

MAU11602 Assignment 2  
Due 2026-02-12

1. Find all subexpressions of the expression below which contain at least one occurrence of the variable  $x$  and indicate which of those occurrences, if any, are free.

`* x let val y = x in + x let val x = 5 in - x y end end`

You should do this for all subexpressions, not just direct subexpressions, in other words for all nodes in the parse tree, not just the children of the root, although you aren't required to draw the parse tree.

2. Mathematics has many kinds of expressions which bind variables. One is  $\lim_{x \rightarrow e_1} e_2$ , where  $e_1$  and  $e_2$  are numerical expressions and  $x$  is a variable, which is bound in the whole expression.

Correctly substitute  $x + z$  for  $y$  in the expression

$$\lim_{x \rightarrow y} (x^2 + xy + y^2).$$