

Pick the Right Box

Variables and data types



What fits in each box?

PAUSE AND TRY

What answers can each box accept? What could you do with each answer?

CONCERT TICKET FORM

Number of tickets: []

Price paid: \$[]

[] I agree to the terms

Your name: []

Could a ticket count be 2.5? Could the checkbox be 17? What would it mean to add two names?

By the end of class you can...

- 1 Explain a data type as a set of values plus the operations on them.
- 2 Sort data types into primitive and reference.
- 3 Name the values that belong to int, double, and boolean.
- 4 Declare a variable with a type and a name, and trace its value as it changes.
- 5 Choose the most appropriate type for a piece of information.

A large, white, rounded square containing the number '1' in a bold, dark teal font.

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PART 1

Data types

A data type is values plus operations



A **data type** is a set of values and the set of operations that can be done on those values. Both halves matter.

In a video game	Set of values	Operations that make sense
Coins collected	Whole numbers: 0, 1, 2, 1250, ...	Add, subtract, multiply, divide, compare
Running speed	Numbers with fractions: 4.75, 0.5	Add, subtract, multiply, divide, compare
Game paused?	Only two: yes or no	Flip it; combine it with another yes/no

Two pieces of information can look alike and still need different types.

Two categories: primitive and reference

Primitive types

Built into Java. Hold simple values: numbers and true/false.

`int` `double` `boolean`

Reference types

Every type that is not primitive. Used to define objects.

`String` (text, like "Hi")

Size doesn't decide it. A one-letter piece of text is still a String, and String is a reference type.

A large, white, rounded square containing the number '2' in a bold, teal, sans-serif font.

PART 2

int, double, and boolean

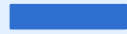
Java reads the type from how a value is written



int

An integer: a whole number, no decimal point

1250 0 -12



double

A real number, written with a decimal point

4.75 -0.5 12.0



boolean

Either true or false. Nothing else.

true false

Same amount, different values

INSIDE MAIN

```
System.out.println(12);  
System.out.println(12.0);  
System.out.println(true);
```

OUTPUT

```
12  
12.0  
true
```

Value	Type	How you can tell
12	int	No decimal point
12.0	double	Has a decimal point
true	boolean	One of the two true/false values

true is not 1, and it is not True



The only **boolean** values are **true** and **false**: lowercase, no quotation marks.

```
boolean ready = 1;
```

COMPILER SAYS

```
error: incompatible types: int cannot be converted to boolean
```

```
boolean ready = True;
```

COMPILER SAYS

```
error: cannot find symbol  
symbol:   variable True
```

Fix for both: `boolean ready = true;`

Name that type

PAUSE AND TRY

int, double, boolean, or String? How can you tell?

-40

98.6

false

"98.6"

0.0

100



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PART 3

Variables

Declaring a variable



A **variable** is a storage location that holds a value. Every variable has a **name** and a **data type**.

int

TYPE

coins

NAME

=

STORE

1250

VALUE

;

END

With no starting value, `int coins;` still declares the variable, but it can't be used until it gets a value.

NAMING RULES

No spaces: `highScore`, not `high score`

Not a Java word like `int`

Case-sensitive: `coins` is not `Coins`

Camel case, with a name that says what it means

The game's three variables

GAMESTATS.JAVA

```
public class GameStats {  
    public static void main(String[] args) {  
        int coins = 1250;  
        double speed = 4.75;  
        boolean paused = false;  
        System.out.println(coins);  
        System.out.println(speed);  
        System.out.println(paused);  
    }  
}
```

Name	Type	Holds
coins	int	1250
speed	double	4.75
paused	boolean	false

OUTPUT

```
1250  
4.75  
false
```

A variable holds one value at a time

INSIDE MAIN

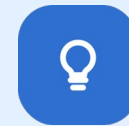
```
int coins = 1250;  
System.out.println(coins);  
coins = 1300;  
System.out.println(coins);
```

OUTPUT

```
1250  
1300
```

No type on line 3: coins already exists.

Line	coins afterward	Displayed
1	1250	
2	1250	1250
3	1300	
4	1300	1300



The name and type never change. Only the value does, and a new value **replaces** the old one.

A variable holds only values of its type



The compiler checks every value against its variable's type. A mismatch is a **compiler error**, so nothing runs.

PIZZA TRACKER

```
int slices = 2.5;
```

FIX IT BY MEANING: HALF SLICES ARE POSSIBLE

```
double slices = 2.5;
```

Now the value and the variable match.

COMPILER SAYS

```
error: incompatible types: possible lossy conversion from double to int
```

A large, bold, teal-colored number '4' centered within a white rounded square with a slight drop shadow.

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PART 4

Choosing the right type

Four questions, in order

1 Yes or no? `boolean`

2 A count that is always whole? `int`

3 A number that can have a fraction? `double`

4 Text? `String` (a reference type)

School app stores...	Type
Number of students in a class	<code>int</code>
Price of a hoodie, like \$24.99	<code>double</code>
Whether homework is turned in	<code>boolean</code>
Goals scored in a soccer game	<code>int</code>
A student's name	<code>String</code>

Pick the right box

PAUSE AND TRY

Choose a type for each. Then write one declaration.

Number of siblings

Height in meters

Is the phone charging?

Name of a city

Test average

Words to know

Data type

A set of values plus the operations on them.

Primitive type

Built in; holds a number or true/false: int, double, boolean.

Reference type

Any type that is not primitive; used for objects. String.

Variable

A named storage location that holds one value of its type.

Declaration

A statement that gives a variable its type and name.

Camel case

Naming style: lowercase first, capital for each new word.

Why not one box for everything?



Explain to your partner why a program shouldn't just use double for every number.

SENTENCE STARTER

An int is better for _____ because its set of values _____, so the compiler can _____.

Next: the Pick the Right Box puzzle worksheet.