2000 Paper 11 Question 2

Foundations of Programming

The following is the start of a Java program which is intended to print out all prime numbers below 600.

```
public class Primes
 { private static final int SIZE=600, SQRTSIZE=25;

   public static void main(String[] args)
    { boolean[] primes = new boolean[SIZE];
      for (int i=2; i<SIZE; i++)
         primes[i] = true;

      int next = 2;
      while (next < SQRTSIZE)
       { for (int i = next; i<SIZE/next; i++)
            primes[i*next] = false;
         do
          { next++;
          } while (!primes[next]);
       }
      .
      .
```

Explain how the program is intended to work. [5 marks]

Unfortunately one value determined by the program is 589 which is not prime. Where is the bug in the program and how may it be fixed? [4 marks]

All other values determined by the program *are* prime. If the bug were left unfixed and the `final` values were adjusted so that the program attempted to find all primes below 150, would any non-prime be determined? If so, what is it? If not, why not? [4 marks]

Supply the missing part of the program so that the values which are printed out are arranged 10 numbers to a line with each number in a field of 5 places. It is not necessary to write out the part of the program which is shown above (with or without the bug). [7 marks]