Section 11.4

1. (a) $2^2 \cdot 3 \cdot 5 = 60$ (b) $2 \cdot 3^2 \cdot 5 \cdot 7 = 630$ (c) $19^4 = 130\,321$ (d) 12112

3. (a) 2 (b) 5 (c) 0

(d) 0 (e) 2 (f) 2

(g) 1 (h) 3 (i) 0

5. (a) 1 (b) 1 (c) $m(4) = r(4)$, where $m = 11q + r, 0 \leq r < 11$.

7. Since the solutions, if they exist, must come from $\mathbb{Z}_2$, substitution is the easiest approach.

(a) 1 is the only solution, since $1^2 +_2 1 = 0$ and $0^2 +_2 1 = 1$

(b) No solutions, since $0^2 +_2 0 +_2 1 = 1$, and $1^2 +_2 1 +_2 1 = 1$

9. Hint: Prove by induction on m that you can divide any positive integer into m, That is, let $p(m)$ be "For all n greater than zero, there exist unique integers q and r such that. . . ." In the induction step, divide n into $m - n$.