Midterm. Math 11A. Wtr 2020.

March 1, 2020

VERSION 1

Name: _____ Student ID#: _____

No calculators allowed! No phones allowed!

INSTRUCTIONS: On your scantron, use a #2 pencil to:

1. **Write and bubble your student ID#**
2. **Write and bubble your exam version**
3. **Write and bubble your last name, and first name, and , if you use one, middle initial. DO NOT USE HYPHENS.**

UNSTARRED MULTIPLE CHOICE QUESTION: Have just one right answer.
STARRED QUESTIONS: May have MORE THAN ONE ANSWER. EXAMPLE: If (a) and (c) are both correct, then bubble in both (a) and (c). If you only bubble in (a) then you will get 0 points for such a starred question.

1. A certain function f having continuous derivatives satisfies $f(0) = 0, f(10) = 0$ and $f'(0) = -5$. **TRUE or FALSE?** There is an x between 0 and 10 for which $f'(x) = -.5$.

   (a) FALSE
   (b) TRUE TRUE !

2. **TRUE or FALSE? As long as $x \neq 0, y \neq 0$ and $x \neq y$ then we have that**

$$\frac{(x^{-1} + y^{-1})^{-2}}{(x^{-1} - y^{-1})^{-2}} = \frac{x^2 + y^2}{x^2 - y^2}$$

   (a) TRUE
   (b) FALSE

3. (*) Which of the following fractions is represented by the infinite repeating decimal .112112112112...?

   (a) $\frac{112}{999}$
   (b) $\frac{1}{9} + \frac{1}{999}$
   (c) $\frac{1}{9} + \frac{2}{1000}$
   (d) $\frac{1}{9} + \frac{1}{1000}$

4. TRUE or FALSE? . $\frac{1}{2}(\frac{1}{2} + \frac{1}{3}) > \frac{2}{5}$

   (a) TRUE
   (b) FALSE

5. $\frac{n}{n+1} - \frac{n-1}{n} =$

   (a) $\frac{-1}{n(n+1)}$
   (b) $\frac{1}{n(n+1)}$
   (c) none of the above
   (d) $\frac{-2}{n+1}$
   (e) $\frac{1}{n^2}$

6. TRUE or FALSE?

$$\frac{1}{1 + \frac{2}{\frac{1}{1+\frac{3}{4}}}} < 1/3$$

   (a) TRUE TRUE !
   (b) FALSE

7. Consider iterating the map $F(x) = sin(bx)$, where $b > 0$ is a real parameter. For what, if any, range of values for the parameter b are we guaranteed that F has a fixed point $x = x_*$ with $x_* > 0$?

   (a) none
   (b) $b > 1$
   (c) $b > \pi/2$
   (d) any $b > 0$

Text

8. (*) Let $F(x)$ be the logistic map, $F(x) = rx(1-x)$ with r a real parameter. For what values of r is there a positive **unstable** fixed point for the map $x \mapsto F(x)$?

   (a) all $r > 0$
   (b) all $r > 1$
   (c) all $r > 1/2$
   (d) no values of r

   the correct answer was not listed here:
   correct: r > 3

9. (*) a $[8(x + \frac{1}{x})^2]^{-1/3} = ?$

   (a) $-\frac{1}{3}8(x^{-2/3} + (1/x)^{-2/3})$
   (b) $\frac{1}{2}\frac{1}{x^2+2+(1/x)^2}$
   (c) $\frac{1}{2}(x + \frac{1}{x})^{-2/3}$
   (d) $8^{-2/3}(x^{-2/3} + (1/x)^{-2/3})$
   (e) $8^{-2/3}(x + \frac{1}{x})^{-2/3}$

10. (*) Suppose that $k > 0$ is a constant. For

$$N(t) = \frac{9e^{kt}}{e^{kt} + 2e^{-kt}},$$

    which of the following assertions is true?

    (a) $\lim_{t\to+\infty} N(t) = 9$
    (b) $dN(t)/dt > 0$ for all values t
    (c) $d^2N/dt^2 > 0$ for all t
    (d) there is exactly one t with $N(t) = 8.935$.
    (e) $\lim_{t\to+\infty} N(t) = +\infty$

11. The function $p(x)$ is a 4th degree polynomial with roots $0, 1, 4$ and 5. Moreover $p'(4) = 3$. Then, regarding $p'(0)$ we know

    (a) nothing : $p'(0)$ could be any number
    (b) $p'(0) = 3$
    (c) $p'(0) = 5$
    (d) only that $p'(0) \neq 0$.
    (e) $p'(0) = -12$.

12. $H(x) = F(F(F(x)))$ where $F(x)$ is a differentiable function. Suppose that $F(0) = 1, F(1) = 2, F(2) = 0, F'(0) = 1/2, F'(1) = 1/3, F'(2) = -1/4$. Then $H'(0)$ is which of the following?

    (a) $\frac{-1}{24}$
    (b) 0
    (c) $\frac{1}{24}$
    (d) $\frac{-1}{12}$
    (e) 1

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