question 3.
$A - B \subseteq A$
Assume that $x \in A - B$. Then it follows that $x \in A$ and $x \notin B$. Since $x \in A$ the statement $A - B \subseteq A$ holds.

Question 4
a. All good weight lifters are strong.
$(W(x) \rightarrow S(x))$
b) Good weight lifters are not a good basketball player
$W(x) \rightarrow \neg B(x)$

c) If someone is strong then they are a good basketball player or a good weight lifter.
$\forall x(S(x) \rightarrow (B(x) \vee W(x))$

d) There is someone who is a good basketball player and a good weight lifter.
$\exists x(B(x) \wedge W(x))$

question 5

p	q	r	$p \rightarrow q$ (2)	(2) $\rightarrow R$	$P \wedge \neg Q$ (3)	(3) $\vee R$
1	1	1	1	1	0	1
1	1	0	1	0	0	0
1	0	1	0	1	1	1
0	0	0	0	0	0	0
0	1	1	1	1	0	1
0	1	0	1	0	0	0

Columns 5 and 7 are identical so they are logically equivalent.

question 6
Use a direct proof to show that the sum of two rational numbers is rational. (Recall that a number is rational if and only if it can be expressed as the ratio of integers.)

Assume that a and b are rational numbers. so $a = \frac{x}{z}, andb = \frac{j}{k}$ and x,z,j, and k are also integers. Then the sum of $a + b = \frac{x+j}{z+k}$ which is also a rational number.

Question 7.
Assume for contradiction that n and m have the same parity. If m and n are even:
$n = 2k_1, m = 2k_2$
$2k_1 - 5(2k_2) = 2(k_1 - 5k_2)$ which is an even number and contradicts our assumption that$n - 5m$ is odd.

For the case when they are odd.
$n = 2k_1 + 1, m = 2k_2 + 1$

$2k_1 + 1 - 5(2k_2 + 1) = 2(k_1 - 5k_2 + 3)$ which is also even and contradicts our assumption.

Question 8:
$\sum_{j=3}^{6}(5j^2 + (-1)^j) = \sum_{j=3}^{6}(5j^2) + \sum_{j=3}^{6}(-1)^j = (15^2 + 20^2 + 30^2) + \sum_{j=0}^{6}(-1)^j - \sum_{j=0}^{2}(-1)^j$
$= (15^2 + 20^2 + 30^2) + (\frac{(-1)^7-1}{-1-1}) - (\frac{(-1)^3-1}{-1-1})$

$\sum_{i=0}^{8}(2^{i+1} - 3) = \sum_{i=0}^{8} 2^{i+1} - 8 * 3 = 2 * \sum_{i=0}^{8} 2^i - 8 * 3$
$= 2 * \frac{2^9-1}{2-1} - 24$

question 9: Base case: P(0) $3^0 = 1$, $\frac{3^0-1}{2} = 1$
inductive case:
$3^n = \frac{3^{n+1}-1}{2}$
for n=k:
$3^k = \frac{3^{k+1}-1}{2}$
and for n=k+1
$3^{k+1} = \frac{3^{k+2}-1}{2}$
assuming that $3^k = \frac{3^{k+1}-1}{2}$ is true then:
$\frac{3^{k+1}-1}{2} + 3^{k+1} = \frac{3^{k+1}-1}{2} + \frac{2*3^{k+1}}{2} = \frac{3^{k+1}-1+2*3^{k+1}}{2} = \frac{3^{k+1}*(1+2)-1}{2} = \frac{3^{k+2}-1}{2}$ so the hypothesis holds.

question 10:
Use strong induction to prove that every amount of postage of 12 cents or more can be formed using just 4-cent and 5-cent stamps

Base case:
P(12) = 4*4*4 = 12
p(13) = 4*4*5 = 13
p(14) = 5*5*4 =14
This proves the first three base cases. n, n+1, and n+2
Inductive case:
Assume a new stamp k such that $12 \leq k \leq j$. We know p(n)...p(n+2) is true. The next stamp P(n+3) has to be true since P(n+2) was proven in our base case.