

**More Practice Problems for 2nd Midterm**

1. Use Lemma 5.4 to show that the set of squares (i.e., of numbers of the form  $a^2$ ) is representable in  $\mathbb{Q}$ .
2. Give a formula that represents the set of squares in  $\mathbb{Q}$ .
3. Let  $f : \mathbb{N}^3 \rightarrow \mathbb{N}$ ,  $g_1 : \mathbb{N}^2 \rightarrow \mathbb{N}$ , and  $g_2 : \mathbb{N} \rightarrow \mathbb{N}$  be primitive recursive. Prove that  $h : \mathbb{N}^2 \rightarrow \mathbb{N}$  is primitive recursive, where

$$h(a_1, a_2) = f(g_1(a_1, a_2), g_2(a_2), 5).$$

*Hint.* Use closure under Composition. To make the example fit the form, use one of the functions  $I_i^n$  and another application of closure under Composition.