

PROBLEM SET 2  
Due Friday, April 13, 2007, in class

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**Instructions:** Same as for Problem Set 1.

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*The exercise numbers refer to the number in Rosen's book, 6th Edition. When a different number is used in the 5th edition, that number is also mentioned.*

1. Give the negation of each of the following statements (your final answer must be in the form of English sentences):
  - (a) No males give birth to their young.
  - (b) No students of mathematics are unable to use a computer.
  - (c) Everyone in the class with an Internet connection has emailed at least one other student in the class.
  - (d) All good students study hard.
2. Section 1.3, Exercise 62 (Section 1.3, Exercise 58 in 5th edition)
3. Section 1.4, Exercise 18, parts b,c,d,e. (same numbers in 5th edition)
4. Determine the truth value of  $\exists x \forall y (x \leq y^2)$  when the universe of discourse is
  - (a) Positive reals
  - (b) Nonnegative reals
  - (c) Positive integers
  - (d) Nonnegative integers
5. Is  $\forall x (P(x) \leftrightarrow Q(x))$  logically equivalent to  $\forall P(x) \leftrightarrow \forall Q(x)$ ? Justify your answer.
6. Prove the resolution inference rule which states that  $q \vee r$  follows from  $p \vee q$  and  $\neg p \vee r$ , using **only** the equivalences and basic inference rules described in class and the logic handout.
7. Section 1.5, Exercise 14, parts a,b. (5th edition: Section 1.5, Exercise 10, parts a,b)
8. Section 1.5, Exercise 34. (5th edition: Section 1.5, Exercise 70)
9. Assuming the truth of the theorem that states that  $\sqrt{n}$  is irrational whenever  $n$  is a positive integer that is not a perfect square, prove that  $\sqrt{2} + \sqrt{3}$  is irrational.