

Answers to Selected Exercises

Exercises 1.1

1. (b) false
(g) true
2. (c) not a proposition; the symbol x acts as a variable
(f) a true proposition
3. (a) $P \quad \sim P \quad P \wedge \sim P$

T	F	F
F	T	F

- (c) $P \quad Q \quad \sim Q \quad P \wedge \sim Q$

T	T	F	F
F	T	F	F
T	F	T	T
F	F	T	F

- (e) $P \quad Q \quad \sim Q \quad P \wedge Q \quad (P \wedge Q) \vee \sim Q$

T	T	F	T	T
F	T	F	F	F
T	F	T	F	T
F	F	T	F	T

- (i) $P \quad Q \quad R \quad Q \vee R \quad P \wedge (Q \vee R)$

T	T	T	T	T
F	T	T	T	F
T	F	T	T	T
F	F	T	T	F
T	T	F	T	T
F	T	F	T	F
T	F	F	F	F
F	F	F	F	F

4. (a) false
 (c) true
 (f) false
 (g) true
6. (a) equivalent
 (c) equivalent
 (e) not equivalent
 (g) not equivalent
8. (a) Since P is equivalent to Q , P has the same truth table as Q . Therefore, Q has the same truth table as P , so Q is equivalent to P .
9. (c) tautology

P	Q	$P \wedge Q$	$\sim P \vee \sim Q$	$(P \wedge Q) \vee (\sim P \vee \sim Q)$
T	T	T	F	T
F	T	F	T	T
T	F	F	T	T
F	F	F	T	T

10. (a) contradiction
 (c) tautology
11. (a) x is not positive.
 (c) $5 < 3$
 (e) Roses are not red or violets are not blue.
13. (a) (i)

P	Q	$P \odot Q$
T	T	F
F	T	T
T	F	T
F	F	F

Exercises 1.2

1. (a) Antecedent: squares have three sides.
 Consequent: triangles have four sides.
- (d) Antecedent: f is differentiable.
 Consequent: f is continuous.
- (f) Antecedent: f is integrable.
 Consequent: f is bounded.
- (i) Antecedent: An athlete qualifies for the Olympic team.
 Consequent: The athlete has a time of 3 minutes, 48 seconds or less.
2. (a) Converse: If triangles have four sides, then squares have three sides.
 Contrapositive: If triangles do not have four sides, then squares do not have three sides.
- (d) Converse: If f is continuous, then f is differentiable.
 Contrapositive: If f is not continuous, then f is not differentiable.
- (f) Converse: If f is bounded, then f is integrable.
 Contrapositive: If f is not bounded, then f is not integrable.