2) \[ p \lor v \lor w \]

3) \[ B \Rightarrow u \in w \Rightarrow s \]

4) \[ u \]

5) \[ w \lor v \Rightarrow p \]

6) \[ t \lor v \Rightarrow p \Rightarrow \exists u \Rightarrow \exists w \]

7) \[ u \Rightarrow v \]

8) \[ p \lor v \]

9) \[ \neg s \]

10) \[ \neg t \]

11) \[ p \lor v \lor s \]

12) \[ p \lor q \]

13) \[ p \lor (\exists, \text{logical axiom}) \]

14) \[ r \]

15) \[ w \]

\[ 3 + 9 \]

\[ 3 \times 9 \]

\[ 1 + 10 \]

\[ 9,11 \]

\[ (2, \text{logical axiom}) \]

\[ (12,13,2) \]

\[ (14,5) \]

4d) It is someone's birthday every day.

\[ \exists y \forall x \ B(x,y) \quad \forall \]

\[ \exists y \ B(x,y) \quad \exists y \ B(x,y) \quad T \]

\[ B(x,y) = "x \ is \ y's \ birthday" \]
negation:

\neg \forall x \exists y \ B(x, y)

\exists y \forall x \neg B(x, y)

For some day x, all people do not have x as their birthday.

For some day x, it is no one's birthday on x.

Some day is no one's birthday.

6c) All languages with a game written in them that is available for Nintendo DS have a game written in them that is available for Vectors.

\forall L, \exists G \in G s.t. L(g, L) \land A(g, DS) \rightarrow \exists G \in G s.t. L(g, L) \land A(g, Vectors)

L has a game written in it available for DS

L has a game written in it available for Vectors
∀L ∈ L, ∃g ∈ G s.t. \( L(g, R) \land A(g, DS) \rightarrow A(g, Vector) \)

For all languages there exists a game g s.t. if g is worth in L and available for DS then that same game is also available for Vector.
Def: \( n \in \mathbb{Z} \) is prime means \( n > 1 \) and whenever two positive ints have product \( n \), then one of them is \( 1 \).

\[ n > 1 \land \forall r, s \in \mathbb{Z}^+, rs = n \implies r = 1 \lor s = 1 \]

\( \forall n \in \mathbb{Z} \) is composite means \( n > 1 \land \neg \exists r, s \in \mathbb{Z}^+ \text{ s.t. } rs = n \implies r = 1 \lor s = 1 \)

\[ n > 1 \land \exists r, s \in \mathbb{Z}^+ \text{ s.t. } rs = n \uparrow \neg(r = 1 \lor s = 1) \]

\[ n > 1 \land \exists r, s \in \mathbb{Z}^+ \text{ s.t. } rs = n \land r \neq 1 \land s \neq 1 \]

\( n > 1 \) and there are two factors of \( n \)
such that neither is equal to \( 1 \).

Is \( 6 \) composite? \( \yes \) \( \land \) \( 6 = 2 \cdot 3 \)

Is \( 3 \) prime? \( \yes \)

\[ \begin{align*}
2 & : 1 & \cdot 2 & : \checkmark \\
3 & : 1 & \cdot 3 & : \checkmark \\
6 & : 1 & \cdot 6 & : \checkmark \\
\end{align*} \]

\[ \begin{align*}
a, b, c, d & \text{ positive} \\
a > 1 \\
c > d \\
ac > bd
\]
Is 1 prime? \( N \) (1 \# 1)
Is 1 composite? \( N \) (1 \# 1)

<table>
<thead>
<tr>
<th>( n )</th>
<th>( n^2 + 5n + 6 )</th>
<th>( \sqrt{n} )</th>
<th>( \sqrt[3]{n} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>72</td>
<td>2.45</td>
<td>5.6</td>
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<td>3</td>
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<td>1.8</td>
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<tr>
<td>2</td>
<td>20</td>
<td>4.5</td>
<td></td>
</tr>
</tbody>
</table>

Thus \( \forall n \in \mathbb{Z}^+ \), \( n^2 + 5n + 6 \) is composite.

Proof: Assume \( n \in \mathbb{Z}^+ \).

Thus \( n^2 + 5n + 6 > 1 \) (Appendix A, \( n \geq 1 \))

Let \( r = \frac{n^2}{2} \), \( s = \frac{n}{3} \)

Then \( r \cdot s = n \) and \( r \neq 0 \wedge s \neq 1 \) (algebra, Appendix A)

\( \therefore r, s \in \mathbb{Z}^+ \) s.t. \( rs = n \wedge r \neq 1 \wedge s \\
\therefore n^2 + 5n + 6 \) is composite (def composite)