

**MATH 1A MIDTERM 1 (PRACTICE 2)**  
**PROFESSOR PAULIN**

**DO NOT TURN OVER UNTIL  
INSTRUCTED TO DO SO.**

**CALCULATORS ARE NOT PERMITTED**

**YOU MAY USE YOUR OWN BLANK  
PAPER FOR ROUGH WORK**

**SO AS NOT TO DISTURB OTHER  
STUDENTS, EVERYONE MUST STAY  
UNTIL THE EXAM IS COMPLETE**

**REMEMBER THIS EXAM IS GRADED BY  
A HUMAN BEING. WRITE YOUR  
SOLUTIONS NEATLY AND  
COHERENTLY, OR THEY RISK NOT  
RECEIVING FULL CREDIT**

**THIS EXAM WILL BE ELECTRONICALLY  
SCANNED. MAKE SURE YOU WRITE ALL  
SOLUTIONS IN THE SPACES PROVIDED.  
YOU MAY WRITE SOLUTIONS ON THE  
BLANK PAGE AT THE BACK BUT BE  
SURE TO CLEARLY LABEL THEM**

Name and section: \_\_\_\_\_

GSI's name: \_\_\_\_\_

**This exam consists of 5 questions. Answer the questions in the spaces provided.**

1. Determine the domains of the following functions:

(a) (15 points)

$$\ln\left(\frac{x+1}{x+4}\right)$$

**Solution:**

(b) (10 points)

$$\arcsin(3 - 2x)$$

**Solution:**

2. Let  $f(x) = \begin{cases} \frac{x^2+kx-2}{x^2+2x-3} & \text{if } x \neq 1 \\ l & \text{if } x = 1 \end{cases}$  for some real number  $k$  and  $l$ .

Determine what values of  $k$  and  $l$  make  $f(x)$  continuous at  $x = 1$ ? Carefully justify why  $f(x)$  is continuous at  $x = 1$  for these values.

**Solution:**

3. (25 points) Calculate (using the limit laws) the following limits. If a limit does not exist determine if it is  $\infty$ ,  $-\infty$  or neither.

(a)

$$\lim_{x \rightarrow 0} (e^{x^2+x} + x^2 + 1)$$

**Solution:**

(b)

$$\lim_{x \rightarrow 1^+} \frac{x^2 - 9}{x^2 + 2x - 3}$$

**Solution:**

(c)

$$\lim_{x \rightarrow \infty} (\ln(3 + x) - \ln(1 + x))$$

**Solution:**

(d)

$$\lim_{x \rightarrow 1} 2^{\arcsin\left(\frac{x^2 - 2x + 1}{x - 1}\right)}$$

**Solution:**

4. (a) (20 points) Prove, using  $\epsilon, \delta$  methods, that

$$\lim_{x \rightarrow 1} \frac{2x^2 - x - 1}{x - 1} = 3.$$

**Solution:**

- (b) (5 points) Is  $\frac{2x^2 - x - 1}{x - 1}$  differentiable at  $x = 1$ ?

**Solution:**

5. (a) (15 points) Using the direct definition of the derivative, calculate the derivative of the function

$$f(x) = x^{3/2}.$$

**Solution:**

- (b) (10 points) Does there exist a tangent line to  $y = x^{3/2}$  which contain the point  $(1, 0)$ ? Carefully justify your answer.

**Solution:**