Challenge: Skills and Applications

1. inverse: If a bicycle is not red, then it does not have two seats. converse: If a bicycle has two seats, then it is red. contrapositive: If a bicycle does not have two seats, then it is not red.

2. inverse: If a thopfoo cannot make a pucho, then all gorups are not purple. converse: If all gorups are purple, then a thopfoo can make a pucho. contrapositive: If all gorups are not purple, then a thopfoo cannot make a pucho.

3. inverse: If a student does not enjoy mathematics, then he or she does not have a logical mind. converse: If a student has a logical mind, then he or she enjoys mathematics. contrapositive: If a student does not have a logical mind, then he or she does not enjoy mathematics.

4. inverse: If a person is not a citizen of the Regal Kingdom, then he or she does not have blue hair. converse: If a person has blue hair, then he or she is a citizen of the Regal Kingdom. contrapositive: If a person does not have blue hair, then he or she is not a citizen of the Regal Kingdom.

5. true; If a positive integer is divisible by both 3 and 5, then it is divisible by 15; true.

6. false; If a positive integer is divisible by 12, then it is divisible by both 2 and 3; true; counterexample for original statement: 18 is divisible by 2 and 3 but not by 12.

7. true; If an integer n is divisible by 3, then n^2 is divisible by 3; true.

8. false; If an integer n is divisible by 4, then n^2 is divisible by 4; true; counterexample for original statement: If $n = 6$ then n^2 is divisible by 4 but n is not divisible by 4.

9. true; Postulate 11: If two planes intersect, then their intersection is a line

10. false; There are many planes (but only one line) through any pair of points.

11. true; Since a plane contains at least 3 *noncollinear* points, it certainly contains at least three points.

12. false; Any three collinear points are also coplaner.

13. *Sample answer:* There exists exactly one plane which contains both lines a and b.

14. Postulate 6: A line contains at least two points.

15. Postulate 7: If two lines intersect, then their intersection is exactly one point.

16. Postulate 8: Through any three noncollinear points there exists exactly one plane.

17. Postulate 10: If two points lie in a plane, then the line containing them lies in the plane.

18. Answers will vary.