MATH 1013: Applied Calculus I

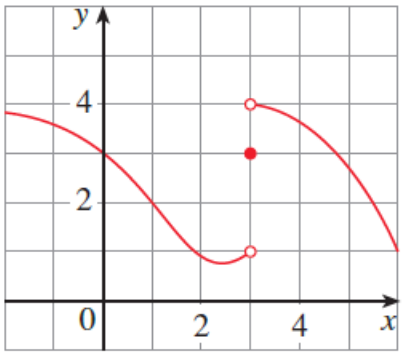
Assignment 1 - 20 marks total
due Friday, June 18th (11:59pm)

Submission Instructions. Complete any FOUR (4) of the 6 questions below, each worth 5 marks. Your submission will be graded both on accuracy and clear and effective communication (mathematical, non-mathematical, written and visual). If you submit more than 4 solutions, we will grade the first four you submit.

You may consult with other classmates for inspiration, but your final submission must be written in your own words with your own thoughts and ideas.

(1) (5 marks) For the function *f* whose graph is given, state the value of each quantity, if it exists. If it does not exist, explain why.

(a) $\lim_{x\to 1} f(x)$ $(b)\ \lim_{x\to 3^-} f(x)$ $(c)\ \lim_{x\to 3^+} f(x)$ $(d)\ \lim_{x\to 3} f(x)$ $(e) f(3)$



(2) (5 marks):
(a) Determine the infinite limit

(1) $\lim_{x\to 0^+} \left(\frac{1}{x} - \ln x\right)$ (2) $\lim_{x\to 3^-} \frac{\sqrt{3}}{(x-3)^5}$ (3) $\lim_{x\to (\pi/2)^+} \frac{1}{x}\sec x$

(b) Find the vertical asymptote of the function

$$(4) f(x) = \frac{x-1}{2x+4} \qquad (5)\ y = \frac{x^2+1}{3x-2x^2}$$

(3) (5 marks) Given that

$$\lim_{x\to 2} f(x) = 4 \qquad \lim_{x\to 2} g(x) = -2 \qquad \lim_{x\to 2} h(x) = 0$$

Find the limits that exist. If the limit does not exist, explain why.

$(a)\quad \lim_{x\to 2}[f(x) + 5g(x)]$ $\qquad (b)\ \lim_{x\to 2}[g(x)]^3$ $\qquad$ (c) $\lim_{x\to 2}\sqrt{f(x)}$

$$(d)\lim_{x\to 2}\frac{3f(x)}{g(x)} \qquad (e)\lim_{x\to 2}\frac{g(x)h(x)}{f(x)}$$

(4) (5 marks) Find the limit or show that it does not exist.

(a) $\lim_{t\to-\infty}\left(\sqrt{25t^2+2}-5t\right)$ $\qquad (b)\ \lim_{x\to\infty}\left(\sqrt{x^2+ax}-\sqrt{x^2+bx}\right)$

$(c)\quad \lim_{x\to-\infty}(x^2+2x^7)$ $\quad (d)\ \lim_{t\to\infty}\frac{t+3}{\sqrt{2t^2-1}}$ $\qquad (e)\ \lim_{x\to\infty}\frac{-2}{3x+7}$

(5) (5 marks) Find the horizontal and vertical asymptotes of each curve.

$(a)\ y=\frac{5+4x}{x+3}$ $\qquad (b)y=\frac{2x^2+1}{3x^2+2x-1}$ $\quad$ (c) $y=\frac{2x^2+x-1}{x^2+x-2}$ $\quad$ (d)$y=\frac{2e^x}{e^x-5}$

$$(e)\ \frac{1+x^4}{x^2-x^4}$$

(6) (5 marks) Prove the statement using the ε, δ definition of a limit.

$$(a)\ \lim_{x\to -1.5}\frac{9-4x^2}{3+2x}=6 \qquad (b)\lim_{x\to 9}\left(1-\frac{1}{3}x\right)=-2$$

$$(c\ )\ \lim_{x\to -2}(-2x+1)=5 \qquad (d)\lim_{x\to 1}(2x-5)=-3$$

$$\text{(e)}\ \lim_{x\to -2}(x^2-1)=3$$

Good Luck