

**Math 270 Basic Discrete Math**  
**Practice Test 1**  
Sections 1.4, 1.2, 2.1, 2.2, 3.1, 3.2, 3.3, 4.1

Name: (Please Print) \_\_\_\_\_

**Directions:** Answer the problems below. You may use scientific (non-graphing) calculators, but no other electronic devices. Show all work.

1. Determine whether the logical expressions  $(p \rightarrow q) \wedge (p \rightarrow r)$  and  $p \rightarrow (q \wedge r)$  are logically equivalent or not. Justify your answer.

2. Answer parts a. and b. below. In both parts your answers may be sentences, and you do not need to determine whether the given statements are true or false.

a. Write negations for each of the following statements.

(i) Math 270 is relaxing and enjoyable.

(ii) Every multiple of five is an odd number.

(iii) There exists a real number  $x$  such that  $x^7 = -20$ .

b. Write contrapositives for each of the following universal conditionals.

(i) For all squares  $S$ , if  $S$  has side length  $\ell$  then  $S$  has area  $\ell^2$ .

(ii) For all integers  $m$  and  $n$ , if  $mn$  is even then  $m$  is even or  $n$  is even.

3. Provide short answers for parts a.-d.

a. Draw a graph  $G$  with 5 vertices with degrees 1, 1, 2, 2, 2.

b. State the definition for an integer  $n$  to be *composite*.

c. Let  $P$  be the set of all prime divisors of the number 2400: express  $P$  in set-roster notation.

d. What are De Morgan's Laws?

4. Let  $S$  be the set of students at CSUSM,  $G$  be the set of all video games ever made, and let  $P(s, g)$  be the predicate “student  $s$  has played game  $g$ ”.

a. Rewrite each of the following as a sentence without using the symbols  $\forall$  or  $\exists$ , and without using variables.

i.  $\forall s \in S, \exists g \in G$  such that  $P(s, g)$ .

ii.  $\exists s \in S$  such that  $\forall g \in G, \sim P(s, g)$ .

iii.  $\forall s \in S, P(s, \text{Mario Kart 8 Deluxe}) \vee P(s, \text{Minesweeper})$ .

b. Rewrite each of the following sentences symbolically, using variables along with the symbols  $\forall$  and  $\exists$  and the predicate  $P(s, g)$ .

i. There is a game that every student at CSUSM has played.

ii. There is a game Student  $A$  has played that Student  $B$  has not played.

iii. Student  $A$  has played every game that Student  $B$  has played.

5. Answer parts a. and b. below.

a. Prove the following statement: There exist integers  $a$  and  $b$  such that  $(a + b)^2 = a^2 + b^2$ .

b. Find a counterexample that shows the following statement is false: For all integers  $n$ , if  $n$  is odd then  $\frac{n + 1}{2}$  is also odd.