Math 1151 Midterm 1 Name: ______________________

13 September 2016 OSU name.#: ______________________

Form B Lecturer: ______________________

 Recitation Instructor: ______________________

Recitation Time: ______________________

Instructions.

- **Show all relevant work** to receive full credit on Problems 2, 3, and 5.
  Incorrect answers with substantially correct work may receive partial credit.
  Unsupported answers may receive no credit.

  You do not need to show work for Problems 1, 4, and 6.

- Problems 1(a), 4(b), 4(c), 4(d), and 6(b) are **multiple choice**. Circle *exactly one* choice.
  Ambiguous markings may receive no credit.

- Give **exact** answers unless instructed to do otherwise.

- **No calculators, phones, or other devices may be used** during the exam.

  Do not have these devices out!

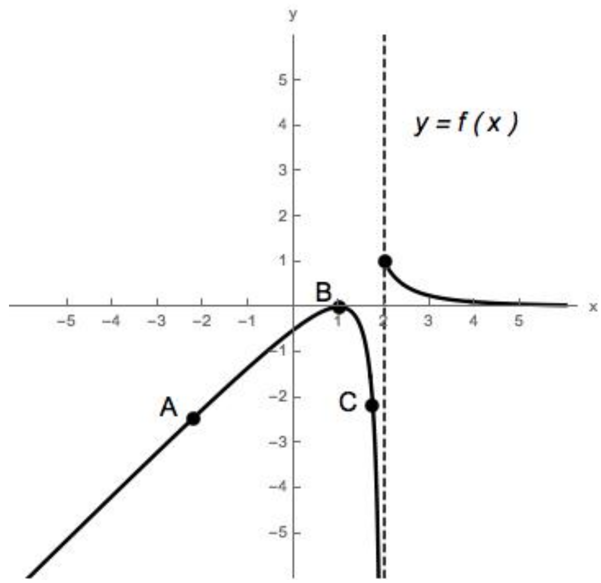
- No notes or references are permitted.

- The allotted time for this exam is **55 minutes**.

- The exam consists of 6 problems starting on Page 2 and ending on Page 8. Check that your exam is complete before you begin.

Problem 1 [22 points]	
Problem 2 [10 points]	
Problem 3 [16 points]	
Problem 4 [18 points]	
Problem 5 [26 points]	
Problem 6 [8 points]	
Total [100 points]	

1. (22 pts) The graph of a function f is given in the figure below.



Use the graph of f to complete the problems below.

(a) Let m_A be the slope of the tangent line to the curve $y = f(x)$ at point A, let m_B be the slope of the tangent line at point B, and let m_C be the slope of the tangent line at point C.

Circle the correct statement.

i. $m_A = m_B = m_C$

ii. $m_A < m_B < m_C$

iii. $m_C < m_B < m_A$

iv. $m_C < m_A < m_B$

v. $m_B < m_A < m_C$

vi. None of the above.

(b) Determine the **range** of f. Use interval notation to write your answer.

(c) Determine the values. Write "does not exist" only if a limit does not exist and is not $+\infty$ or $-\infty$.

i. $f(2) =$

ii. $\lim_{x\to 2^+} f(x) =$

iii. $\lim_{x\to 2^-} f(x) =$

iv. $\lim_{x\to 2} f(x) =$

v. $\lim_{x\to -\infty} f(x) =$

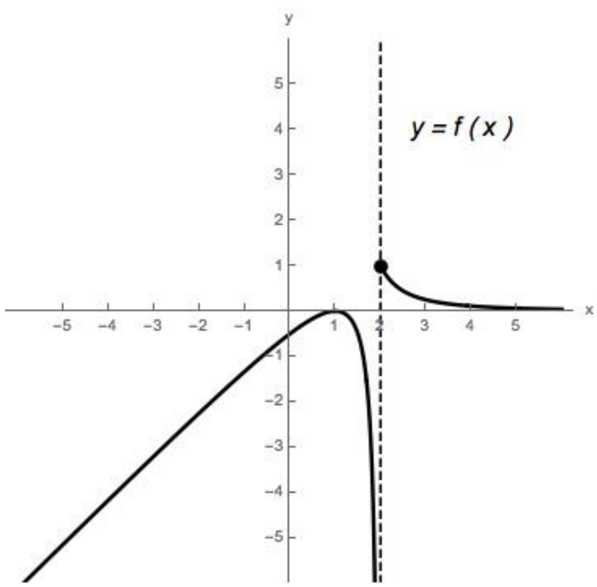
vi. $\lim_{x\to +\infty} f(x) =$

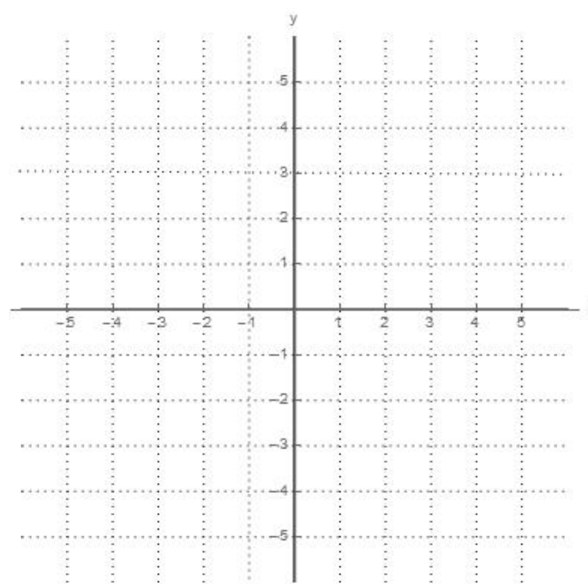
(d) Write the **equation(s)** of any **vertical asymptote(s)**. Write "none" if appropriate.

(e) Write the **equation(s)** of any **horizontal asymptote(s)**. Write "none" if appropriate.

(f) Determine the **intervals of continuity** of f. Use interval notation to write your answer.

(g) On the grid below, sketch the graph of $y = -f(x+1)$.





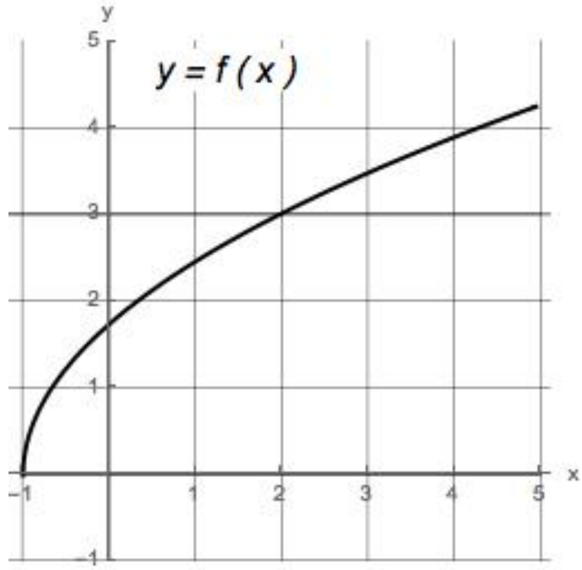
2. (10 pts) Let $f(x) = \sqrt{x-3}$. Use the **definition of derivative** to compute $f'(7)$. Show your work.

3. (16 pts) Evaluate each limit. Write "does not exist" only if the limit does not exist and is not $+\infty$ or $-\infty$. Do not use L'Hôpital's Rule. Show your work.

   (a) $\displaystyle\lim_{x\to\infty} \frac{(x^2+6)^2 - x^4}{x^2} =$

   (b) $\displaystyle\lim_{x\to 4} \left(\frac{2}{x-4} - \frac{x+12}{x^2-16} \right) =$

4. (18 pts) A function f is continuous on the interval $[-1, 5]$ and differentiable on the interval $(-1, 5)$. The graph of f is given below.



Use the graph of f to complete the problems below.

(a) On the figure above, **draw a line tangent to the curve** $y = f(x)$ **at the point where** $x = 2$.

Estimate the slope $\mathbf{m_{tan}}$ of this tangent line.

Use your estimate to **write an equation for this tangent line**.

(b) **Circle the correct statement**.

i. $f(-0.5) = f(2)$ ii. $f(-0.5) < f(2)$ iii. $f(-0.5) > f(2)$

(c) **Circle the correct statement**.

i. $f'(-0.5) = f'(2)$ ii. $f'(-0.5) < f'(2)$ iii. $f'(-0.5) > f'(2)$

(d) Consider the equation $f(c) = 2$.

Circle the correct statement.

i. $-1 < c < 0$

ii. $0 < c < 1$

iii. $1 < c < 2$

iv. $2 < c < 3$

v. $3 < c < 5$

vi. The equation has no solution.

5. (26 pts) Let g be the function given by

$$g(x) = \begin{cases} b + (x+1)^2 & \text{if } x < 0, \\ \dfrac{\sin x}{x-2} & \text{if } 0 \leq x \text{ and } x \neq 2. \end{cases}$$

(a) (8 pts) Use the **definition of continuity** to determine the value(s) of the constant b for which the function g is continuous at 0. Show your work.

(b) (6 pts) Write the **equation(s)** of any **vertical asymptote(s)** for the graph of g. Write "none" if appropriate. Show your work.

Use the expression for g on the previous page to complete the following problems.

(c) (10 pts) Evaluate each limit. Write "does not exist" only if the limit does not exist and is not $+\infty$ or $-\infty$. Show your work.

i. $\lim_{x \to -\infty} g(x) =$

ii. $\lim_{x \to +\infty} g(x) =$

(d) (2 pts) Write the **equation(s)** of any **horizontal asymptote(s)** for the graph of g. Write "none" if appropriate.

6. (8 pts) Some values of a function g are given in the table below.

x	1	2	3
g(x)	3	1	2

(a) Use the table above to find the following values:

i. $\left(g(1)\right)^2 =$

ii. $g\left(g(1)\right) =$

(b) Assume that g is continuous on the interval $(0, 4)$ with the particular values given in the table above.

One of the arguments below proves that the equation

$$g(x) = \sqrt{3}$$

has a solution $x = c$.

Circle the correct argument.

i. g is continuous on $(0, 4)$ and $0 < \sqrt{3} < 4$. So, by the Intermediate Value Theorem, there exists c in $(0, 4)$ satisfying $g(c) = \sqrt{3}$.

ii. g is continuous on $(0, 4)$ and $0 < \sqrt{3} < 4$. So, by the Squeeze Theorem, there exists c in $(0, 4)$ satisfying $g(c) = \sqrt{3}$.

iii. g is continuous on $[1, 3]$ and $g(3) < \sqrt{3} < g(1)$. So, by the Intermediate Value Theorem, there exists c in $(1, 3)$ satisfying $g(c) = \sqrt{3}$.

iv. g is continuous on $[2, 3]$ and $g(2) < \sqrt{3} < g(3)$. So, by the Intermediate Value Theorem, there exists c in $(2, 3)$ satisfying $g(c) = \sqrt{3}$.