Show All Solutions

Rosen, Discrete Mathematics and Its Applications, 7th edition
Extra Examples
Section 1.4—Predicates and Quantifiers

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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p.38, icon at Example 3
#1. Let $P(x)$ be the statement

$$x^2 < x$$

where the universe for x is all real numbers.

(a) Determine the truth value of $P(0)$.

(b) Determine the truth value of $P(1/3)$.

(c) Determine the truth value of $P(2)$.

(d) Determine the set of all real numbers for which $P(x)$ is true.

See Solution

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p.38, icon at Example 3
#2. Let $Q(x, y)$ be the statement

$$x + y = x - y$$

where the universe for x and y is the set of all real numbers. Determine the truth value of:
(a) $Q(5, -2)$.
(b) $Q(4.7, 0)$.
(c) Determine the set of all pairs of numbers, x and y, such that $Q(x, y)$ is true.

See Solution

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p.38, icon at Example 3
#3. Find all real numbers x and y such that $R(x, y)$ is true, where $R(x, y)$ is the predicate "$xy = y$."

See Solution

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p.41, icon at Example 8
#1. Suppose $P(x)$ is the predicate "$x < |x|$." Determine the truth value of $\forall x\, P(x)$, where the universe for x is:
(a) the three numbers $-3, -2, -1$.

(b) all real numbers.

See Solution

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p.41, icon at Example 8
#2. Find a universe for x such that $\forall x\,(x^2 < x)$ is true.

See Solution

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p.43, icon at Example 14
#1. Suppose $P(x)$ is the predicate "$x < |x|$." Determine the truth value of $\exists x\, P(x)$ where the universe for x is:

(a) the three numbers $1, 2, 3$.

(b) the six numbers $-2, -1, 0, 1, 2, 3$.

See Solution

p.43, icon at Example 14
#2. Determine whether $\exists t\,(t^2 + 12 = 7t)$ is true, where the universe for t consists of all real numbers.

See Solution

p.43, icon at Example 14
#3. Write the following statement in English, using the predicates

$F(x)$: "x is a Freshman"
$T(x, y)$: "x is taking y"

where x represents students and y represents courses:

$$\exists x\,(F(x) \wedge T(x, \text{Calculus 3})).$$

See Solution

p.47, icon at Example 20
#1. Negate "There is a person who walked on the moon."

See Solution

p.47, icon at Example 20
#2. Negate "Everyone in the class has a laptop computer."

See Solution

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p.47, icon at Example 20
#3. Negate "Some integer x is positive and all integers y are negative."

See Solution

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p.47, icon at Example 20
#4. Negate "There is a student who came late to class and there is a student who is absent from class."

See Solution

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p.48, icon at Example 23
#1. Write in symbols using predicates and quantifiers: "Everyone who visited France stayed in Paris."

See Solution

p.48, icon at Example 23

#2. Express this statement in symbols, using predicates and any needed quantifiers:

"Every freshman at the College is taking CS 101."

See Solution

p.48, icon at Example 23
#3. Express this statement in symbols, using predicates and any needed quantifiers:

"Every freshman at the College is taking some Computer Science course."

See Solution

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p.48, icon at Example 23
#4. Consider this sentence, which is the final sentence of 12th Amendment of U. S. Constitution: "No person constitutionally ineligible to the office of President shall be eligible to the office of Vice President of the United States."

(a) Rewrite the sentence in English in the form "If . . . , then . . . ."

(b) Using the predicates $P(x)$: "x is constitutionally eligible to the office of President" and $V(x)$: "x is constitutionally eligible to the office of Vice President of the United States," where the universe for x consists of all people, write the sentence using quantifiers and these predicates.

See Solution

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p.48, icon at Example 23
#5. Consider this sentence, which is Section 2 of Article I of the U. S. Constitution: "No person shall be a Representative who shall not have attained the age of twenty-five years, and been seven years a citizen

of the United States, and who shall not, when elected, be an inhabitant of that state in which he shall be chosen."

(a) Rewrite the sentence in English in the form "If ..., then ...".

(b) Using the predicates $A(x)$: "x is at least twenty-five years old," $C(x)$: "x has been a citizen of the United States for at least seven years," $I(x)$: "x, when elected, is an inhabitant of the state in which he is chosen," and $R(x)$: "x can be a Representative," where the universe for x in all four predicates consists of all people, rewrite the sentence using quantifiers and these predicates. [Note: At the time at which the U. S. Constitution was ratified, the universe for x consisted of landowning males.]

See Solution

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p.50, icon at Example 25

#1. Express the specification "Whenever at least one network link is operating, a 10 megabyte file can be transmitted" using predicates and quantifiers.

See Solution
