1. Determine with justification if the following are true or false:

(a) \( \exists n \in \mathbb{Z}, (2n - 1)/5 \in \mathbb{Z} \).
   Solution:

(b) \( \exists! n \in \mathbb{Z}, (2n - 1)/5 \in \mathbb{Z} \).
   Solution:

(c) \( \forall n \in \mathbb{Z}, (2n - 1)/5 \in \mathbb{Z} \).
   Solution:

(d) \( \exists x \in \mathbb{Z}, \exists y \in \mathbb{R}, x^2 + y^2 = 3 \)
   Solution:

(e) \( \sim (\exists x \in \{3, 5, 11\}, \exists y \in \{3, 5, 11\}, xy - 2 \text{ is not prime}) \)
   Solution:
2. Distribute the negation signs for each of the following, adjusting other symbols accordingly.

(a) \( \sim (\forall x, P(x)) \equiv \) ?

Solution:

(b) \( \sim (\exists x, Q(x)) \equiv \) ?

Solution:

(c) \( \sim (\forall x, \exists y, P(x, y) \lor Q(x, y)) \equiv \) ?

Solution:

(d) \( \sim (\exists x, \forall y, P(x, y) \land (\sim Q(x, y))) \equiv \) ?

Solution:

(e) \( \sim (\exists x, \forall y, P(x, y) \rightarrow Q(x, y)) \equiv \) ?

Solution:

3. Negate the following.

(a) For every year there is at least one day when it’s sunny.

Solution:

(b) For every week there is at least one day where it rains or snows.

Solution: