

King Fahd University of Petroleum and Minerals  
Department of Mathematics  
**Math 101**  
**Major Exam II**  
**233**  
**July 25, 2024**  
**Net Time Allowed: 90 Minutes**

**USE THIS AS A TEMPLATE**

Write your questions, once you are satisfied upload this file.

## Question 10/ Review Exercises Chapter 4 Page 278 Section 4.2

1. The value of  $c$  that satisfies Rolle's Theorem when applied to  $f(x) = (x - 2)(x + 3)^2$  on  $[-3, 2]$  is equal to

- (a)  $\frac{1}{3}$
- (b)  $\frac{1}{2}$
- (c)  $-3$
- (d)  $2$
- (e)  $-\frac{1}{3}$

## Question 17 / Review Exercises Chapter 4 Page 278 Section 4.2

2. The value of  $c$  that satisfies the Mean Value Theorem when applied to  $f(x) = x - \cos x$  on  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$  is equal to

- (a)  $0$
- (b)  $\frac{\pi}{6}$
- (c)  $\frac{\pi}{3}$
- (d)  $-\frac{\pi}{4}$
- (e)  $-\frac{\pi}{3}$

## Question 19 / Section 4.1 Page 211

3. If  $x = c$  is a critical number of the function  $f(x) = \sin^2 x + \cos x$  on  $(0, 2\pi)$ , then the sum of all possible values of  $c$  is

- (a)  $3\pi$
- (b)  $2\pi$
- (c)  $\pi$
- (d)  $\frac{5\pi}{3}$
- (e)  $\frac{2\pi}{3}$

## Question 31 / Section 4.1 Page 211

4. If  $M$  and  $m$  are the absolute maximum and absolute minimum respectively of the function  $f(x) = 3x^{2/3} - 2x$  on  $[-1, 1]$ , then  $M + m =$

- (a) 5
- (b) 2
- (c) 4
- (d) 7
- (e) 3

## Question 13 / Section 3.8 Page 198

5. Newton's Method is used to approximate a zero of the function  $f(x) = x - e^{-x}$ . If we choose  $x_1 = 0$ , then  $x_2 =$

- (a)  $\frac{1}{2}$
- (b)  $-\frac{1}{2}$
- (c) 1
- (d)  $-1$
- (e) 2

## Question 119 / Review Exercises Chapter 3 Page 202 Section 3.7

6. A point moves along the curve  $y = \sqrt{x}$  in such a way that the  $y$ -component of the position of the point is increasing at a rate of 2 units per second. At what rate is the  $x$ -component changing when  $x = 4$ ?

- (a) increasing at a rate of 8 units per second
- (b) decreasing at a rate of 8 units per second
- (c) increasing at a rate of  $\frac{1}{2}$  unit per second
- (d) decreasing at a rate of  $\frac{1}{2}$  unit per second
- (e) increasing at a rate of 1 unit per second

## Question 26 / Section 3.7 Page 191

7. An airplane is flying at an altitude of 5 miles and passes directly over a radar antenna. When the distance between the plane and the radar is 10 miles, the radar detects that the distance between the radar and the plane is changing at a rate of 240 miles per hour. What is the speed of the plane?

- (a)  $160\sqrt{3}$
- (b)  $320\sqrt{3}$
- (c) 160
- (d) 320
- (e) 480

## Example 4 / Section 3.6 Page 180

8. If  $y = \arctan(3x) + \arcsin(\sqrt{x})$ , then  $\frac{dy}{dx}\bigg|_{x=\frac{1}{2}} =$

- (a)  $\frac{25}{13}$
- (b)  $\frac{23}{13}$
- (c)  $\frac{27}{13}$
- (d)  $\frac{29}{13}$
- (e)  $\frac{21}{13}$

Question 111 / Review Exercises Chapter 3 Page 202 Section 3.6

9. If  $f(x) = \tan x$ ,  $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ , then  $(f^{-1})' \left( \frac{\sqrt{3}}{3} \right) =$

- (a)  $\frac{3}{4}$
- (b)  $\frac{1}{4}$
- (c) 1
- (d)  $\frac{1}{2}$
- (e)  $\frac{5}{4}$

Question 51 / Section 3.5 Page 176

10. The slope of the graph of the relation  $x + y - 1 = \ln(x^2 + y^2)$  at the point  $(1, 0)$  is

- (a) 1
- (b) 2
- (c)  $-1$
- (d)  $-2$
- (e) 0

## Question 63 / Section 3.5 Page 176

11. If  $y = Ax + B$  is the equation of the normal line to the circle  $x^2 + y^2 = 25$  at the point  $(4, 3)$ , then  $A + B =$

- (a)  $\frac{3}{4}$
- (b)  $\frac{-3}{4}$
- (c)  $\frac{4}{3}$
- (d)  $\frac{-4}{3}$
- (e)  $\frac{1}{5}$

## Question 80 / Section 3.5 Page 176

12. If  $y = (\ln x)^{\ln x}$ ,  $x > 1$ , then  $y'(e) =$

- (a)  $\frac{1}{e}$
- (b)  $e$
- (c)  $e^2$
- (d)  $1$
- (e)  $\frac{1}{e^2}$

Question 129 / Section 3.4 Page 166

13. If  $h(x) = \frac{1}{9}(3x + 1)^3$ , then  $h''(1) =$

- (a) 24
- (b) 22
- (c) 26
- (d) 20
- (e) 28

Question 30 / Section 3.4 Page 164

14. If  $g(x) = \left( \frac{3x^2 - 2}{2x + 3} \right)^2$ , then  $g'(0) =$

- (a) 3
- (b) 4
- (c) 2
- (d) 0
- (e) 1