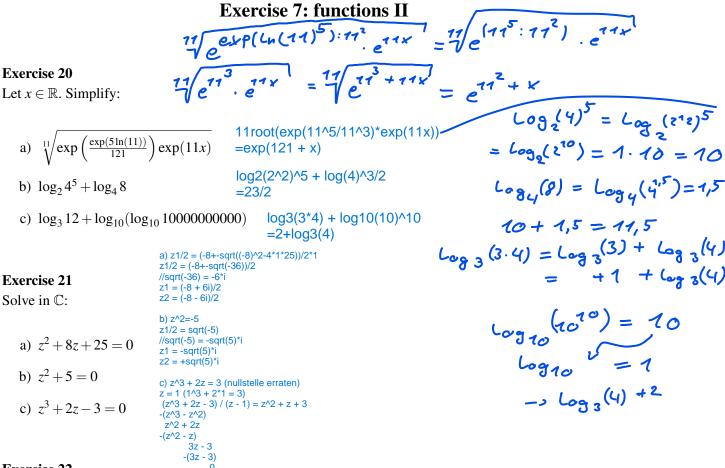
WiSe 2021/22

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## Exercise 22

Consider the complex number z = -3 + 3i and the following statements:

(1) 
$$|z| := \sqrt{z\overline{z}} = 3\sqrt{2}$$

(2) 
$$\bar{z} = 3 + 3i$$

(3) 
$$Re(z) = 3$$

(4) 
$$Re(z) - i Im(z) = -3(1+i)$$

$$(5) \ \frac{1}{z} = \frac{\bar{z}}{|z|^2}.$$

Which are true?

## Exercise 23

Due to our first version of the intermediate value theorem (Bolzano theorem on zeros), the following algorithm allows to find zeros:

- (0) Given: function f, interval [a,b] with a < b, maxit maximal number of iterations, eps given tolerance. Set i = 0 (counter of iterations).
- (1) If  $f(a)f(b) \ge 0$  then print "method not applicable", STOP.
- (2) While  $i \le maxit$  do  $c := \frac{a+b}{2}$  If |f(c)| < tol or (b-a)/2 < tol then print "solution:" c, STOP. i := i+1 If  $f(c)f(a) \ge 0$  then a := c else b := c. End while
- (3) Print "method failed (increase maxit)", STOP.

## It is called **bisection search**.

Implement the bisection search, e.g., in MATLAB. The MATLAB function receives the function f and a start interval [a,b] as input and returns as output a zero of the function within the interval, if successful. As stopping criterion we consider a sensitive number maxit of iterations.

By this means find a zero of the function  $f(x) = -\exp(-x) + x$  in [0,1]. Alternatively, you may use a calculator.

Please state all intervals  $[a_i, b_i]$  and the corresponding function values for each iteration i.

```
f(0) = -1
f(1) = 0.632
f(0.5) = -0.107
-> 0 is in right half
f(0.75) = 0.278
-> 0 is below
f(0.625) = 0.0897
-> 0 is below
f(0.6) = 0.0512
-> 0 is below
f(0.55) = -0.027
-> 0 is above
f(0.57) = 0.005
-> 0 is below
f(0.56) = -0.011
-> 0 is above
f(0.565) = -0.003
-> 0 is above
f(0.5675) = 0.001
-> 0 is below
close enough
```