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1. Because $P(x)$ is true for all positive integers less than 4, the truth value of the quantification $\forall x \, P(x)$ is true.

Here is the statement, $x^2 < 10$,

The statement $\forall x \, P(x)$ is the same as the conjunction $P(1) \wedge P(2) \wedge P(3)$

3. Let $P(x)$ be "x is perfect"; let $F(x)$ be "x is your friend."

a) $\forall x \, \neg P(x)$

b) $\neg \forall x \, P(x)$

c) $\forall x \, (F(x) \rightarrow P(x))$

d) $\exists x \, (F(x) \wedge P(x))$

e) $\forall x \, (F(x) \wedge P(x))$

f) $(\neg \forall x \, (F(x)) \vee (\exists x \, \neg P(x))$

4. $A = \{1, 2\}$.

$B = \{a, b\}$

$C = \{x, y, z\}$

$A \times B \times C = \{1, 2\} \times \{a, b\} \times \{x, y, z\}$

$= \{1, a, x\} = \{(1, a, x), (1, b, x), (1, a, y), (1, b, y),$

$(1, a, z), (1, b, z), (2, a, x), (2, b, x), (2, a, y),$

$(2, b, y), (2, a, z), (2, b, z)\}$

(Answer)

6. $A = \{1, 3, 4, 5, 6\}$.

$B = \{x \mid x$ is an odd positive integer and $x < 10\}$

$= \{1, 3, 5, 7, 9\}$

$A \cup B = \{1, 3, 4, 5, 6\} \cup \{1, 3, 5, 7, 9\}$

$= \{1, 3, 4, 5, 6, 7, 9\}$

$A \cap B = \{1,3,4,5,6\} \cap \{1,3,5,7,9\}$

$= \{1,3,5\}$

$B - A = \{1,3,4,5,6\} \quad \{1,3,5,7,9\} - \{1,3,4,5,6\}$

$= \{4,6\} \quad \{7,9\}$

$A \oplus B = (A-B) \cup (B-A)$

$= \{1,3,4,5,6\} - \{1,3,5,7,9\} \cup \{4,6\} \quad \{7,9\}$

$= \{4,6\} \cup \{7,9\}$

$= \{4,6,7,9\}$

(Answer)

7. A membership table for the distributive property:

A	B	C	B∪C	A∩(B∪C)	A∩B	A∩C	(A∩B)∪(A∩C)
1	1	1	1	1	1	1	1
1	1	0	1	1	1	0	1
1	0	1	1	1	0	1	1
1	0	0	0	0	0	0	0
0	1	1	1	0	0	0	0
0	1	0	1	0	0	0	0
0	0	1	1	0	0	0	0
0	0	0	0	0	0	0	0