MIDTERM 1
September 15, 2015
Form A

OSU Name.# : ___ ___ ___ ___ ___ ___ __

Lecturer: :___ ___ ___ ___ ___ ___ ___

Recitation Instructor : ___ ___ ___ ___

Recitation Time : ___ ___ ___ ___ ___ __

INSTRUCTIONS

- **SHOW ALL WORK in problems 2, 3, and 4.**
  Incorrect answers with work shown may receive partial credit,
  but unsubstantiated correct answers may receive NO credit.

  You don't have to show work in problems 1 and 5.

- **Give EXACT answers unless asked to do otherwise.**

- **Calculators are NOT permitted!**
  PDA's, laptops, and cell phones are prohibited.
  Do not have these devices out!

- **The exam duration is 55 minutes.**

- **The exam consists of 5 problems starting on page 2 and ending on page 8.**
  Make sure your exam is not missing any pages before you start.

PROBLEM NUMBER	SCORE
1	(20)
2	(20)
3	(21)
4	(21)
5	(18)
TOTAL	(100)

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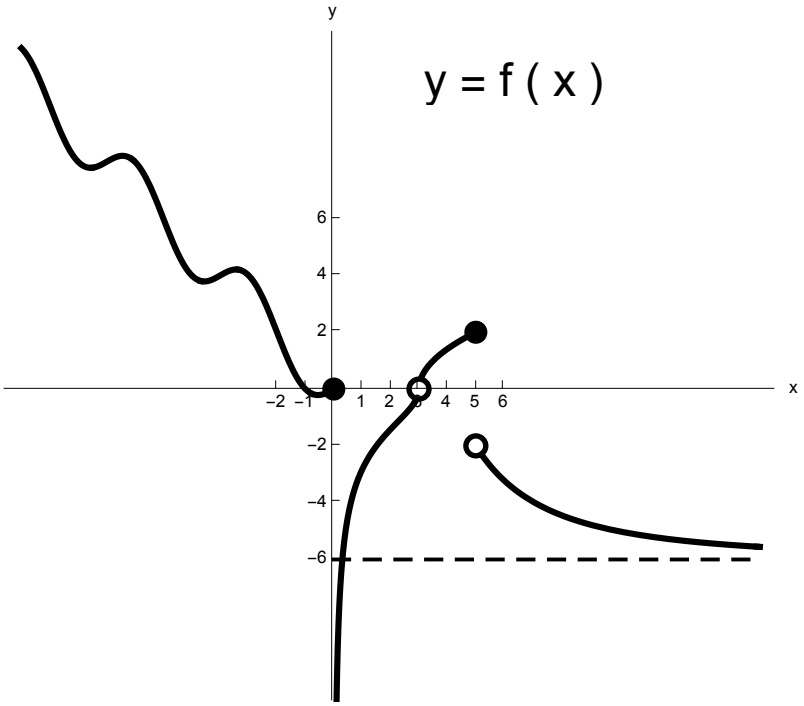
1. (20 pts)
The graph of a function f is given in the figure below.

Use the graph of f to answer the questions below.



(I) (1 pt) Find the domain of f.

(II) (1 pt) Find the range of f.

(III) Find the following values.

(Note : Possible answers include + ∞ , - ∞, or "does not exist".)

(a) (1 pt) $\lim_{x \to 3} f(x) =$

(b) (1 pt) $f(3) =$

(c) (1 pt) $f(5) =$

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1. (CONTINUED)

(d) (1 pt) $\lim_{x \to 0^-} f(x) =$

(e) (1 pt) $\lim_{x \to 0^+} f(x) =$

(f) (1 pt) $\lim_{x \to 0} f(x) =$

(g) (1 pt) $\lim_{x \to -\infty} f(x) =$

(h) (1 pt) $\lim_{x \to +\infty} f(x) =$

(IV) (2 pts) Find all vertical asymptotes.

(V) (2 pts) Find all horizontal asymptotes.

(VI) (6 pts) Determine the intervals of continuity for f .

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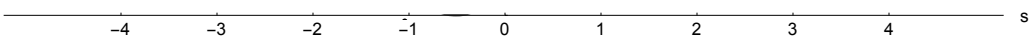
2. (20 pts) SHOW YOUR WORK !



The position, s (t), of an object moving along a horizontal line (see the figure above) is given by

$$s(t) = t^2 - 2.$$

(I) Mark the position of the object at the time t = 1 on the line above.

(II) Find the average velocity, v_{AV}, of the object during the time interval [1, 3].

v_{AV} =

(III) Compute the average velocity, $v_{AV}(t)$, of the object during the time interval

(a) [1, t], for t > 1;

(b) [t, 1], for 0 < t < 1.

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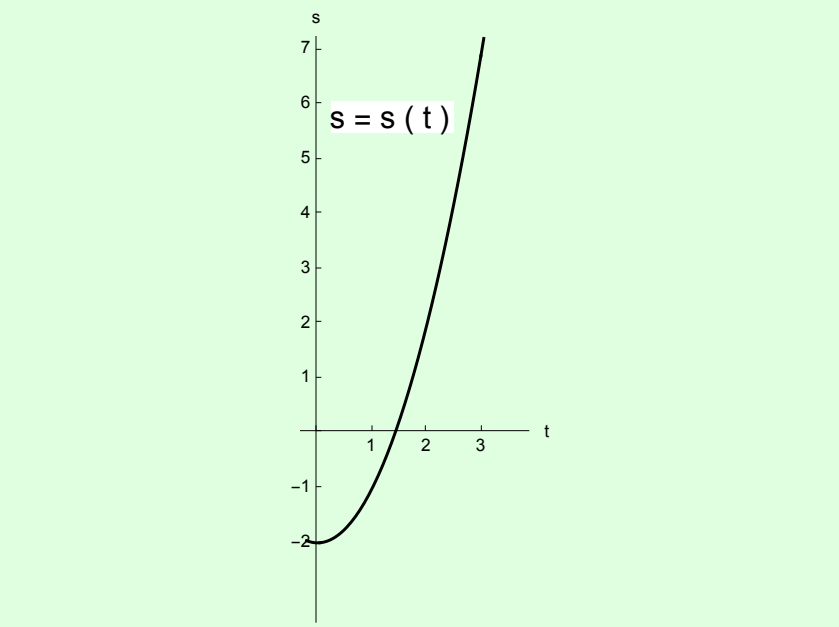
2. (CONTINUED)

(IV) Find the instantaneous velocity, v_{inst}, of the object at $t = 1$. Justify your answer.

v_{inst} =

(V) Let $s(t) = t^2 - 2$.
The graph of of the function s is given in the figure below.



(a) Assume P is a point on the graph of s. Fill in the blank.

$P = (1, \_)$

(b) Plot the point P and draw the tangent line at this point in the figure above.

(c) Find the slope, m_{tan}, of the tangent line in part (b). Explain.

m_{tan} =

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3. (21 pts) Evaluate the limit or say that the limit does not exist. If a limit does not exist, explain why. Show your work.

You may NOT use a table of values, a graph, or L'Hospitals's Rule to justify your answer.

(Note: Possible answers include $+\infty$ or $-\infty$.)

(a) (7 pts) $\lim_{x \to 3} \dfrac{x^2 - 2x - 3}{\sqrt{x+1} - 2} =$

(b) (7 pts) $\lim_{x \to 0^+} x \sin(\ln x)$

(c) (7 pts) $\lim_{x \to 2^-} \dfrac{(\ln x)}{(x-2)} =$

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4. (21 pts) (I) (6 pts) Determine the value of a constant b for which the function g is continuous at 0. Show your work. Justify your answer!

$$g(x) = \begin{cases} \dfrac{2x+b}{x-5} & \text{if } x < 0, \\ \dfrac{x+16}{x^2-16} & \text{if } x \geq 0,\ x \neq 4. \end{cases}$$

In the questions below the function g is given in part (I).

(II) (4 pts) Evaluate the limit. Show your work!

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

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

(III) (4 pts) Determine whether g has any horizontal asymptotes. If so, write the equation (or equations) of all horizontal asymptotes.

(IV) (7 pts) Determine whether g has any vertical asymptotes. If so, write the equation (or equations) of all vertical asymptotes. Show your work. Justify your answer!

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5. (18 pts) Circle True if the statement is ALWAYS true; circle False otherwise. No explanations are required.

(a) Let f be a one-to-one function and f^{-1} its inverse.

If the point (2, 5) lies on the graph of f, then the point (5, 2) lies on the graph of f^{-1}.

True False

(b) $\sin^{-1}(\pi) = 0$ True False

(c) If f and g are two functions defined on (-1, 1), and if $\lim_{x\to 0} g(x) = 0$, then it must be true that $\lim_{x\to 0} [f(x)\, g(x)] = 0$. True False

(d) If f is continuous on (-1, 1), and if $f(0) = 10$ and $\lim_{x\to 0} g(x) = 2$,

then $\lim_{x\to 0} \frac{f(x)}{g(x)} = 5$. True False

(e) If f is continuous on [1, 3], and if

$f(1) = 0$ and $f(3) = 4$, then the equation $f(x) = \pi$

has a solution in (1, 3).

True False

(f) Let f be a positive function with vertical asymptote $x = 5$. Then

$$\lim_{x\to 5} f(x) = +\infty.$$

True False