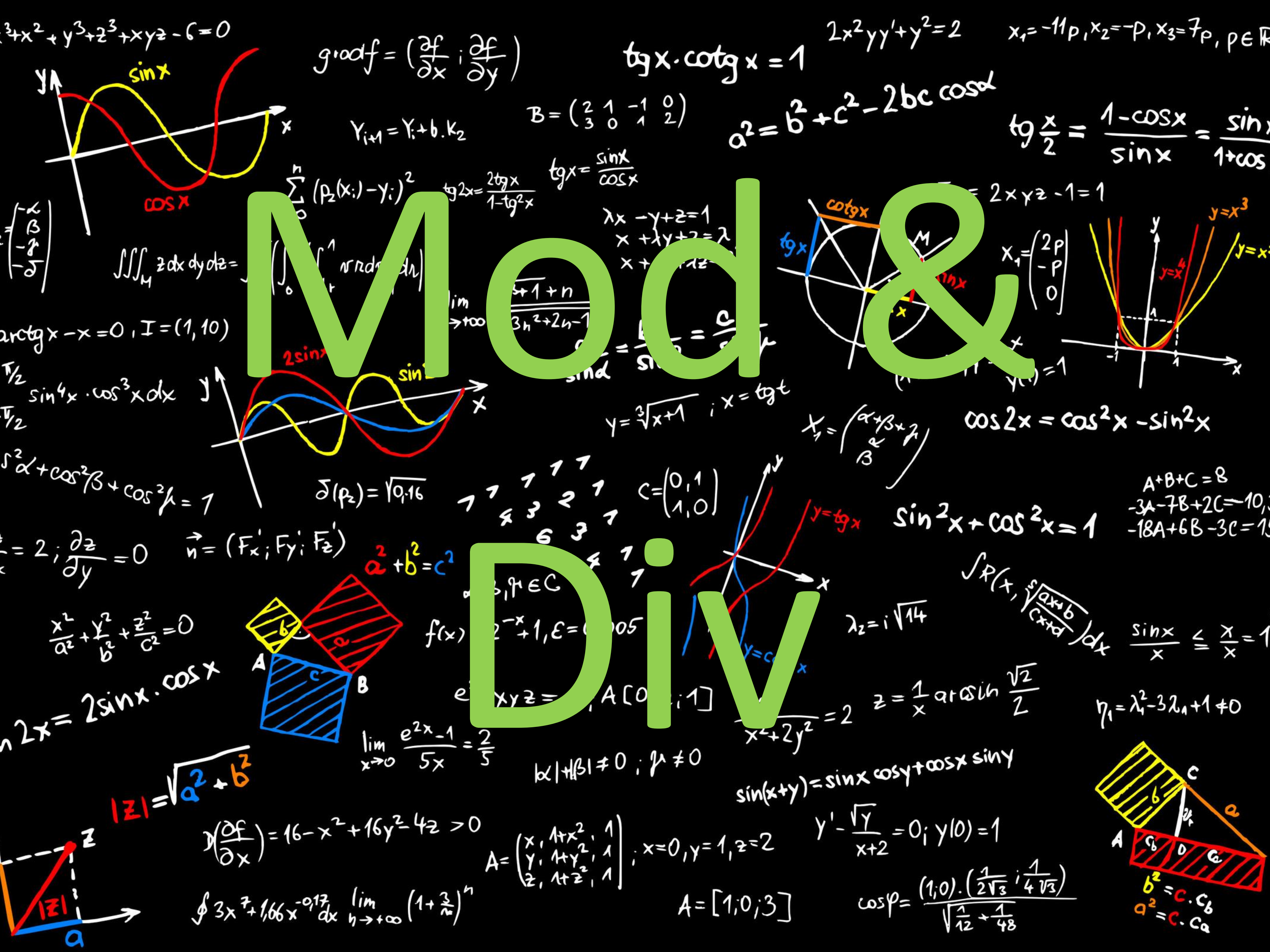
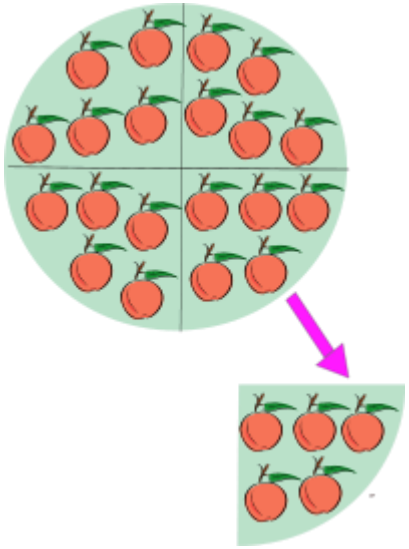


Mod & Div

With doubles, division works as you'd expect.

Eg. 5/2 = 2.5



With doubles, division works as you'd expect.

Eg. 5/2 = 2.5

With integers, the decimal is CHOPPED OFF.

It is NOT rounded.

Eg. 5/2 = 2

With doubles, division works as you'd expect.

Eg. 5/2 = 2.5

With integers, the decimal is CHOPPED OFF.
It is NOT rounded.

Eg. 5/2 = 2

To get the remainder of the integer division, we use a function called modulus or mod.

It's symbol is %.

With doubles, division works as you'd expect.

Eg. 5/2 = 2.5

With integers, the decimal is CHOPPED OFF.
It is NOT rounded.

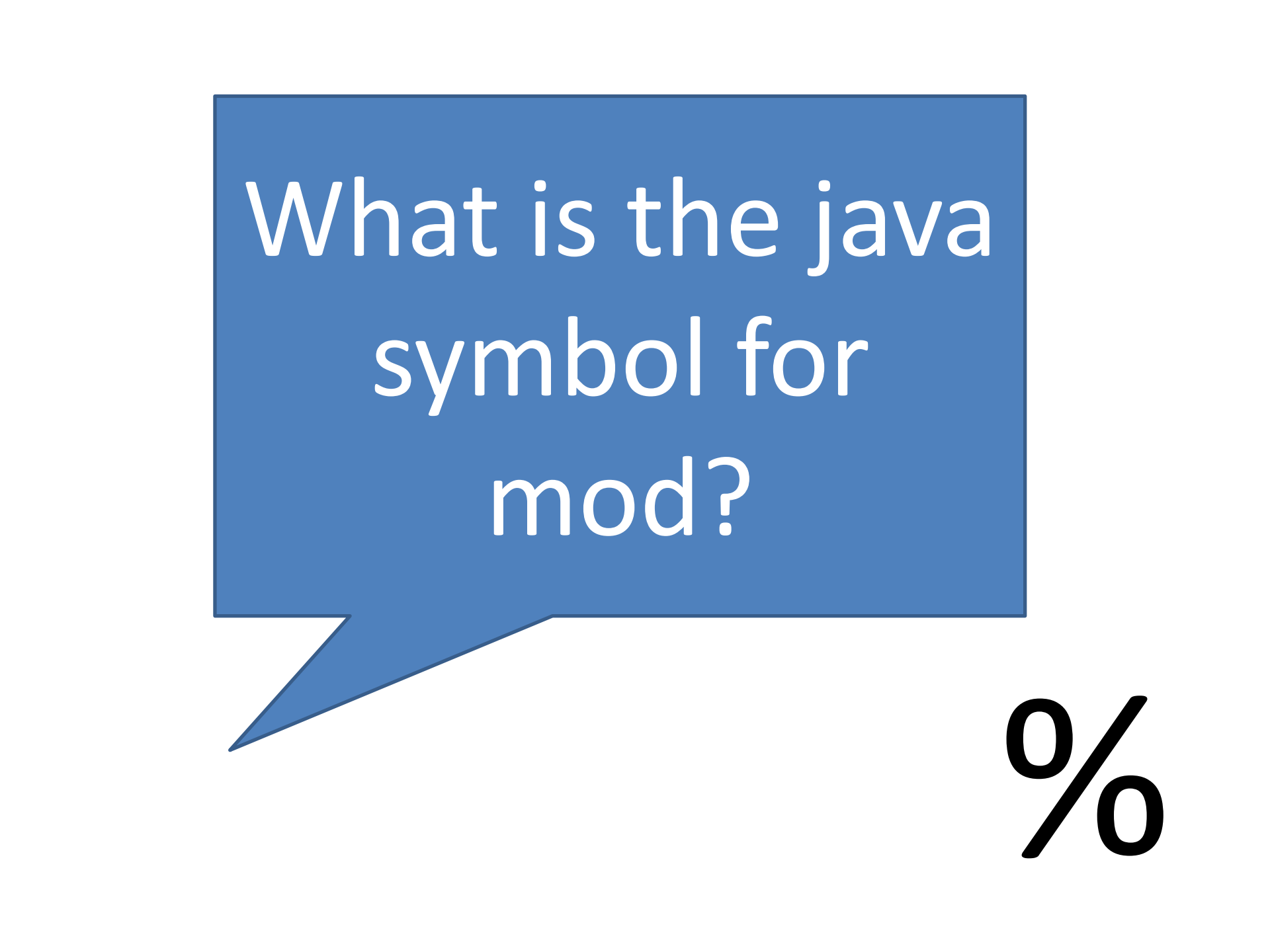
Eg. 5/2 = 2

To get the remainder of the integer division, we use a function called modulus or mod.

It's symbol is %

What is the java symbol for mod?

What is the java symbol for mod?



Which type uses mod?

Which type uses mod?

int

1. (a) What variable type is used with mod?

(b) What is the mathematical symbol for mod?

(c) How does mod work?

(d) What are two common uses of mod?

(e) How is integer division different?

1. (a) What variable type is used with mod? int

(b) What is the mathematical symbol for mod?

(c) How does mod work?

(d) What are two common uses of mod?

(e) How is integer division different?

1. (a) What variable type is used with mod? int

(b) What is the mathematical symbol for mod? %

(c) How does mod work?

(d) What are two common uses of mod?

(e) How is integer division different?

1. (a) What variable type is used with mod? int

(b) What is the mathematical symbol for mod? %

(c) How does mod work? remainder of division

(d) What are two common uses of mod?

(e) How is integer division different?

1. (a) What variable type is used with mod? int

(b) What is the mathematical symbol for mod? %

(c) How does mod work? remainder of division

(d) What are two common uses of mod? calculate change
determine even/odd

(e) How is integer division different?

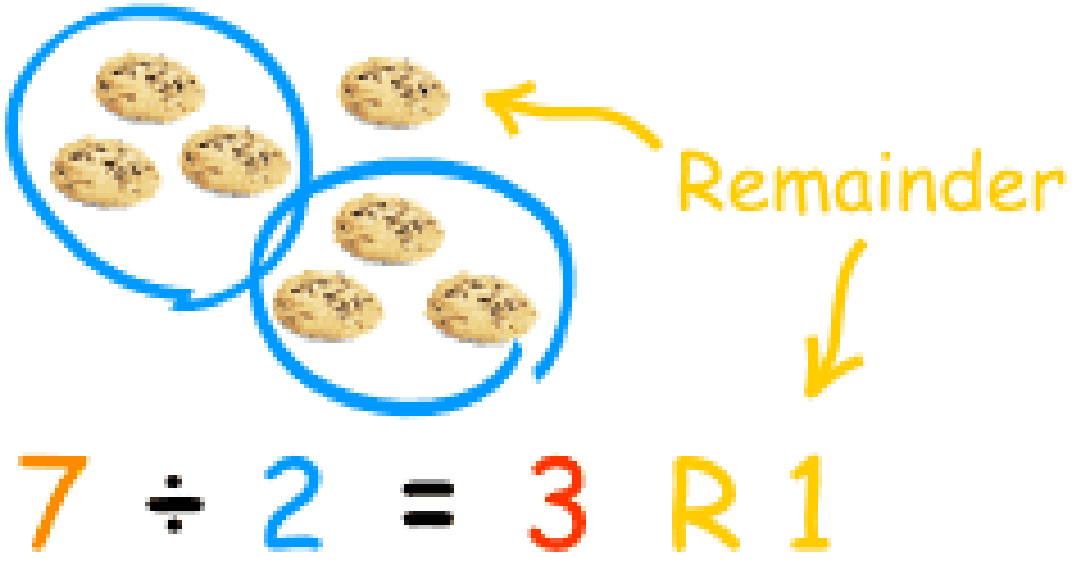
1. (a) What variable type is used with mod? int

(b) What is the mathematical symbol for mod? %

(c) How does mod work? remainder of division

(d) What are two common uses of mod? calculate change
determine even/odd

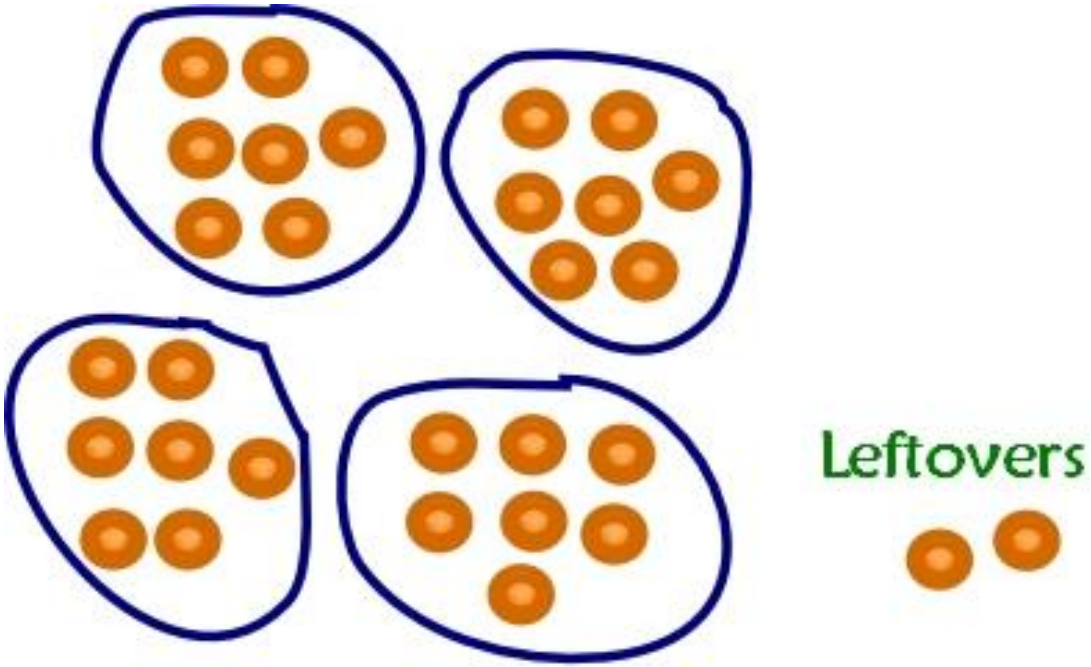
(e) How is integer division different? do not round
chop off the decimal



In Java, with integers, we say:

7/2 = 3

7%2 = 1



$30 \div 7 = 4 \text{ R } 2$

In Java, with integers, we say:

30/7 = 4

30%7 = 2

Divide 11 into groups of 4: (circle)

How many circles?

What is 11/4? _____

How many are leftover?

What is 11%4? _____

Divide 11 into groups of 4: (circle)

How many circles?

What is 11/4? _____

How many are leftover?

What is 11%4? _____

Divide 11 into groups of 4: (circle)

How many circles?

What is 11/4? 2

How many are leftover?

What is 11%4? 3

Divide 11 into groups of 3: (circle)

How many circles?

What is 11/3? _____

How many are leftover?

What is 11%3? _____

Divide 11 into groups of 3: (circle)

How many circles?

What is 11/3? _____

How many are leftover?

What is 11%3? _____

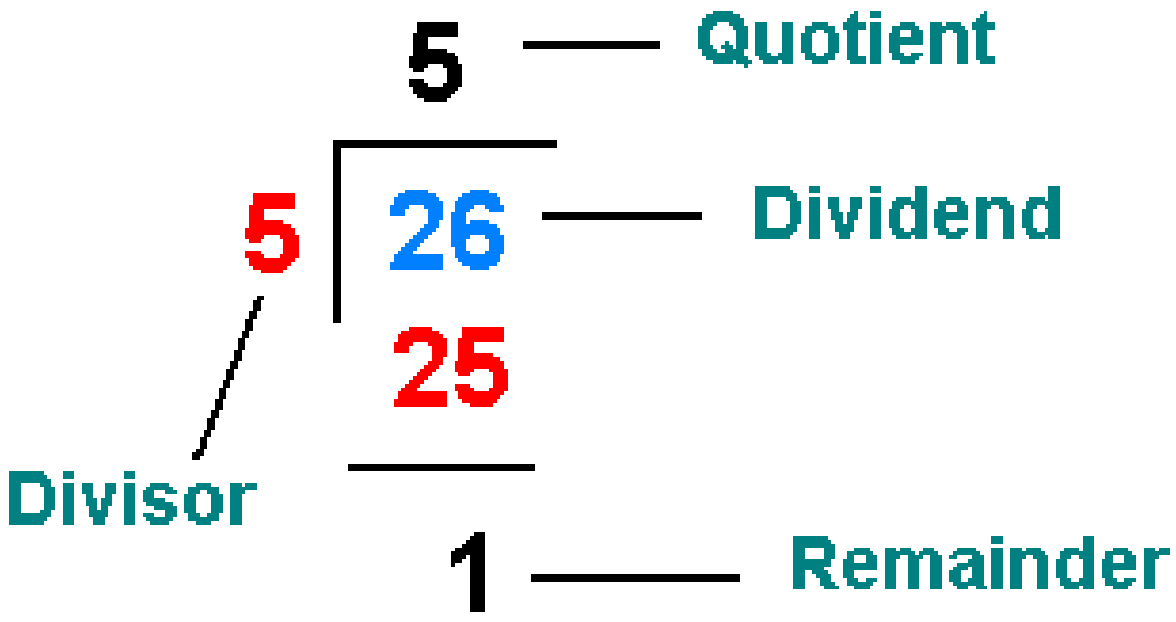
Divide 11 into groups of 3: (circle)

How many circles?

What is 11/3? 3

How many are leftover?

What is 11%3? 2

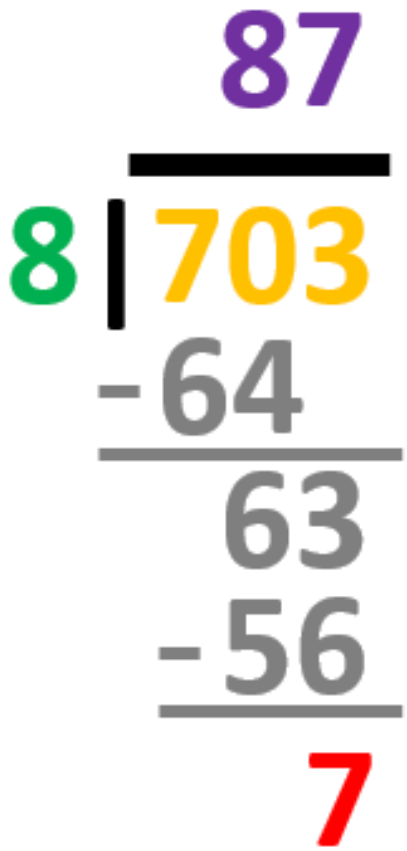


In Java, with integers, we say:

26/5 = 5

26%5 = 1

Look at the long division and pick out the answers to div and mod.



What's the Quotient?

What is 703/8? _____

What's the remainder?

What is 703%8? _____


What’s
100%25?

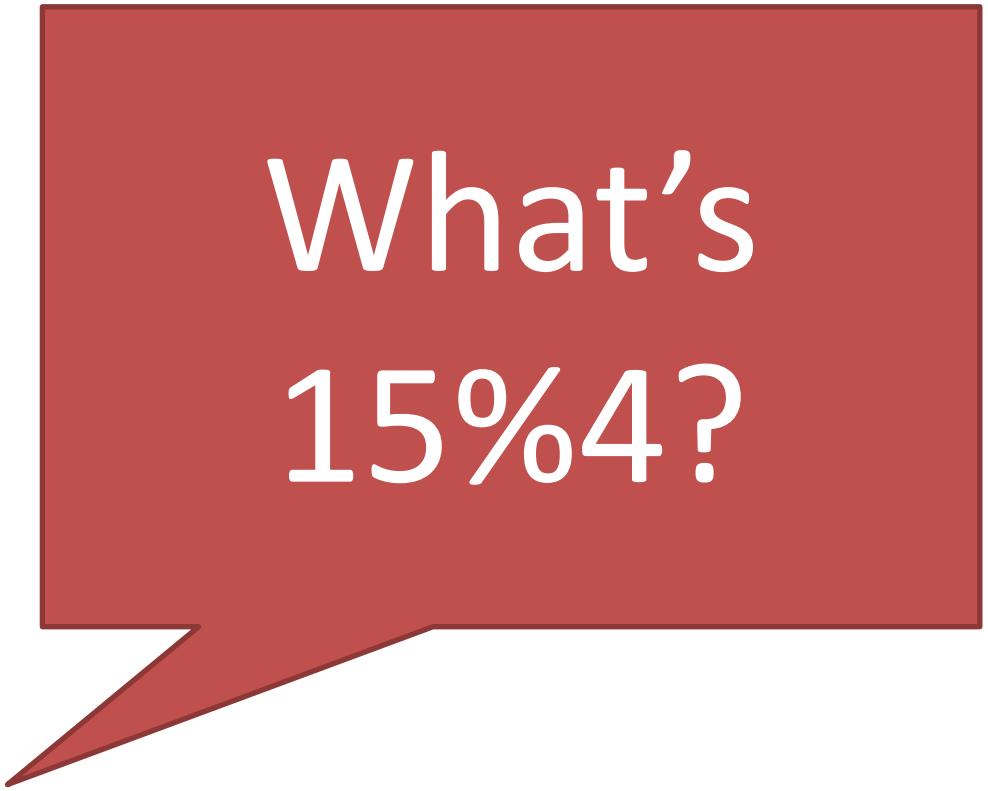
What’s 100%25?

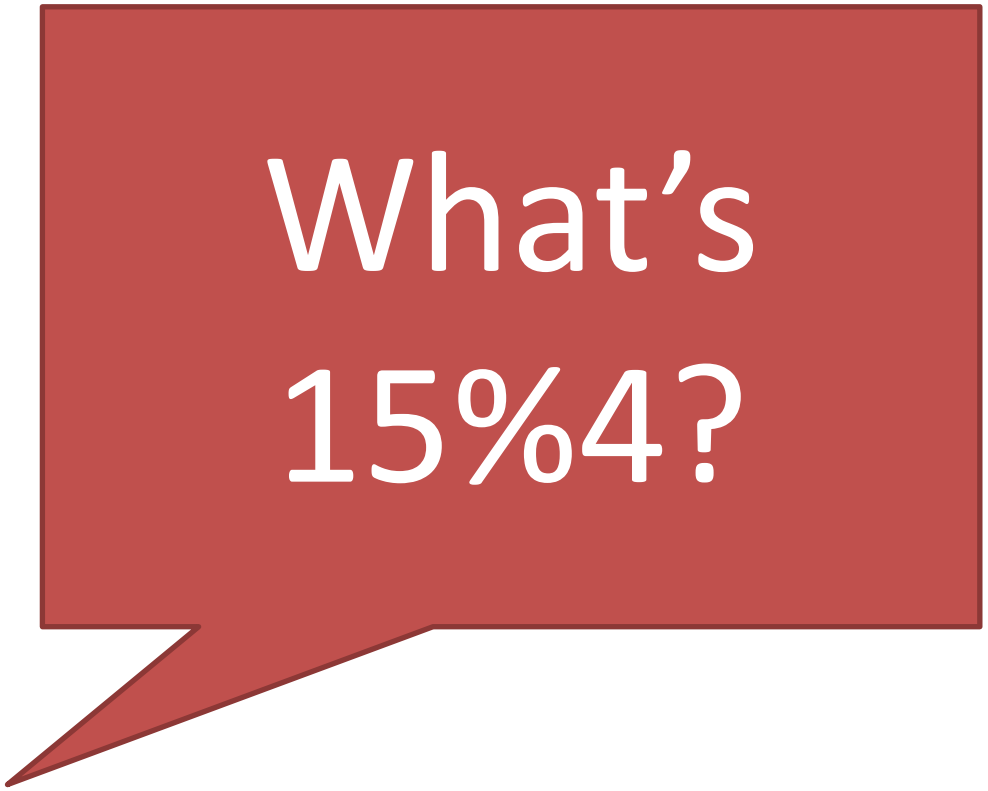
0


What's
12%10?

What's 12%10?

2


What's
15%4?



3


What's
25%6?

1

Let’s compare Even and Odd numbers:

Question	Answer	Question	Answer
8/2		8%2	
20/2		20%2	
26/2		26%2	
3/2		3%2	
15/2		15%2	
7/2		7%2	

Let’s compare Even and Odd numbers:

Question	Answer	Question	Answer
8/2	4	8%2	0
20/2	10	20%2	0
26/2	13	26%2	0
3/2		3%2	
15/2		15%2	
7/2		7%2	

Let’s compare Even and Odd numbers:

Question	Answer	Question	Answer
8/2	4	8%2	0
20/2	10	20%2	0
26/2	13	26%2	0
3/2	1	3%2	1
15/2	7	15%2	1
7/2	3	7%2	1

If x is 14, is this Boolean expression true or false?

$$x\%2==0$$

If x is 14, is this Boolean expression true or false?

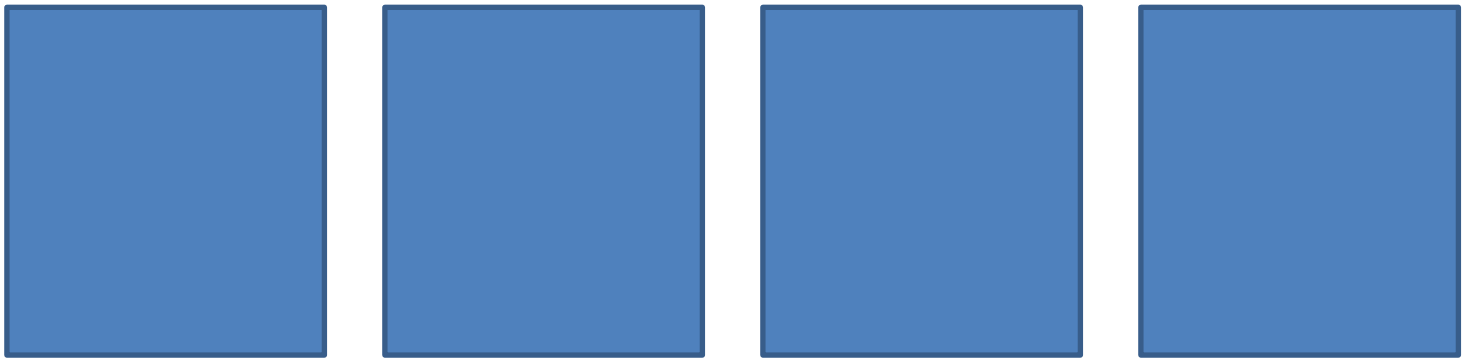
```
x%2==0
14%2==0
```

If x is 14, is this Boolean expression true or false?

```
x%2==0
14%2==0
0==0
```

If x is 14, is this Boolean expression true or false?

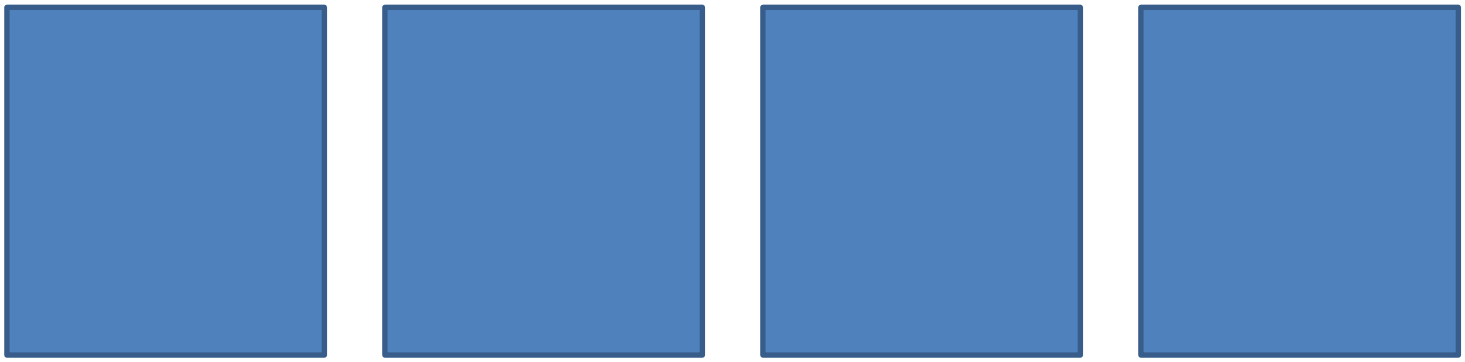
```
x%2==0
14%2==0
0==0
true
```



What is 4 / 5?

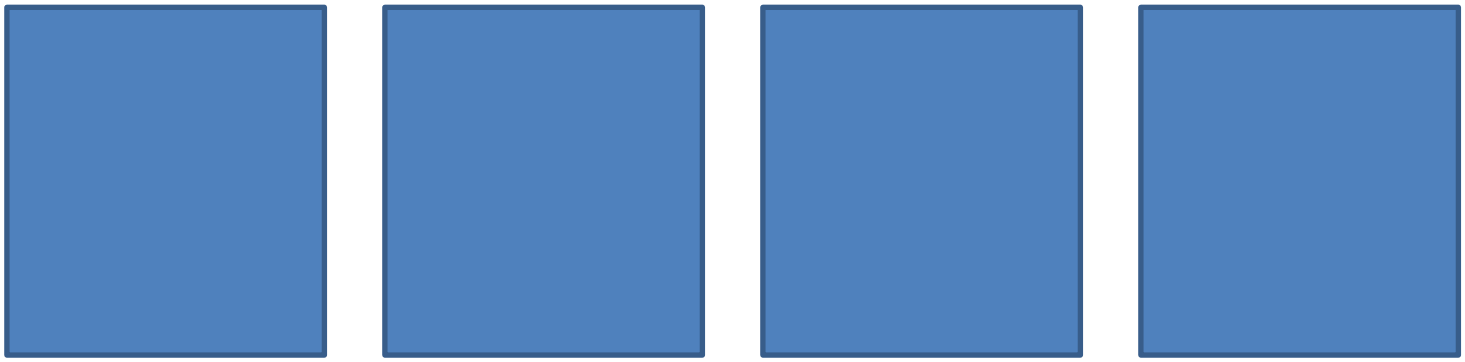
What is 4 % 5?

Try these two questions. Write in your best guess.



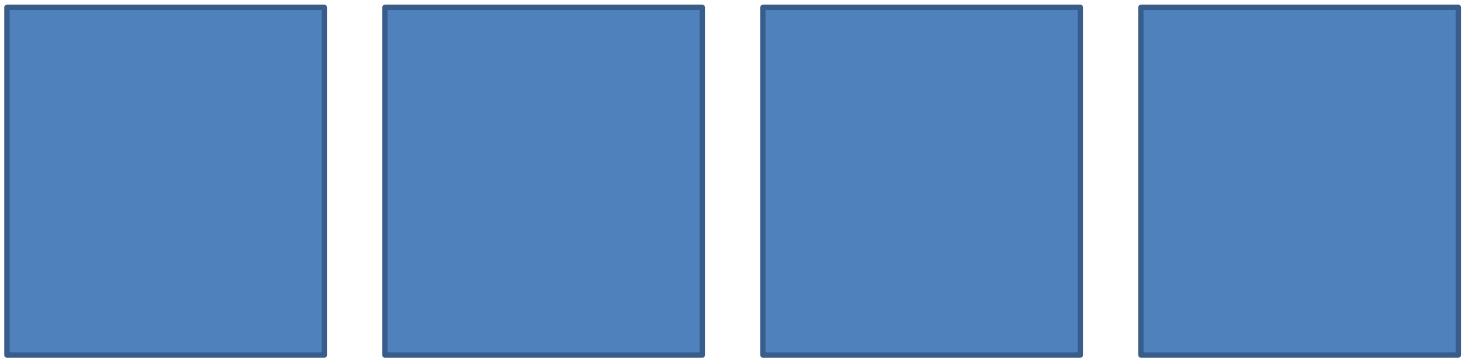
What is 4 / 5? 0

What is 4 % 5?



What is 4 / 5? 0

What is 4 % 5? 4



What is 4 / 5? 0

What is 4 % 5? 4

If the first number is smaller, than all of them remain.

Good old Zero, causing problems again….

What is 0 / 5?

What is 0 % 5?

What is 5 / 0?

What is 5 % 0?

Try these two questions. Write in your best guess.

Good old Zero, causing problems again….

What is 0 / 5? 0

What is 0 % 5? 0

What is 5 / 0? undefined

What is 5 % 0? undefined

This code mods a number by **5** so that you can see the answer.

```
int n = IO.inputInt("Enter the value: ");
int answer = n%5;
System.out.println(n + "%5=" + answer + ", 0 = 5 multiple");
```

a) What are the names of the two variables? _____ and _____.

b) If the user enters 25 for the number, what is printed?

This code mods a number by **5** so that you can see the answer.

```
int n = IO.inputInt("Enter the value: ");
int answer = n%5;
System.out.println(n + "%5=" + answer + ", 0 = 5 multiple");
```

a) What are the names of the two variables? _____ and _____.

b) If the user enters 25 for the number, what is printed?

This code mods a number by **5** so that you can see the answer.

```
int n = IO.inputInt("Enter the value: ");
int answer = n%5;
System.out.println(n + "%5=" + answer + ", 0 = 5 multiple");
```

a) What are the names of the two variables? n and answer.

b) If the user enters 25 for the number, what is printed?

This code mods a number by **5** so that you can see the answer.

```
int n = IO.inputInt("Enter the value: ");
int answer = n%5;
System.out.println(n + "%5=" + answer + ", 0 = 5 multiple");
```

a) What are the names of the two variables? n and answer.

b) If the user enters 25 for the number, what is printed?

25%5=

This code mods a number by **5** so that you can see the answer.

```
int n = IO.inputInt("Enter the value: ");
int answer = n%5;
System.out.println(n + "%5=" + answer + ", 0 = 5 multiple");
```

a) What are the names of the two variables? n and answer.

b) If the user enters 25 for the number, what is printed?

25%5=0

This code mods a number by **5** so that you can see the answer.

```
int n = IO.inputInt("Enter the value: ");
int answer = n%5;
System.out.println(n + "%5=" + answer + ", 0 = 5 multiple");
```

a) What are the names of the two variables? n and answer.

b) If the user enters 25 for the number, what is printed?

25%5=0, 0=5 multiple

This code calculates how many dimes you will get for change.

```
int cents = IO.inputInt("How many cents? ");
int dimes = cents/10;
int leftover = cents%10;
System.out.println("# Dimes: " + dimes);
System.out.println("Remaining change: " +leftover);
```

(a) If the user enters 24 for the number of cents what is printed?

(b) If the user enters 59 for the number of cents what is printed?

This code calculates how many dimes you will get for change.

```
int cents = IO.inputInt("How many cents? ");
int dimes = cents/10;
int leftover = cents%10;
System.out.println("# Dimes: " + dimes);
System.out.println("Remaining change: " +leftover);
```

(a) If the user enters 24 for the number of cents what is printed?

```
#Dimes: 2
Remaining change: 4
```

(b) If the user enters 59 for the number of cents what is printed?

This code calculates how many dimes you will get for change.

```
int cents = IO.inputInt("How many cents? ");
int dimes = cents/10;
int leftover = cents%10;
System.out.println("# Dimes: " + dimes);
System.out.println("Remaining change: " +leftover);
```

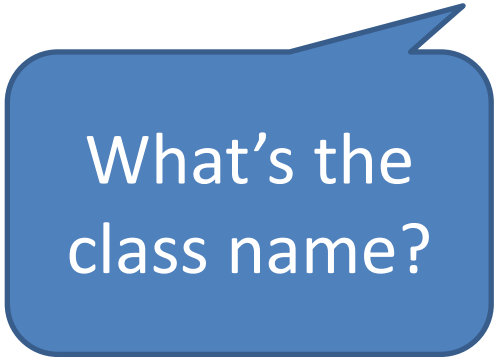
(a) If the user enters 24 for the number of cents what is printed?

```
#Dimes: 2
Remaining change: 4
```

(b) If the user enters 59 for the number of cents what is printed?

```
#Dimes: 5
Remaining change: 9
```

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickles = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickles + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```



```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickles = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickles + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

What's the class name?

makingChange

What are the variable types?

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickles = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickles + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

```
public class makingChange
{
    public static void main (String args[])
    {
        new makingChange ();
    }
    public makingChange ()
    {
        int cents = IO.inputInt ("How many cents? ");
        int quarters = cents / 25;
        cents = cents % 25;
        int dimes = cents / 10;
        cents = cents % 10;
        int nickles = cents / 5;
        cents = cents % 5;
        System.out.println ("That is " + quarters + " quarters, ");
        System.out.println (dimes + " dimes, " + nickles + " nickles, ");
        System.out.println (cents + " pennies.");
    }
}
```

What are the variable types?

int

Trace the program.

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickels = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickels + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

Cents = 94

Trace the program.

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickels = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickels + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

Cents = 94
Quarters = 94 / 25 = 3

Trace the program.

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickels = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickels + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

Cents = 94
Quarters = 94 / 25 = 3
Cents = 94 % 25 = 19

Trace the program.

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickels = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickels + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

Cents = 94
Quarters = 94 / 25 = 3
Cents = 94 % 25 = 19
Dimes = 19 / 10 = 1

Trace the program.

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickels = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickels + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

Cents = 94
Quarters = 94 / 25 = 3
Cents = 94 % 25 = 19
Dimes = 19 / 10 = 1
Cents = 19 % 10 = 9

Trace the program.

```
public class makingChange
{
    public static void main (String args[])
    {
        new makingChange ();
    }
    public makingChange ()
    {
        int cents = IO.inputInt ("How many cents? ");
        int quarters = cents / 25;
        cents = cents % 25;
        int dimes = cents / 10;
        cents = cents % 10;
        int nickels = cents / 5;
        cents = cents % 5;
        System.out.println ("That is " + quarters + " quarters, ");
        System.out.println (dimes + " dimes, " + nickels + " nickles, ");
        System.out.println (cents + " pennies.");
    }
}
```

Cents = 94
Quarters = 94 / 25 = 3
Cents = 94 % 25 = 19
Dimes = 19 / 10 = 1
Cents = 19 % 10 = 9
Nickels = 9 / 5 = 1

Trace the program.

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickels = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickels + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

Cents = 94
Quarters = 94 / 25 = 3
Cents = 94 % 25 = 19
Dimes = 19 / 10 = 1
Cents = 19 % 10 = 9
Nickels = 9 / 5 = 1
Cents = 9 % 5 = 4

Trace the program.

```
public class makingChange
{
   public static void main (String args[])
   {
      new makingChange ();
   }
   public makingChange ()
   {
      int cents = IO.inputInt ("How many cents? ");
      int quarters = cents / 25;
      cents = cents % 25;
      int dimes = cents / 10;
      cents = cents % 10;
      int nickels = cents / 5;
      cents = cents % 5;
      System.out.println ("That is " + quarters + " quarters, ");
      System.out.println (dimes + " dimes, " + nickels + " nickles, ");
      System.out.println (cents + " pennies.");
   }
}
```

Cents = 94
Quarters = 94 / 25 = 3
Cents = 94 % 25 = 19
Dimes = 19 / 10 = 1
Cents = 19 % 10 = 9
Nickels = 9 / 5 = 1
Cents = 9 % 5 = 4

```
How many cents? 94
That is 3 quarters,
1 dimes, 1 nickles,
4 pennies.
```