

$$1) x^2 - y^2 = 105$$

$$x^2 - 105 = y^2$$

$$\begin{matrix} 11 & 4 & 2^2 \\ 13 & 8 & 2^3 \\ 14 & 16 & 2^4 \end{matrix}$$

2a)	1	5	9	13	17	21	25	33	37	41
	45	49	53	57	61	65	69	73	77	81
	85	89	93	97	101	105	109	113	117	121
	125	129	133	137	141	145	149	153	157	161
	165	169	173	177	181	185	189	193	197	201
	205	209	213	217	221	225				

first 15 S-Primes

$$\{5, 9, 13, 17, 21, 33, 37, 41, 49, 53, 57, 61, 69, 73, 77\}$$

b) first 15 S-composites:

$$\{25, 45, 65, 81, 85, 105, 117, 125, 145, 153, 165, 169, 185, 189, 205\}$$

c) $\boxed{441} = 21 \cdot 21 = 49, 9$

d) ?

3) Primes from $\{601 \dots 8003\} =$
 $\{601, 607, 613, 617, 619, 631, 641,$
 $647, 653, 659, 661, 673, 677, 683,$
 $691, 701, 709, 719, 727, 733, 739, 743,$
 $751, 757, 761, 769, 773, 787, 797\}$

4a) $12 = 2^2 \cdot 3$

$$\begin{array}{ccccccccccccccccc} 2 & 3 & 5 & 7 & 11 & 13 & 17 & 19 & 23 & 29 & 31 & 37 & 41 \\ \hline & 1 & & & & & & & & & & & & & \end{array}$$

b) $123 = 3 \cdot 41$

$$\begin{array}{ccccccccccccccccc} 2 & 3 & 5 & 7 & 11 & 13 & 17 & 19 & 23 & 29 & 31 & 37 & 41 \\ \hline & \times & 1 & \times & <\sqrt{41} & - & & & & & & & & & & \end{array}$$

c) $1234 = 2 \cdot 617$

$$\begin{array}{ccccccccccccccccc} 2 & 3 & 5 & 7 & 11 & 13 & 17 & 19 & 23 & 29 & 31 & 37 & 41 \\ \hline & 1 & \times & \times & \times & \times & > & \times & \times & >\sqrt{617} & - & & & & & \end{array}$$

d) $12345 = 3 \cdot 5 \cdot 823$

$$\begin{array}{ccccccccccccccccc} 2 & 3 & 5 & 7 & 11 & 13 & 17 & 19 & 23 & 29 & 31 & 37 & 41 \\ \hline & \times & 1 & & & & & & & & & & & & & \end{array}$$

$$\begin{array}{ccccccccccccccccc} & & \times & 1 & & & & & & & & & & & & & \end{array}$$

$$\begin{array}{ccccccccccccccccc} & & \times & >\sqrt{823} & - & & & & & \end{array}$$

$$e) 123456 = 2^6 \cdot 3 \cdot 643$$

2 3 5 7 11 13 17 19 23 29 31 37 41

|

|

|

|

x |

x

x

x

x

x

x

x

x

x

x

x

$> \sqrt{643} \rightarrow$

$$f) 1234567 = 127 \cdot 9721$$

... 127 131 ...

x |

x

$> \sqrt{9721} \rightarrow$

$$g) 12345678 = 2 \cdot 3^2 \cdot 47 \cdot 14593$$

2 3 5 7 11 13 17 19 23 29 31 37 41 47

|

x |

|

x x + x x x x x x x x x x |

$$h) 123444321 = 3 \cdot 7 \cdot 11^2 \cdot 13 \cdot 37 \cdot 101$$

2 3 5 7 11 13 17 19 23 29 31 37 41 ... 101

x |

x *

|

x |

|

x |

x

x

x

x

x

x

x

|

...

|

5) run Eratosthenes' sieve with a max of
 $(\sqrt{8887} + 1)^2 = 31^2 = 961$. This will find the next prime, 907

6)

	2	3	5	7	11	13	17	19	23	29	31	37	41	47
888	1													
889	X	X	X	1										
891	X		1											
893	X	X	X	X	X	X	X	X	1					
895	X	X		1										
897	X		1											
899	X	X	X	X	X	X	X	X	X	X	1			
901	X	X	X	X	X	X		1						
903	X		1											
905	X	X		1										
907	X	X	X	X	X	X	X	X	X	X	X			

52 trial divisions

		0	1	2	3	4	5 (x)
		0	3	6	9	12	15
		1	10	13	16	19	22
1		7	10	13	16	19	22
2		14	17	20	23	26	29
3		21	24	27	30	33	36
4		28	31	34	37	40	43
5		35	38	41	44	47	50
(y)							

we are missing many values near the multiples
of 3, for example 8 (near 9) 3 11 (near 12)

we have all the multiples of 3, 7, 10