

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

(2) 1. It is false that: if I am in the E-Z pass lane, then I have an E-Z pass.

- a) Am I in the E-Z pass lane? **YES**  
b) Do I have an E-Z pass? **NO**

Answer yes, no, or maybe for each.

*(p implies q) is false only when p is true and q is false*

(2) 2. If John loves Mary, then he gives her a valentine. What can you deduce if:

- a) he gives her a valentine; b) he doesn't give her a valentine? Explain.

- a) *Nothing. The converse may not be true.*  
b) *He doesn't love her. If he did, then he would give her a valentine.*

(4) 3. If p is false and q is true, find the truth values of:

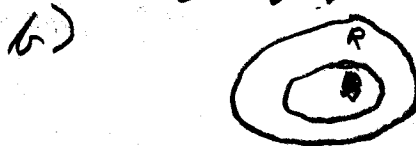
- a) p implies q; b) q implies p; c) (not q) implies (not p); d) not (p implies q).

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

a) T ; b) F c) T d) F

*note a) & c) are equivalent since c) is the contrapositive of a)*

(2) 4. Draw diagrams illustrating the meaning of: a) Some birds are not red; b) the negation of a).



- (4) 5. a) Estimate the yearly increase in cost from 1998 to 2005.  
b) Write a model that estimates the cost C, x years after 1998.  
c) Estimate the cost in 2012.  
d) Estimate when the cost will reach \$30,000.

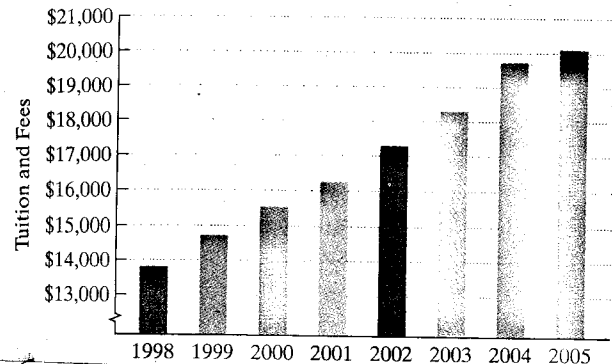
a) *in 7 years the cost increases by  $20 - 13,800 = 6,200$ . So  $\frac{6200}{7} \approx 900$*

b)  $C \approx 13,800 + 900x$

c)  $C \approx 13,800 + 900 \cdot 14 = 13,800 + 12,600 = 26,400$

d)  $30,000 \approx 13,800 + 900x$

*So  $x \approx \frac{16,200}{900} \approx 18$ , so in **2016***



- (1) 6. What could cause the casual reader to draw an incorrect conclusion from the graph in the previous problem?

Since the bars are truncated, they are shorter than they should be. Thus the changes look proportionately larger. Hence, the rate of increase appears larger than it really is.

- (2) 7. In a group of 100 students, 80 take art or music, 50 take art, 40 take music. How many take: a) both; b) neither.

$$n(U) = 100$$

$$n(A \cup M) = 80$$

$$n(A) = 50$$

$$n(M) = 40$$

$$a) 80 = n(A \cup M) = n(A) + n(M) - n(A \cap M)$$

$$80 = 50 + 40 - n(A \cap M) \text{ so } \boxed{n(A \cap M) = 10}$$

$$b) n(A' \cap M') = n((A \cup M)') = n(U) - n(A \cup M) = 100 - 80 = \boxed{20}$$

- (2) 8. Find the product of  $5.4(10^{12})$  and  $2(10^{-7})$  and write it in scientific notation.

$$5.4(10^{12}) \cdot 2(10^{-7}) = (5.4 \cdot 2)(10^{12} 10^{-7}) = 10.8 \cdot 10^5 = 1.08 \cdot 10^6$$

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

$$a) A' = \{d, e\}; B' = \{a, b, e\} \text{ so } A' \cap B' = \{e\}$$

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

- (1) 10. I have an 8 by 4 chocolate bar. I intend to break individual pieces in 2 (one piece at a time) until I have 32 pieces. How many breaks must I make? Explain.

Each time I break a piece, I increase the number of pieces by 1. Since I started with 1 piece, if  $b$  is number of breaks &  $p$  is number of pieces,  $p = 1 + b$ . For  $p = 32 = 1 + b$ ,  $\boxed{b = 31}$   
What problem does this remind you of?