1 Give em the 'Ol Switcheroo

For each function call in the main method, write out the x and y values of both foobar and baz after executing that line. (Spring '15, MT1)

```java
public class Foo {
    public int x, y;

    public Foo (int x, int y) {
        this.x = x;
        this.y = y;
    }
    public static void switcheroo (Foo a, Foo b) {
        Foo temp = a;
        a = b;
        b = temp;
    }
    public static void fliperoo (Foo a, Foo b) {
        Foo temp = new Foo(a.x, a.y);
        a.x = b.x;
        a.y = b.y;
        b.x = temp.x;
        b.y = temp.y;
    }
    public static void swaperoo (Foo a, Foo b) {
        Foo temp = a;
        a.x = b.x;
        a.y = b.y;
        b.x = temp.x;
        b.y = temp.y;
    }

    public static void main (String[] args) {
        Foo foobar = new Foo(10, 20);
        Foo baz = new Foo(30, 40);
        switcheroo(foobar, baz);    foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
        fliperoo(foobar, baz);      foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
        swaperoo(foobar, baz);      foobar.x: ___ foobar.y: ___ baz.x: ___ baz.y: ___
    }
}
```

Solution:

```
line 34: foobar.x: 10 foobar.y: 20 baz.x: 30 baz.y: 40
line 35: foobar.x: 30 foobar.y: 40 baz.x: 10 baz.y: 20
line 36: foobar.x: 10 foobar.y: 20 baz.x: 10 baz.y: 20
```

2   Quik Maths

What would the contents of the array be after being run through these functions in the `main` method? (Fall '16, MT1)

```java
public class QuikMaths {
    public static void mulitplyBy3(int[] A) {
        for (int x: A) {
            x = x * 3;
        }
    }

    public static void multiplyBy2(int[] A) {
        int[] B = A;
        for (int i = 0; i < B.length; i+= 1) {
            B[i] *= 2;
        }
    }

    public static void swap(int A, int B ) {
        int temp = B;
        B = A;
        A = temp;
    }
    public static void main(String[] args) {
        int[] arr;
        arr = new int[]{2, 3, 3, 4};
        multiplyBy3(arr);

        /* Value of arr: {_____} */

        arr = new int[]{2, 3, 3, 4};
        multiplyBy2(arr);

        /* Value of arr: {_____} */

        int a = 6;
        int b = 7;
        swap(a, b);

        /* Value of a: _____  Value of b: _____ */
    }
}
```

Solution:

line 26: /* Value of arr: {2, 3, 3, 4} */
line 31: /* Value of arr: {4, 6, 6, 8} */
line 37: /* Value of a: 6 Value of b: 7 */

3 Static Books

Suppose we have the following Book and Library classes.

```java
class Book {
    public String title;
    public Library library;
    public static Book last = null;

    public Book(String name) {
        title = name;
        last = this;
        library = null;
    }

    public static String lastBookTitle() {
        return last.title;
    }
    public String getTitle() {
        return title;
    }
}

class Library {
    public Book[] books;
    public int index;
    public static int totalBooks = 0;

    public Library(int size) {
        books = new Book[size];
        index = 0;
    }

    public void addBook(Book book) {
        books[index] = book;
        index++;
        totalBooks++;
        book.library = this;
    }
}
```

(a) For each modification below, determine whether the code of the Library and
    Book classes will compile or error if we **only** made that modification, i.e. treat
    each modification independently.

    1. Change the totalBooks variable to **non static**

    2. Change the lastBookTitle method to **non static**

    3. Change the addBook method to **static**

    4. Change the last variable to **non static**

    5. Change the library variable to **static**

   Solution:

    1. Compile

    2. Compile

    3. Error

    4. Error

    5. Compile

(b) Using the Book and Library classes from before, write the output of the main method below. If a line errors, put the precise reason it errors and continue execution.

```
1   public class Main {
2       public static void main(String[] args) {
3           System.out.println(Library.totalBooks);              _____
4           System.out.println(Book.lastBookTitle());            _____
5           System.out.println(Book.getTitle());                 _____
6
7           Book goneGirl = new Book("Gone Girl");
8           Book fightClub = new Book("Fight Club");
9
10          System.out.println(goneGirl.title);                  _____
11          System.out.println(Book.lastBookTitle());            _____
12          System.out.println(fightClub.lastBookTitle());       _____
13          System.out.println(goneGirl.last.title);             _____
14
15          Library libraryA = new Library(1);
16          Library libraryB = new Library(2);
17          libraryA.addBook(goneGirl);
18
19          System.out.println(libraryA.index);                  _____
20          System.out.println(libraryA.totalBooks);             _____
21
22          libraryA.totalBooks = 0;
23          libraryB.addBook(fightClub);
24          libraryB.addBook(goneGirl);
25
26          System.out.println(libraryB.index);                  _____
27          System.out.println(Library.totalBooks);              _____
28          System.out.println(goneGirl.library.books[0].title); _____
29      }
30  }
```

Solution:

```
1   public class Main {
2       public static void main(String[] args) {
3           System.out.println(Library.totalBooks);              0
4           System.out.println(Book.lastBookTitle());            Error, NullPointerException
5           System.out.println(Book.getTitle());                 Error, does not compile
6
7           Book goneGirl = new Book("Gone Girl");
8           Book fightClub = new Book("Fight Club");
9
10          System.out.println(goneGirl.title);                  Gone Girl
11          System.out.println(Book.lastBookTitle());            Fight Club
```

```
12          System.out.println(fightClub.lastBookTitle());        Fight Club
13          System.out.println(goneGirl.last.title);              Fight Club
14
15          Library libraryA = new Library(1);
16          Library libraryB = new Library(2);
17          libraryA.addBook(goneGirl);
18
19          System.out.println(libraryA.index);                   1
20          System.out.println(libraryA.totalBooks);              1
21
22          libraryA.totalBooks = 0;
23          libraryB.addBook(fightClub);
24          libraryB.addBook(goneGirl);
25
26          System.out.println(libraryB.index);                   2
27          System.out.println(Library.totalBooks);               2
28          System.out.println(goneGirl.library.books[0].title);  Fight Club
29      }
30  }
```