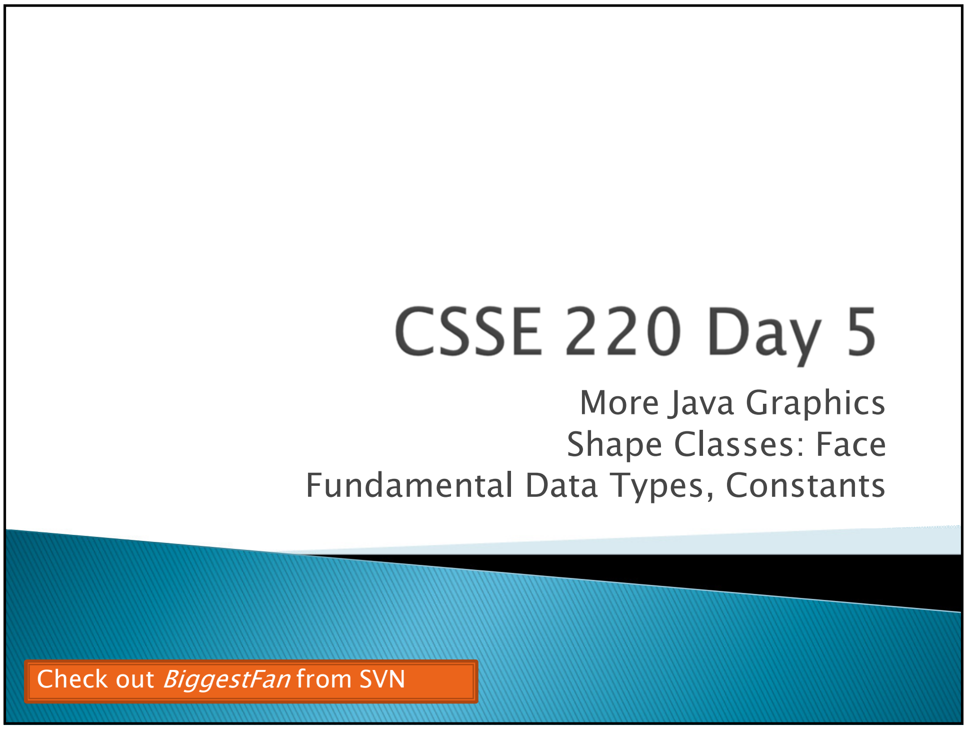


CSSE 220 Day 5

More Java Graphics
Shape Classes: Face
Fundamental Data Types, Constants

Check out *BiggestFan* from SVN

Questions?

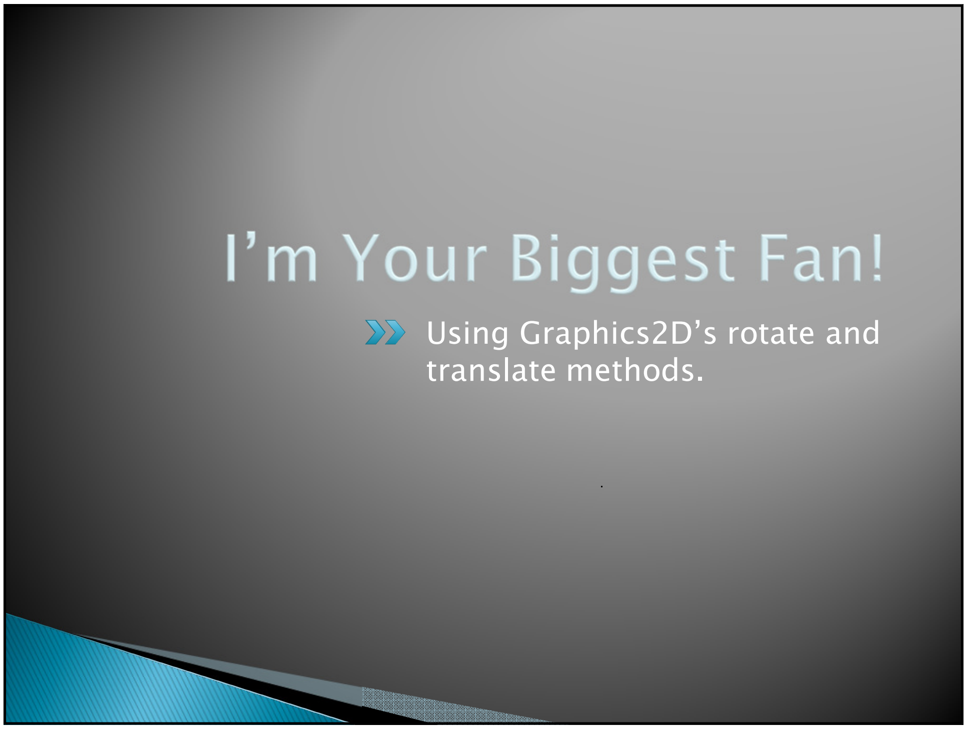
Outline

- Quiz questions 1–3 review choosing fields for a class
- Sample program using:
  - translate
  - rotate
- Design of the Faces project
- Work time:
  - Review of fundamental data types
  - Faces

Choosing Fields for Classes

- Work on Q1–3 alone or in small groups

Q1–Q3

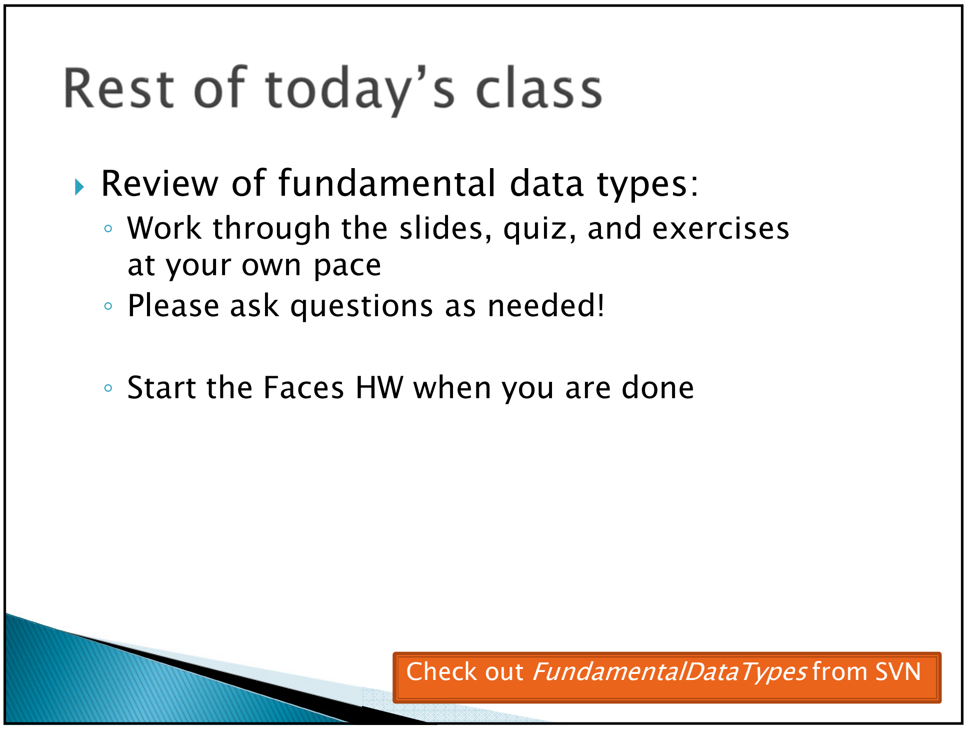


I'm Your Biggest Fan!

- Using Graphics2D's rotate and translate methods.

Making Faces

- Design and implement a Face class that draws a face of a given size at a given location

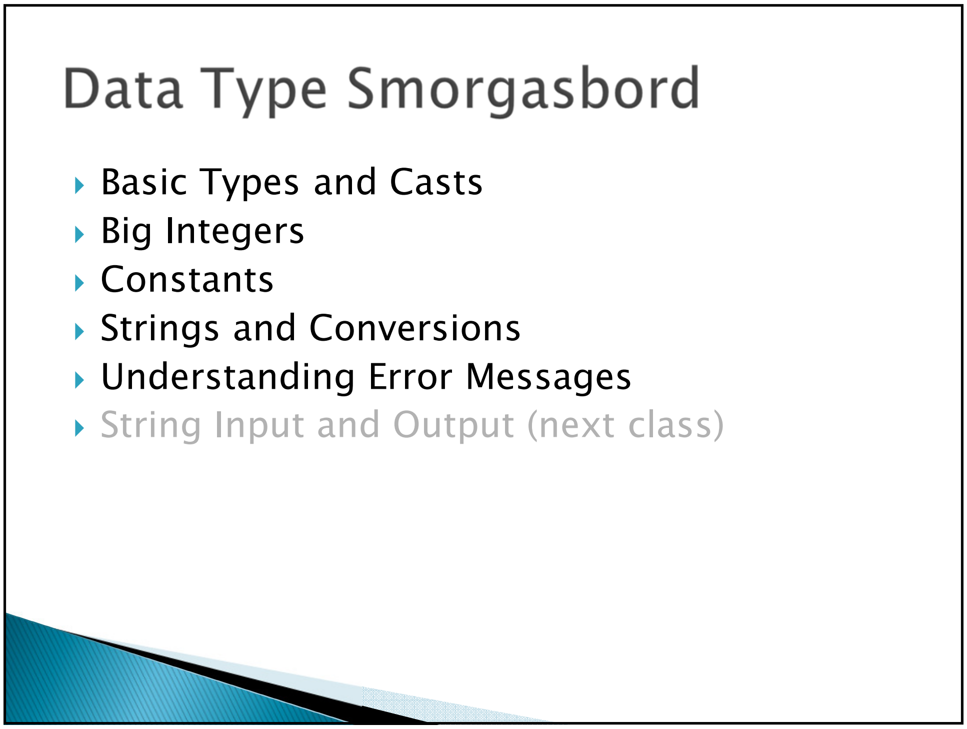


Rest of today’s class

- Review of fundamental data types:
  - Work through the slides, quiz, and exercises at your own pace
  - Please ask questions as needed!

  - Start the Faces HW when you are done

Check out *FundamentalDataTypes* from SVN



Data Type Smorgasbord

- Basic Types and Casts
- Big Integers
- Constants
- Strings and Conversions
- Understanding Error Messages
- String Input and Output (next class)

Basic Types (again)

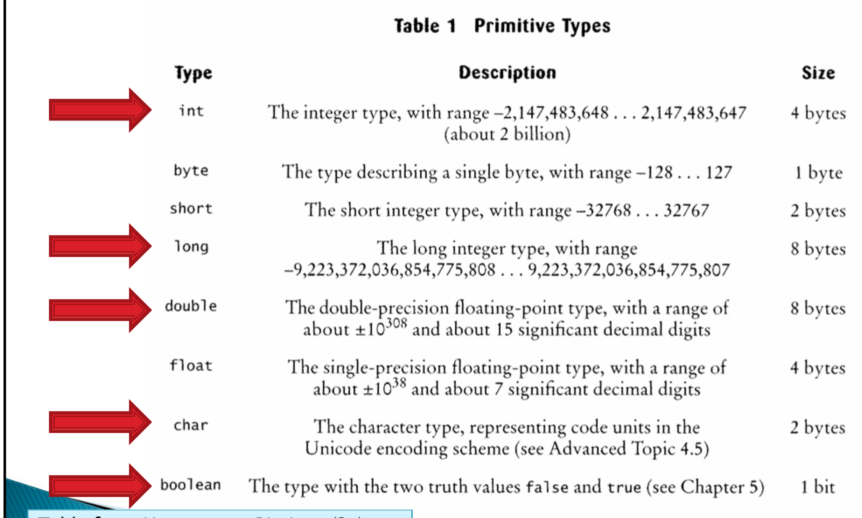


Table 1 Primitive Types

Type	Description	Size
`int`	The integer type, with range −2,147,483,648 . . . 2,147,483,647 (about 2 billion)	4 bytes
`byte`	The type describing a single byte, with range −128 . . . 127	1 byte
`short`	The short integer type, with range −32768 . . . 32767	2 bytes
`long`	The long integer type, with range −9,223,372,036,854,775,808 . . . 9,223,372,036,854,775,807	8 bytes
`double`	The double-precision floating-point type, with a range of about $\pm 10^{308}$ and about 15 significant decimal digits	8 bytes
`float`	The single-precision floating-point type, with a range of about $\pm 10^{38}$ and about 7 significant decimal digits	4 bytes
`char`	The character type, representing code units in the Unicode encoding scheme (see Advanced Topic 4.5)	2 bytes
`boolean`	The type with the two truth values `false` and `true` (see Chapter 5)	1 bit

Table from Horstmann, Big Java (3e), John Wiley & Sons, Copyright 2007

Conversions and Casts

- Consider:

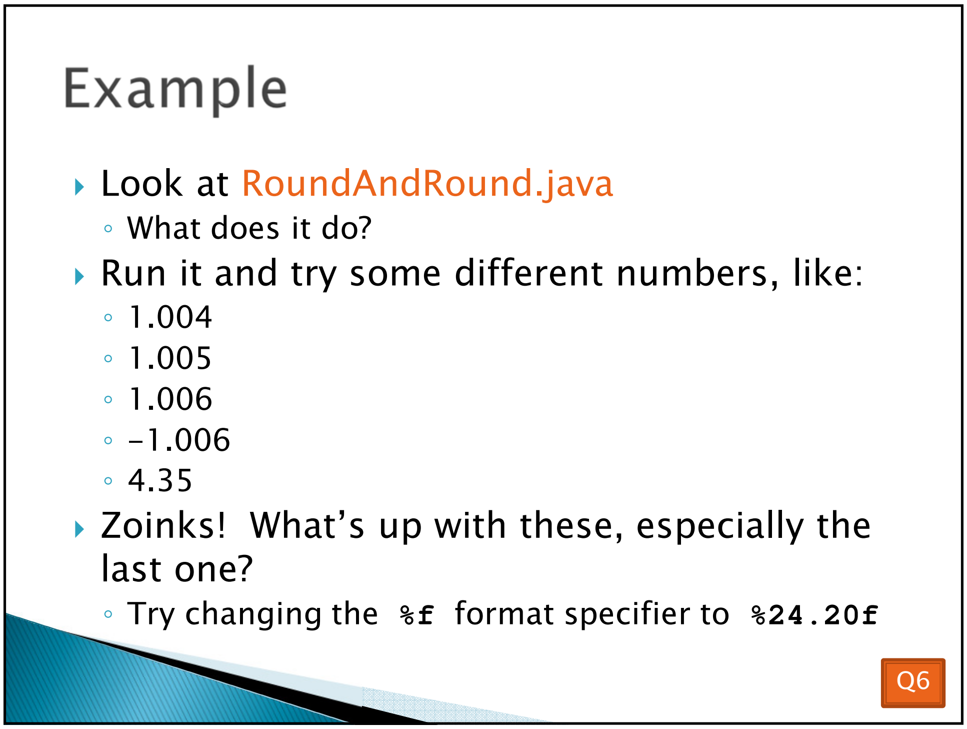
```
int i, j;
double d, e;
i = 10;
d = 20.1;
e = i; // OK
j = d; // ERROR!
```

- Why the difference?
  - Assigning a double to an int can result in information loss (the fractional part)
- Add a cast to tell Java that we understand there could be a problem here:

```
 j = (int) d; // OK
```

- But what happens to the fractional part of d?
  - It is truncated (lost)

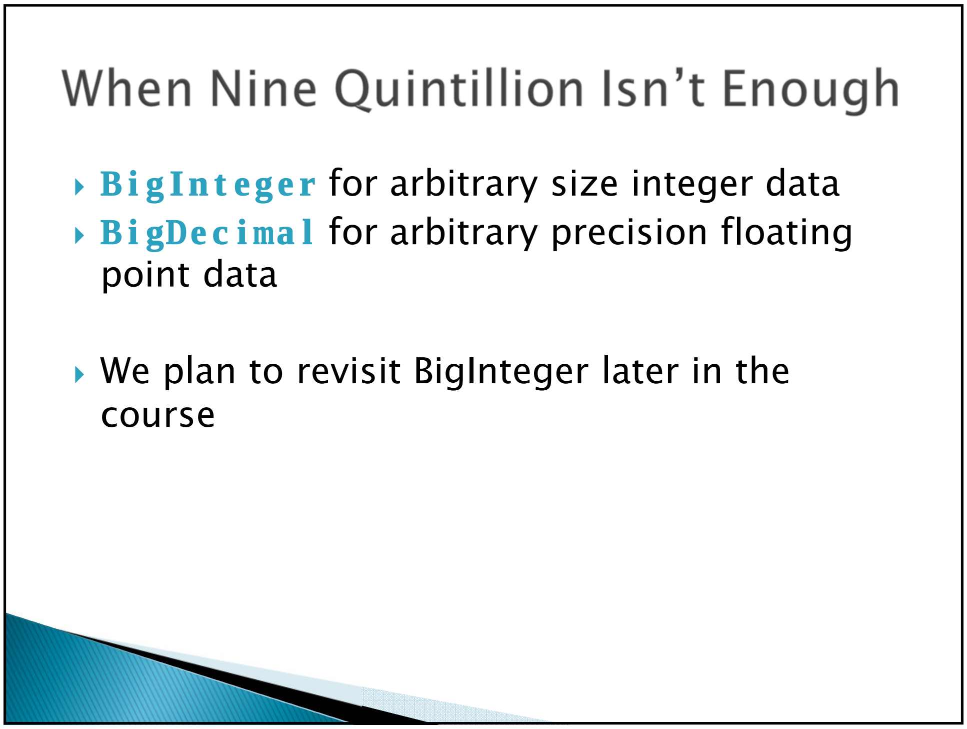
Q4–Q5



Example

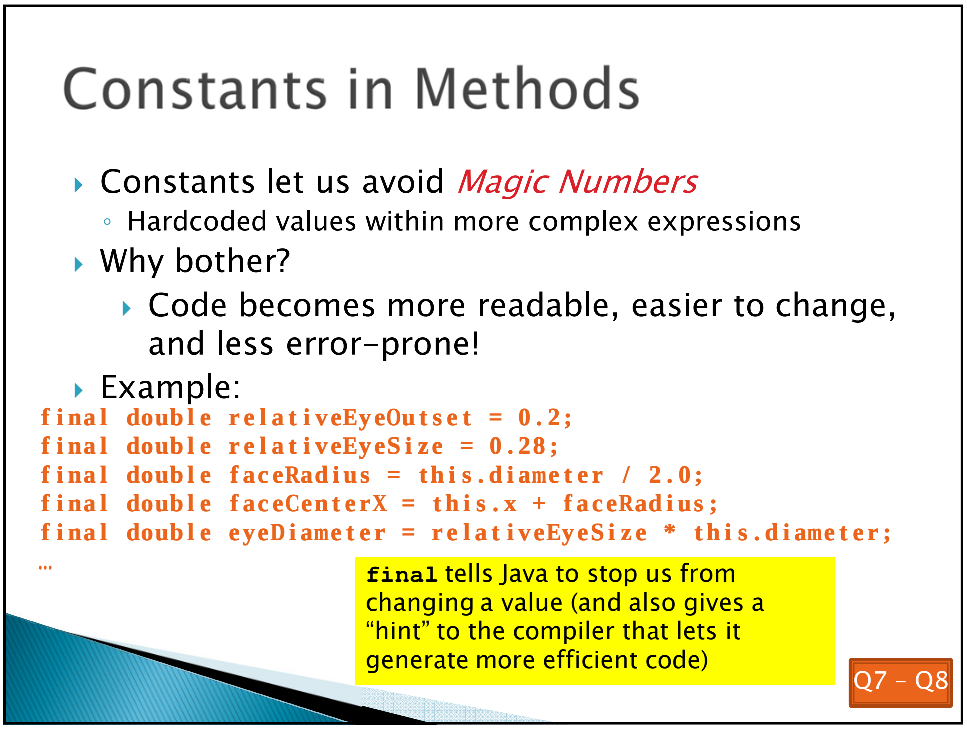
- Look at RoundAndRound.java
  - What does it do?
- Run it and try some different numbers, like:
  - 1.004
  - 1.005
  - 1.006
  - -1.006
  - 4.35
- Zoinks! What's up with these, especially the last one?
  - Try changing the `%f` format specifier to `%24.20f`

Q6



When Nine Quintillion Isn't Enough

- **BigInteger** for arbitrary size integer data
- **BigDecimal** for arbitrary precision floating point data
- We plan to revisit BigInteger later in the course



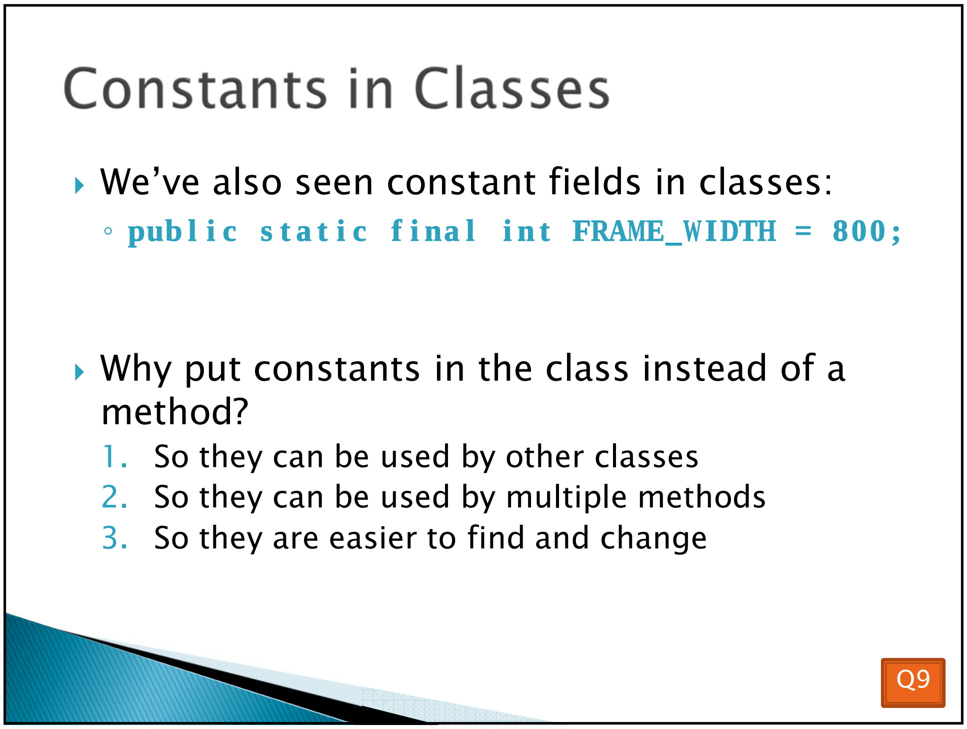
Constants in Methods

- Constants let us avoid *Magic Numbers*
  - Hardcoded values within more complex expressions
- Why bother?
  - Code becomes more readable, easier to change, and less error-prone!
- Example:

```
final double relativeEyeOutset = 0.2;
final double relativeEyeSize = 0.28;
final double faceRadius = this.diameter / 2.0;
final double faceCenterX = this.x + faceRadius;
final double eyeDiameter = relativeEyeSize * this.diameter;
…
```

final tells Java to stop us from changing a value (and also gives a “hint” to the compiler that lets it generate more efficient code)

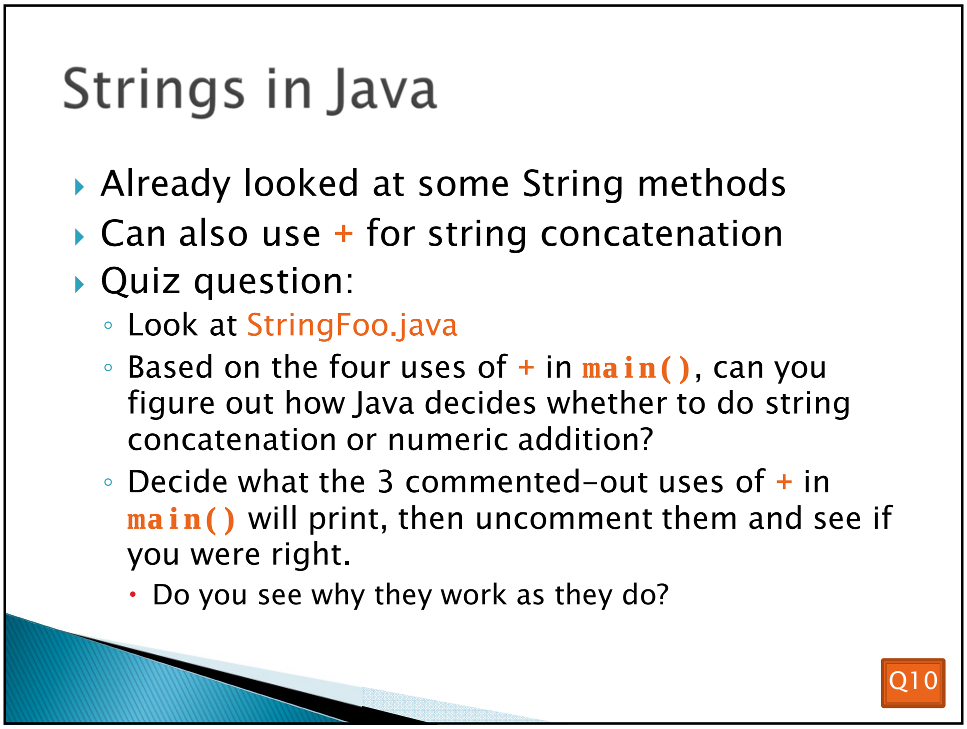
Q7 – Q8



Constants in Classes

- We’ve also seen constant fields in classes:
  - `public static final int FRAME_WIDTH = 800;`
- Why put constants in the class instead of a method?
  1. So they can be used by other classes
  2. So they can be used by multiple methods
  3. So they are easier to find and change

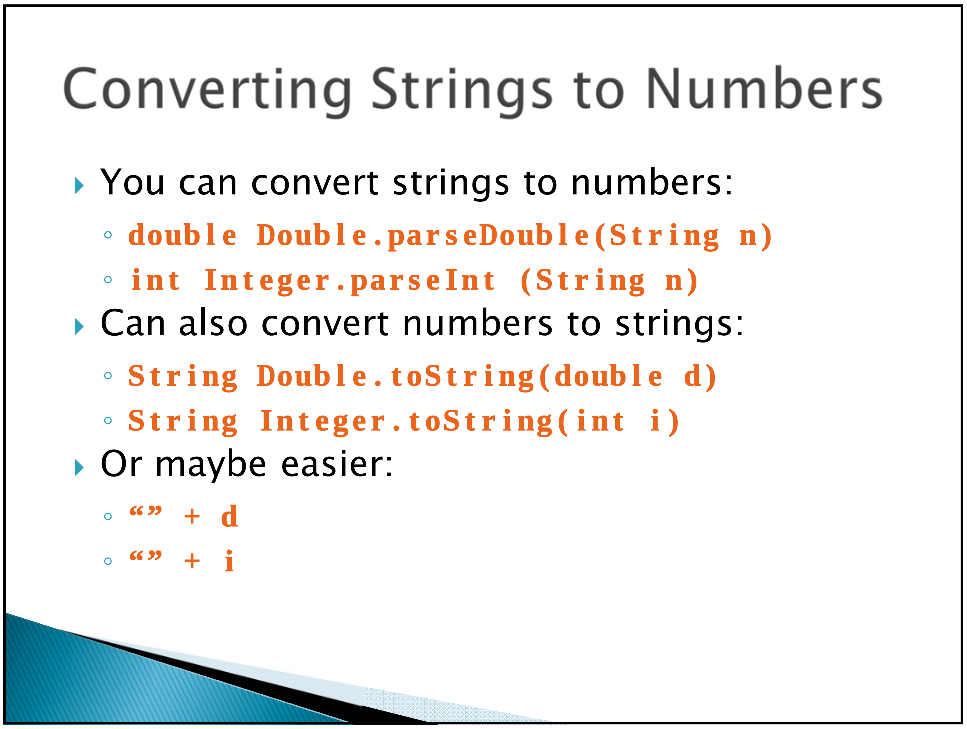
Q9



Strings in Java

- Already looked at some String methods
- Can also use + for string concatenation
- Quiz question:
  - Look at StringFoo.java
  - Based on the four uses of + in `main()`, can you figure out how Java decides whether to do string concatenation or numeric addition?
  - Decide what the 3 commented-out uses of + in `main()` will print, then uncomment them and see if you were right.
    - Do you see why they work as they do?

Q10



Converting Strings to Numbers

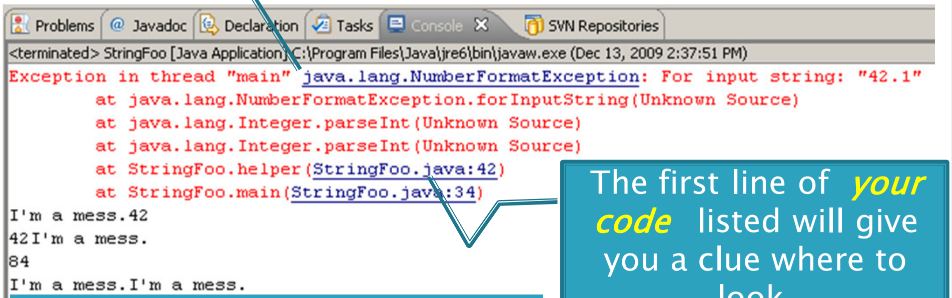
- You can convert strings to numbers:
  - `double Double.parseDouble(String n)`
  - `int Integer.parseInt (String n)`
- Can also convert numbers to strings:
  - `String Double.toString(double d)`
  - `String Integer.toString(int i)`
- Or maybe easier:
  - `“” + d`
  - `“” + i`

Conversions Gone Awry

- Go back to StringFoo.java
- Uncomment the last line of `main()`:
  - `StringFoo.helper();`
- Run it
- What happened?

Reading Exception Stack Traces

The first line will usually give you a hint about what went wrong.

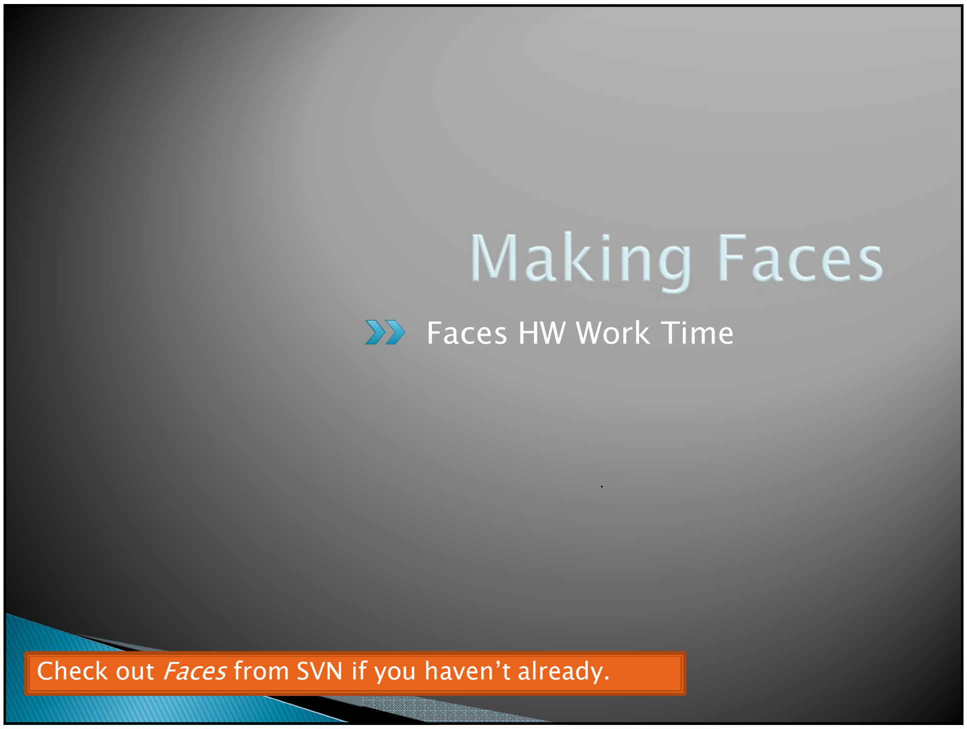


```
<terminated> StringFoo [Java Application] C:\Program Files\Java\jre6\bin\javaw.exe (Dec 13, 2009 2:37:51 PM)
Exception in thread "main" java.lang.NumberFormatException: For input string: "42.1"
	at java.lang.NumberFormatException.forInputString(Unknown Source)
	at java.lang.Integer.parseInt(Unknown Source)
	at java.lang.Integer.parseInt(Unknown Source)
	at StringFoo.helper(StringFoo.java:42)
	at StringFoo.main(StringFoo.java:34)
I'm a mess.42
42I'm a mess.
84
I'm a mess.I'm a mess.
```

The first line of *your code* listed will give you a clue where to look.

The error output often appears at the *top* of the Console window (even though the error occurred *after* the output that is displayed). This is because the normal output and the error output are written *concurrently* to two different places, but Eclipse shows them together.

Q11 – Q13



Making Faces

- Faces HW Work Time

Check out *Faces* from SVN if you haven’t already.