Example 1 Self Tutor

Which of the following statements are propositions? If they are propositions, are they true, false, or indeterminate?

a $20 \div 4 = 80$ **b** $25 \times 8 = 200$

c Where is my pen? **d** Your eyes are blue.

a This is a proposition. It is false as $20 \div 4 = 5$.

b This is a proposition and is true.

c This is a question, so is not a proposition.

d This is a proposition. It is indeterminate, as the statement is true for some people and false for other people.

Example 2 Self Tutor

Find the negation of:

a x is a dog for $x \in \{\text{dogs, cats}\}$

b $x \geqslant 2$ for $x \in \mathbb{N}$

c $x \geqslant 2$ for $x \in \mathbb{Z}$.

a x is a cat.

b $x \in \{0, 1\}$

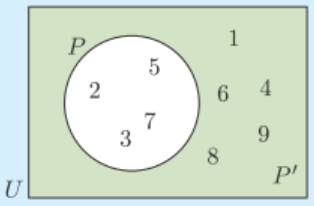
c $x < 2$ for $x \in \mathbb{Z}$

Example 3 Self Tutor

Consider $U = \{x \mid 0 < x < 10,\ x \in \mathbb{N}\}$ and proposition p: x is a prime number.

Find the truth sets of p and $\neg p$, and display them on a Venn diagram.

If P is the truth set of p then $P = \{2, 3, 5, 7\}$.

The truth set of $\neg p$ is $P' = \{1, 4, 6, 8, 9\}$

The Venn diagram representation is: