

Solutions to HW Set 6, from text book

Math 1350

4.1

6. (a) $2310 = 2 \cdot 3 \cdot 5 \cdot 7 \cdot 11$ (b) $6517 = 7^3 \cdot 19$

11. (b)

$$667 = 437 + 230$$

$$437 = 230 + 207$$

$$230 = 207 + 23$$

$$207 = 23 \cdot 9 + 0$$

$$23 = 230 - 207$$

$$= 667 - 437 + 230 - 437$$

$$= 667 - 437 + 667 - 437 - 437$$

$$= 2 \cdot 667 - 3 \cdot 437$$

(d) $3001 = 5 \cdot 541 + 296$

$$541 = 296 + 245$$

$$296 = 245 + 51$$

$$245 = 4 \cdot 51 + 41$$

$$51 = 41 + 10$$

$$41 = 4 \cdot 10 + 1$$

$$296 = 3001 - 5 \cdot 541$$

$$245 = 6 \cdot 541 - 3001$$

$$51 = 2 \cdot 3001 - 11 \cdot 541$$

$$41 = 6 \cdot 541 - 3001 - 4(2 \cdot 3001 - 11 \cdot 541)$$

$$= 50 \cdot 541 - 9 \cdot 3001$$

$$10 = 11 \cdot 3001 - 61 \cdot 541$$

$$1 = 50 \cdot 541 - 9 \cdot 3001 - 44 \cdot 3001 + 244 \cdot 541$$

$$= 294 \cdot 541 - 53 \cdot 3001$$

12. (b) One obtains -32 (or 57) as the inverse, using the Euclidean algorithm.

13. (a) $8^{-1} = 12$, so $x \equiv 36 \equiv 17$

(b) $5^{-1} = 11$, so $x \equiv 451 \equiv 19$

14. (b) $x \equiv 42(1 - 3y)$

$$= 42 - 2 \cdot 3^2 \cdot 7y$$

4.2

1. (b) no.

- (d) yes.

4. 3913

4004

173

2166

5679

4997

5717

5146

6. $96+91+61+21+67=336$

8. (optional) There is a typo here,

$$5^{-1} = 202 \pmod{1009}$$

$$202 \cdot 1607 \pmod{1009} = 725$$

$$\text{but, } 500+125+61+29+8=723$$

4.3

1. (a) $3^2 \equiv 9$, $3^4 \equiv 9$, so $3^8 \equiv 9$, so $3^7 \equiv 3$.

(d) 4^{16+4+2} : $4^2 \equiv 9$, $4^4 \equiv 4$, $4^8 \equiv 9$, $4^{16} \equiv 4$.

2. (a) 99

(b) 1

$$(e) \equiv (65^2)^7 2 \equiv 1$$

7. (b) $d \cdot e = 25$

$$8k = 24$$

$$k = 3$$

(c) $d \cdot e = 33$

$$32 = 8 \cdot k$$

$$k = 4$$