MATH 151, SPRING 2022

COMMON EXAM III - VERSION B

LAST NAME(print): _____ FIRST NAME(print): _____

INSTRUCTOR: _____

SECTION NUMBER: _____

DIRECTIONS:

1. No calculator, cell phones, or other electronic devices may be used, and they must all be put away out of sight.
2. TURN OFF cell phones and put them away. If a cell phone is seen during the exam, your exam will be collected and you will receive a zero.
3. In Part 1, mark the correct choice on your ScanTron using a No. 2 pencil. The scantrons will not be returned, therefore *for your own records, also record your choices on your exam!*
4. In Part 2, present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer.* You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
5. **Be sure to *fill in your name, UIN, section number and version letter of the exam on the ScanTron form.***

THE AGGIE CODE OF HONOR

"An Aggie does not lie, cheat or steal, or tolerate those who do."

Signature: _____

PART I: Multiple Choice. 4 points each

1. Consider the function $f(x) = 3x^4 - 8x^3 + 5$. At what value(s) of x does $f(x)$ have a local minimum?

   (a) $x = 0$ and $x = 2$

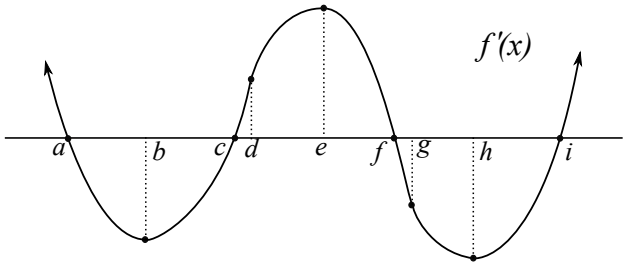
   (b) $x = 2$

   (c) $x = 0$

   (d) $x = \dfrac{3}{4}$

   (e) f has no local minima.

The graph below is the graph of the DERIVATIVE of some function f. Use the graph to answer Questions 2 and 3.



2. For what values of x does f have a local minimum?

   (a) a and f

   (b) d

   (c) b and h

   (d) g

   (e) c and i

3. On what interval(s) is f concave down?

   (a) (d, g) only

   (b) $(-\infty, d) \cup (g, \infty)$

   (c) $(-\infty, b) \cup (e, h)$

   (d) $(b, e) \cup (h, \infty)$

   (e) $(a, c) \cup (f, i)$

4. Given that $f(x)$ is defined everywhere except $x = -3$ and $f'(x) = \dfrac{x^2(1-x)}{(x+3)^3}$, on what intervals is $f(x)$ increasing?

   (a) $(-\infty, 0) \cup (1, \infty)$
   (b) $(-\infty, -3) \cup (1, \infty)$
   (c) $(-3, 1)$
   (d) $(-\infty, 0) \cup (0, 1)$
   (e) $(-3, 0) \cup (1, \infty)$

5. Find the value(s) of c that satisfy the conclusion of the Mean Value Theorem for the function $f(x) = x^2 - 5x + 3$ on the interval $[1, 3]$.

   (a) $c = 3$
   (b) $c = 2$
   (c) $c = 1$
   (d) $c = -1$
   (e) This function does not satisfy the condition of The Mean Value Theorem on the given interval.

6. Find the absolute extrema for $f(x) = 3x - x^3$ on [0, 3]

   (a) Absolute maximum is 0, Absolute minimum is -18
   (b) Absolute maximum is 2, Absolute minimum is -2
   (c) Absolute maximum is 2, Absolute minimum is 0
   (d) Absolute maximum is 2, Absolute minimum is -18
   (e) Absolute maximum is 4, Absolute minimum is -2

7. The domain of $f(x)$ is all real numbers and $f''(x) = x^2(x^2+1)(x-3)$. Find the $x-$coordinate(s) of all inflection points for the function $f(x)$.

   (a) $x = 0, 1, -1, 3$

   (b) $x = 1, -1, 3$

   (c) $x = 0, 3$

   (d) $x = 3$

   (e) f has no inflection points

8. An object is traveling at a speed of 60 m/s when the brakes are fully applied, producing a constant deceleration of 12 meters per second squared. What is the distance covered before the object comes to a stop?

   (a) 450 m

   (b) 310 m

   (c) 210 m

   (d) 200 m

   (e) 150 m

9. Compute $\lim_{x \to 0} \dfrac{\sin(x) - x + 4x^2}{x^3 + 3x^2}$

   (a) 0

   (b) $\dfrac{1}{6}$

   (c) $-\dfrac{1}{6}$

   (d) $\dfrac{4}{3}$

   (e) $\dfrac{3}{2}$

10. Suppose f'' is continuous on $(-\infty, \infty)$. If $f'(0) = 0$ and $f''(0) = 1$, then what can you say about f?

(a) At $x = 0$, f has a local maximum

(b) At $x = 0$, f has an inflection point

(c) At $x = 0$, f has neither a maximum nor a minimum

(d) At $x = 0$, f has a local minimum

(e) More information is needed to determine if f has a maximum or minimum at $x = 0$

11. The following is the graph of f. Evaluate $\int_{-2}^{5} f(x)dx$

(a) 9

(b) 8

(c) -8

(d) -9

(e) -10

12. Find an antiderivative $F(x)$ of $f(x) = \dfrac{x^3 - x^2 + 5}{x^4}$.

(a) $F(x) = \ln|x| + \dfrac{1}{x} - \dfrac{1}{x^5} + C$

(b) $F(x) = \ln|x| + \dfrac{1}{3x^3} - \dfrac{5}{3x^3} + C$

(c) $F(x) = \ln|x| + \dfrac{1}{x} - \dfrac{5}{3x^3} + C$

(d) $F(x) = \ln|x| + \dfrac{1}{3x^3} - \dfrac{1}{x^5} + C$

(e) None of the above

13. Given that $\int_5^1 f(x)\,dx = 3$, $\int_1^3 g(x)\,dx = 1$, $\int_3^5 g(x)\,dx = 2$ determine the value of $\int_5^1 \big(f(x) - g(x)\big)\,dx$.

(a) -6
(b) 0
(c) 2
(d) 3
(e) 6

14. Estimate the area under the graph of $f(x) = x^2+2$ from $x = -3$ to $x = 6$ using three rectangles of equal width and left endpoints.

(a) 54
(b) 153
(c) 72
(d) 186
(e) 125

15. A particle is moving with acceleration $a(t) = 3\sin(t) - 6t$, $v(0) = 5$, and $s(0) = 7$. Find the position function $s(t)$ for the particle.

(a) $s(t) = -3\sin(t) - t^3 + 8t + 7$
(b) $s(t) = -3\sin(t) - t^3 + 2t + 7$
(c) $s(t) = -3\sin(t) - t^3 + 5t + 7$
(d) $s(t) = 3\sin(t) - t^3 + 8t + 7$
(e) $s(t) = 3\sin(t) - t^3 + 5t + 7$

16. Which of the following gives the exact area under the curve $f(x) = \ln(x)$ on the interval $[1, 7]$? Assume the right endpoint is used.

(a) $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{6}{n} \ln\left(1 + \frac{6}{n}i\right)$

(b) $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{6}{n} \ln\left(\frac{6}{n}i\right)$

(c) $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{7}{n} \ln\left(1 + \frac{6}{n}i\right)$

(d) $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{7}{n} \ln\left(\frac{7}{n}i\right)$

(e) $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{7}{n} \ln\left(\frac{7}{n}i\right)$

PART II WORK OUT

Directions: Present your solutions in the space provided. *Show all your work* neatly and concisely and *Box your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

17. (7 points) Find the most general antiderivative for the function.

$f'(x) = \frac{3}{x} + \frac{1}{\sqrt[4]{x^5}} + \frac{2}{1+x^2} + \sec^2 x$

18. (7 points) Evaluate the integral by interpreting it in terms of areas.

$$\int_{-1}^{1} \Big(|x| + 2 \Big) \, dx$$

19. (10 points) Find $\lim_{x \to 0} \left(1 + 3x\right)^{\frac{1}{x}}$

20. (12 points) A rectangular box with an open top is to have a volume of 16m^3. The length of this base is twice the width. Material for the base costs \$2 per square meter. Material for the sides costs \$3 per square meter. Determine the width of the box that minimizes the cost of the container. Be sure to show that your answer is a minimum.

DO NOT WRITE IN THIS TABLE.

Question	Points Awarded	Points
1-16		64
17		7
18		7
19		10
20		12
		100