

# MATH 161: Midterm 1

Name: \_\_\_\_\_

Directions:

- \* Show your thought process (commonly said as "show your work") when solving each problem for full credit.
- \* If you do not know how to solve a problem, try your best and/or explain in English what you would do.
- \* Good luck!

Problem	Score	Points
1		10
2		10
3		10
4		10
5		10
6		10
		<b>60</b>

1. If

$$f(x) = x^2 - x \quad g(x) = 3x^2 - x + 1 \quad h(x) = \sin(x) \quad j(x) = 2^x$$

Evaluate, expand, and/or simplify the following:

(a)  $h\left(\frac{\pi}{6}\right)$

(b)  $j(1) \cdot h(0)$

(c)  $f(x) \cdot g(x)$

(d)  $f(x + h) - f(x)$

2. Short answer questions:

(a) Explain in English the intuition (not the definition) behind the symbols  $\lim_{x \rightarrow a} f(x) = L$ .

(b) True or false: We can simplify

$$\frac{3(x-2)^2(x+3) - 4(x+2)(x-3)^2}{5x(x-3)^2(x-2) - 4(x+3)}$$

by crossing out the  $x + 3$ .

(c) If  $f(x) = x - x^2$ , evaluate  $f(x + h)$  and fully expand + simplify.

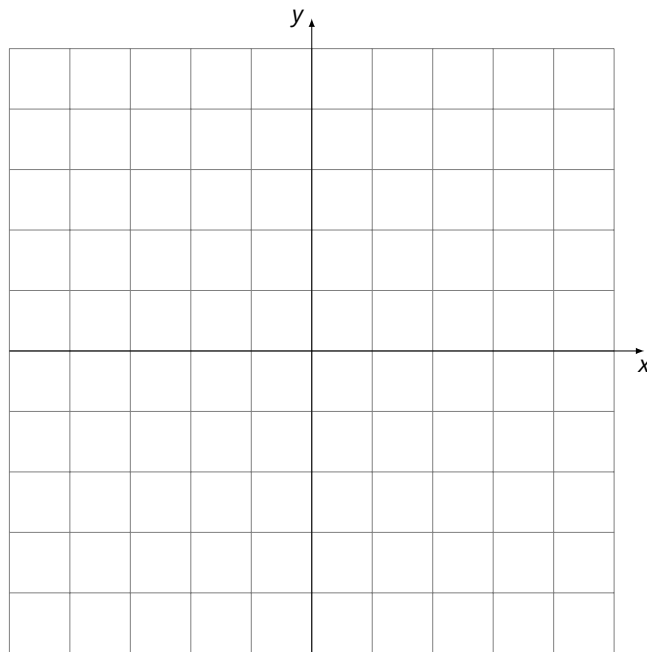
(d) If  $F(x) = \sin^3(x^2)$  find three functions  $f, g, h$  where  $f \circ g \circ h = F$ .

3. Suppose

$$f(x) = \begin{cases} x & x < 1 \\ -x^2 + 1 & x \geq 1 \end{cases}$$

(a) What is  $f(1)$ ?

(b) Sketch a graph of  $f(x)$ .



4. Perform the given instruction. Remember to use the relevant laws/properties and **fully simplify**.

(a) Expand and simplify:  $\frac{3(x+h)^2 - 1 - (3x^2 - 1)}{h}$

(b) Rationalize the numerator (remember to simplify):  $\frac{\sqrt{x+h} - \sqrt{x}}{h}$

(c) Simplify:  $\frac{\frac{2}{x^2 + x} - \frac{3}{\sqrt{x}}}{\sqrt{x} + \frac{1}{x}}$

(d) Expand:  $(x^3 + 6)(2x + 1) - (x^2 + x - 2)(3x^2)$

5. Determine whether the following sequences is convergent or divergent. If it is convergent, find what the limit converges to.

(a)  $a_n = \frac{5^n}{5 + 5^n}$

(b)  $a_n = \frac{3^{n+2}}{5^n}$

6. Solve the following equations for  $x$ :

(a)  $e^{2x} - 3e^x + 2 = 0$

(b)  $\ln(3x - 10) = 2$