

Use the Miller-Rabin test to decide whether the number  $n = 3017$  is prime or not. Check for 3 different bases only if necessary.

Important note: All answer boxes should be filled in using the convention that those not applicable must be filled in with  $x$ .  
All numbers must be filled in as positive numbers mod  $n$ .

**Solution.**

**Decomposition:**

$s = 3$     $t = 377$     $t$  in binary = 0101111001

**Iteration  $k = 1$  for  $a = 2$  (results mod  $n$ ):**

$2^{(2^0)} = 2$     $2^{(2^1)} = 4$     $2^{(2^2)} = 16$     $2^{(2^3)} = 256$     $2^{(2^4)} = 2179$

$2^{(2^5)} = 2300$     $2^{(2^6)} = 1199$     $2^{(2^7)} = 1509$     $2^{(2^8)} = 2263$     $2^{(2^9)} = x$

$2^t = 1152$     $2^{2t} = 2641$     $2^{2^2t} = 2594$     $2^{2^3t} = 926$     $2^{2^4t} = x$

**Iteration  $k = 2$  for  $a = 3$  (results mod  $n$ ):**

$3^t = x$     $3^{2t} = x$     $3^{2^2t} = x$     $3^{2^3t} = x$     $3^{2^4t} = x$

**Iteration  $k = 3$  for  $a = 5$  (results mod  $n$ ):**

$5^t = x$     $5^{2t} = x$     $5^{2^2t} = x$     $5^{2^3t} = x$     $5^{2^4t} = x$

**Conclusion:**

$n$  is prime (yes/no) = no