

Provide clear explanations and clearly show your work.  
Follow the Honor Code.

- (2) 1. How many must be female, if it is FALSE that:  
a) at least one in a pair of 2 people is male; b) everyone in a group of people is male?  
Explain.

a) both since negation of an or statement is an and  
b) at least one since negation of all are is some are not

- (2) 2. If you work a problem correctly, then you get the right answer. What, if anything, can you deduce, if:

a) you get the wrong answer; b) you get the correct answer? Explain.

a) You worked the problem incorrectly because otherwise you would have gotten the right answer.  
b) Nothing because you could have gotten the right answer by accident.

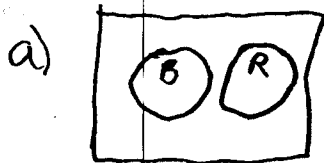
- (2) 3. If p and q are true and r is false, find the truth values of:

a) (p or q) and r    b) p or (q and r).

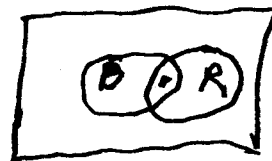
T   T   F    T   T   F  
(T) and F    T or (F)  
                  T

False            True

- (2) 4. Draw diagrams illustrating the meaning of: a) No birds are red; b) the negation of a).



b) some birds are red



- (4) 5. The population (in millions) was 36.2 in 1985 and 42.6 in 2005.  
a) Find the average yearly increase in population from 1985 to 2005.  
b) Write a model that estimates the population P for t years after 1985.  
c) Estimate the population in 2020.  
d) Estimate when the population will reach 68.2.

a)  $(42.6 - 36.2) / (2005 - 1985) = 6.4 / 20 = \boxed{.32}$

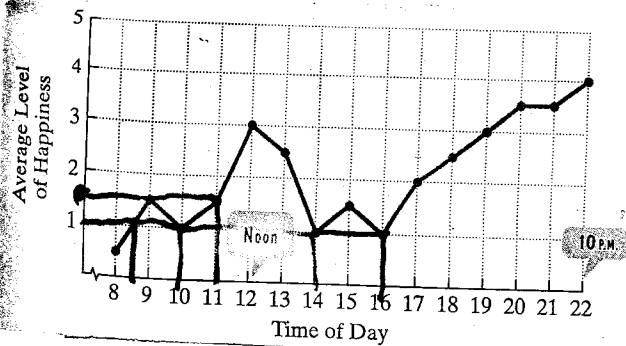
b)  $P = 36.2 + .32t$

c)  $36.2 + .32 \cdot 35 = 36.2 + 11.2 = \boxed{47.4}$

d)  $68.2 = 36.2 + .32 \cdot t$

$32 = .32t, \text{ or } t = 32 / .32 = 100 \text{ so in } \boxed{2085}$

- (2) 6. From the graph:  
 a) What is the happiness level at time 11;  
 b) When does the happiness level equal 1?



- (2) 7. In a group of 100 students, 80 take art or music, 50 take art, 36 take both. How many take: a) art, but not music; b) at least one of the two subjects?

$$\begin{aligned}
 m(U) &= 100 \\
 m(A \cup M) &= 80 \\
 m(A) &= 50 \\
 m(A \cap M) &= 36
 \end{aligned}$$

$$a) m(A) = m(A \cap M) + m(A \cap M')$$

$$50 = 36 + m(A \cap M')$$

$$\boxed{14 = m(A \cap M')}$$

$$b) \boxed{m(A \cup M) = 80}$$

- (2) 8. List the subsets of  $\{a, b\}$ .

$$\{\}, \{a\}, \{b\}, \{a, b\}$$

- (2) 9.  $U = \{a, b, c, d, e\}$ ;  $A = \{a, b, c\}$ ;  $B = \{c, d\}$ . List the objects that are:  
 a) not in A or not in B; b) not in either A or B.

$$a) A' \cup B' = \{d, e\} \cup \{a, b, e\} = \{a, b, d, e\} = (A \cap B)'$$

$$b) (A \cup B)' = \{a, b, c, d\}' = \{e\} = A' \cap B'$$

- (2) 10. 65 teams compete in a single elimination tournament. (A team is eliminated when it loses a game.) How many games must be played in order to determine the champion? Explain.

Every game eliminates one team.

Thus the set of games is equivalent to the set of eliminated teams. Every team but the champion is eliminated. So the latter set has 64 members.

Hence there must be  $\boxed{64}$  games.

What problem does this remind you of?