

1.2-1.3

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1 1.2, p.7

4. variables: x, y, t
 constants: $\{\overline{0}, \overline{1}, \dots, \overline{16}\}$
 R_1 : (team) $x R_1$ (team) y if x and y have played at home.
 R_2 : $x R_2 y$ if x and y have played away.
 R_3 : $x R_3 t$ if x played on t .

$$\neg(\exists x)(\exists y)(\exists t)[x R_3 t \wedge y R_3 t]$$

5. constants: $\{\overline{0}, \overline{1}, \overline{2}, \dots, \overline{10}, \overline{11}, \overline{12}, \dots; \overline{0.1}, \overline{0.12}, \overline{0.13}, \dots, \overline{0.2}, \overline{0.21}, \overline{0.22}, \dots\}$
 variables: $\{t_1, t_2, \dots, t_n, s_1, s_2, \dots, s_{3n}, a_1, a_2, \dots, a_{3n}\}$
 $\{+, \cdot\}$; arity 2
 $\{\sin, \cos, \tan, \csc, \sec, \cot\}$; arity 1
 $\{\sim, \cong, =\}$

2 1.3, p.12

1. $\mathcal{L} = \{\diamond, \heartsuit; Y^1; \flat^2, \#^3\}$
 terms: $\diamond, \heartsuit, \flat\diamond\heartsuit, \#\diamond\heartsuit(\flat\diamond\heartsuit)$
 non-terms: $Y, Y\diamond, Y\heartsuit$
 formulas: $=\diamond\heartsuit, Y\diamond, \neq\diamond\heartsuit, (= \diamond\heartsuit \vee Y\diamond\heartsuit)$
 non-formulas: $\flat\diamond\heartsuit, \#\diamond\heartsuit(\flat\diamond\heartsuit), (\flat\diamond\heartsuit \vee Y\diamond\heartsuit)$
3. \mathcal{L}_{NT} is $\{0, S, +, \cdot, E, <\}$

(a)

(b)

$$(\forall x)(\exists y)(\exists z)(\exists w)(\exists v)(\exists k)(\exists \ell)(\exists m)(\exists n) \\ [x = y + z + w + v \wedge y = k^2 \wedge z = \ell^2 \wedge w = m^2 \wedge v = n^2]$$

(c)

(d)

(e)