Advanced Programming Paradigms
HS 2022
Exercise 4

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Problems In each of the following problems some declarations are given. Give the most general type of each declared value, and if the value is not a function, then also the result of evaluating it.

Problem 1 [**Lambda expressions**]

```
f01 :: Num a => a -> a
f01 = \x -> 2 * x

f01' = \x -> 2 * x

f01'' () = \x -> 2 * x
f01''' _ = \x -> 2 * x

f02 = \x -> \y -> x + y
f03 = \x y -> x + y
f04 x = \y -> x + y
f05 = \(x, y) -> x + y
f06 = \[x, y] -> x + y

f07 = [\x -> x+1, \x -> 2*x, \x -> x^2]
f08 = head f07 5

f09 = \x -> x

f10 = [f09, \x -> x+1]

f11 = \_ -> (\x -> x+1, \() -> 'a')
```

Problem 2 [Sections]

```
x ^+^ y = x^2 + y^2
g01 = (^+^)
g02 = (^+^ 2)
g03 = (3 ^+^)
g04 = (3 ^+^ 2)

g05 x y = 2*x + 3*y
g06 = (`g05` 2)
g07 = (2 `g05`)
g08 = g06 3
g09 = g07 4

g10 x y z = 2*x + 3*y + 4*z
g11 = (`g10` 2)
g12 = g11 3
g13 = g12 4
g14 x = (g10 (x+1))
g15 = g14 2 3 4

g16 n = \x -> ([(+), (-), (*)] !! n) x 2
g17 = g16 1 5
```

Problem 3 [List comprehensions]

```
h01 = [x | x <- [1 .. 5]]
h02 = [2*x | x <- [1 .. 5]]
h03 = [x - y | x <- [1 .. 3], y <- [1 .. 4]]
h04 = [x - y | y <- [1 .. 3], x <- [1 .. 4]]
h05 = [x + y | x <- [1 .. 3], y <- [1 .. 4], x >= y]
h06 = [head x | x <- ["dimdi", "schnurpsel", "zumsel"]]
h07 = [x | (x : _) <- ["dimdi", "schnurpsel", "zumsel"]]
h08 = [xs | ('s' : xs) <- ["dimdi", "schnurpsel", "zumsel"]]
```