$\boxed{\text{Thm } 2.1.8:}$ (a) If $a \in \mathbb{R}$ and $a \neq 0$, then $a^2 > 0$

(b) $1 > 0$ (c) If $n \in \mathbb{N}$, then $n > 0$

$\boxed{\text{Proof:}}$ (a) 1. By Trichotomy property, if $a \in \mathbb{R}$, then exactly one of $a \in P$, $a = 0$, $-a \in P$ holds.

2. Suppose, $a \in P$ holds 3. By defn, $a > 0$ 4. $a \cdot a > 0 \cdot a$ (Thm 2.1.7(c) on 3)

5. $0 \cdot a = a \cdot 0$ (M1) 6. $a \cdot 0 = 0$ (Thm 2.1.2(c)) 7. $0 \cdot a = 0$ (Transitivity of eq on 5,6)

8. $a \cdot a > 0$ (Substitution of eq 7 on 4) 9. $a^2 > 0$ (We write a^2 as $a \cdot a$)

10. $a^2 \in P$ (By defn.)

11. $\because a \neq 0$, $a = 0$ is F 12. Suppose, $-a \in P$ holds 13. By defn, $(-a) > 0$

14. $(-a) \cdot (-a) > 0 \cdot (-a)$ (Thm 2.1.7(c) on 13) 15. $0 \cdot (-a) = (-a) \cdot 0$ (M1)

16. $(-a) \cdot 0 = 0$ (Thm 2.1.2(c)) 17. $0 \cdot (-a) = 0$ (Transitive prop of eq on 15,16)

18. $(-a) \cdot (-a) > 0$ (Substitution of eq 17 on 14)

19. $(-1) \cdot a = (-a)$ (Ex 2.1, 1(c)) 20. $-a = (-1) \cdot a$ (Symmetric prop of eq on 19)

21. $(-a) \cdot (-a) = ((-1) \cdot a) \cdot ((-1) \cdot a)$ (Substitution prop of eq 20)

22. $(-1) \cdot a = a \cdot (-1)$ (M1) 23. $((-1) \cdot a) \cdot ((-1) \cdot a) = (a \cdot (-1)) \cdot ((-1) \cdot a)$ (Substitution prop of eq 22)

24. $(a \cdot (-1)) \cdot ((-1) \cdot a) = a \cdot ((-1) \cdot ((-1) \cdot a))$ (M2)

25. $((-1) \cdot a) \cdot ((-1) \cdot a) = a \cdot ((-1) \cdot ((-1) \cdot a))$ (Transitivity of eq on 23, 24)

26. $((-1) \cdot (-1)) \cdot a = (-1) \cdot ((-1) \cdot a)$ (M2) 27. $(-1) \cdot ((-1) \cdot a) = ((-1) \cdot (-1)) \cdot a$ (Symmetry of eq on 26)

28. $a \cdot ((-1) \cdot ((-1) \cdot a)) = a \cdot (((-1) \cdot (-1)) \cdot a)$ (Substitution of eq 27)

29. $((-1) \cdot a) \cdot ((-1) \cdot a) = a \cdot (((-1) \cdot (-1)) \cdot a)$ (Transitivity of eq on 25,28)

30. $(-1) \cdot (-1) = 1$ (Ex 2.1, 1(d)) 31. $((-1) \cdot (-1)) \cdot a = 1 \cdot a$ (Substitution of eq 30)

32. $1 \cdot a = a$ (M3) 33. $((-1) \cdot (-1)) \cdot a = a$ (Transitivity of eq on 31,32)

34. $a \cdot (((-1) \cdot (-1)) \cdot a) = a \cdot a$ (Substitution of eq 33)

35. $((-1) \cdot a) \cdot ((-1) \cdot a) = a \cdot a$ (Transitivity of eq on 29,34)