MATH1520 Autumn 2018
Homework 1

You don't need to hand in the homework. Solution will be posted online.

1. Determine the domain of the following functions.
   (a) $f(t) = \sqrt{3-t} - \sqrt{2+t}$
   (b) $f(x) = \dfrac{\log(x^2-1)}{\sqrt{4-x^2}}$
   (c) $g(x) = \dfrac{1}{\log\sqrt{5-x}}$
   (d) $h(x) = \dfrac{\ln x}{x^2-2x-15}$
   (e) $f(u) = \dfrac{u+1}{1+\dfrac{1}{u+1}}$
2. Find the domain and sketch the graph of the following function.
   (a) $F(x) = |2x+1|$
   (b) $g(x) = |x| - x$
   (c) $h(x) = \dfrac{3x+|x|}{x}$
   (d) $f(x) = \begin{cases} x+2, & \text{if } x < 0 \\ 1-x, & \text{if } x \geq 0 \end{cases}$
3. Suppose
$$f(x) = \begin{cases} x^2+1 & \text{if } x < 0\ , \\ \sqrt{x}+4 & \text{if } 0 \leq x < 1, \\ 3x-1 & \text{if } x \geq 1. \end{cases}$$
   Compute $f(2.5)$,$f(0)$,$f(-4)$.
4. Let $f(u) = u^2+4u+8$ and $g(x) = x^2-\sqrt{x}+1$. Find $(f\circ g)(x)$, $(g\circ f)(x)$ and determine their domains.
5. Find the difference quotient function of the following functions.
   (a) x^3+x^2+1.
   (b) $2x^2-4x+3$.
   (c) $\dfrac{x+3}{x+6}$
6. Find the limit. If it doesn't exist, state whether it is $+\infty$, $-\infty$ or neither.
   (a) $\lim\limits_{x\to 2} \dfrac{x^2+6x-16}{14x-2x^2-20}$.
   (b) $\lim\limits_{x\to 1} \dfrac{x+x^2+x^3-3}{x^2-1}$.

(d) $\lim_{x\to+\infty} \dfrac{2x+3}{5x+7}$

(e) $\lim_{x\to+\infty} \dfrac{10x^5+x^4+31}{x^6}$

(f) $\lim_{x\to+\infty} \sqrt{x^2+3x}-\sqrt{x^2-2x}$

(g) $\lim_{x\to-\infty} \dfrac{4-3x^3}{\sqrt{x^6+9}}$

(h) $\lim_{x\to1} \dfrac{2-x}{(x-1)^2}$

(i) $\lim_{x\to2^+} \dfrac{x^2-2x-8}{x^2-5x+6}$

(j) $\lim_{x\to2^-} \dfrac{x^2-2x}{x^2-4x+4}$

(k) $\lim_{x\to0} \dfrac{5}{2x}$

(l) $\lim_{x\to0} \dfrac{\sqrt{x^2+9}-3}{x^2}$

(m) $\lim_{x\to0} \left(\dfrac{1}{x}-\dfrac{1}{x^2+x}\right)$

(n) $\lim_{x\to-2} \dfrac{2-|x|}{2+x}$

7. Suppose we have

$$\lim_{x\to+\infty} \frac{ax^2+x-1}{bx+4} = 2.$$

Find a, b.

8. Use the following figure to estimate the limits if they exist:

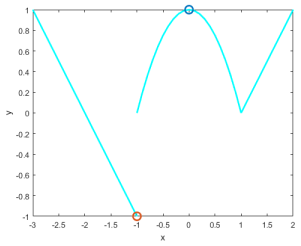

Figure 1: exercise 8

(a) $\lim_{x\to-1^+} f(x)$

(b) $\lim_{x\to0} f(x)$

(c) $\lim_{x\to2^-} f(x)$