

King Fahd University of Petroleum and Minerals
Department of Mathematics
Math 101
Final Exam
233
August 15, 2024
Net Time Allowed: 120 Minutes

MASTER VERSION

1. The function $f(x) = x + \frac{9}{x}$ is decreasing on the interval

- (a) $(-3, 0)$ _____(correct)
(b) $(-9, 9)$
(c) $(3, \infty)$
(d) $(-\infty, -3)$
(e) $(-9, 0)$

Question 29/ Section 4.3 Page 227

2. If the function $f(x) = (x - 1)^2(x + 3)$ has a relative maximum at the point (a, b) , then $a =$

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

Question 8/ Section 4.4 Page 236

3. The graph of the function $f(x) = \frac{2x^2}{3x^2 + 1}$ is concave upward on the interval

- (a) $\left(-\frac{1}{3}, \frac{1}{3}\right)$ _____(correct)
- (b) $\left(-\infty, -\frac{1}{3}\right)$
- (c) $\left(\frac{1}{3}, \infty\right)$
- (d) $(-1, 1)$
- (e) $\left(-\frac{1}{3}, \infty\right)$

Question 30/Section 4.4 Page 236

4. The number of inflection points for the graph of the function $f(x) = x + 2 \cos x$ over $[0, 2\pi]$ is

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

Question 20/ Section 4.6 Page 256

5. If $y = Ax + B$ is the slant asymptote for the graph of the function

$$f(x) = \frac{-x^2 - 4x - 7}{x + 3}, \text{ then } A + B =$$

- (a) -2 _____(correct)
(b) 2
(c) -1
(d) 1
(e) 0

Question 7/ Section 4.7 Page 266

6. Let x and y be two positive numbers such that their product is 147 and the sum of the first number plus three times the second number is a minimum. Then $x + y =$

- (a) 28 _____(correct)
(b) 26
(c) 30
(d) 32
(e) 34

Question 12/ Section 4.8 Page 276

7. If $L(x)$ is the tangent line approximation to the graph of $f(x) = \log_2 x$ at the point $(2, 1)$, then $L(1) =$

- (a) $1 - \frac{1}{2 \ln 2}$ _____(correct)
- (b) $2 - \frac{1}{\ln 2}$
- (c) 0
- (d) $1 + \frac{1}{\ln 2}$
- (e) $2 + \frac{1}{2 \ln 2}$

Question 40/ Section 4.8 Page 277

8. The radius of a spherical balloon is measured as 8 inches, with a possible error of 0.02 inch. The percent error, approximately, in computing the volume of the sphere is, (Note, the volume of the sphere is $V = \frac{4}{3}\pi r^3$).

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

Question 44/ Section 5.1 Page 291

9. If $f''(x) = \frac{2}{x^2}$, $f'(1) = 4$, and $f(1) = 3$, then $f(-1) =$

- (a) -9 _____(correct)
(b) 9
(c) -6
(d) 6
(e) -11

Question 105/ Section 5.6 Page 355

10. If $\lim_{x \rightarrow 0} \frac{a - \cos bx}{x^2} = 2$, where $b > 0$, then $a + b =$

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

Question 47/ Section 5.6 Page 352

11. $\lim_{x \rightarrow 0^+} (e^x + x)^{2/x} =$

- (a) e^4 _____(correct)
- (b) e^3
- (c) e^2
- (d) e
- (e) 1

Question 33/ Section 5.9 Page 380

12. If $f(x) = \arctan(\sinh x)$, then $f'(\ln 2) =$

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

Example 7/ Section 2.4 Page 100

13. Which one of the following functions is continuous on the entire real number line?

$$(a) f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases} \text{-----(correct)}$$

$$(b) f(x) = \begin{cases} \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

$$(c) f(x) = \begin{cases} x^2 \sin \frac{1}{x}, & x \neq 0 \\ 1, & x = 0 \end{cases}$$

$$(d) f(x) = \tan x$$

$$(e) f(x) = \llbracket x \rrbracket$$

Question 101/ Review Chapter 3 Page 202

14. If $x \sin y = y \cos x$, defines y as an implicit function of x , then $\frac{dy}{dx} =$

$$(a) \frac{y \sin x + \sin y}{\cos x - x \cos y} \text{-----(correct)}$$

$$(b) \frac{y \sin x - \sin y}{\cos x + x \cos y}$$

$$(c) \frac{y \cos x + \cos y}{\sin x - x \sin y}$$

$$(d) \frac{y \cos x - \cos y}{\sin x + x \sin y}$$

$$(e) \frac{y \sin x}{x \cos y}$$

Question 108/ Review Chapter 3 Page 202

15. If $y = \frac{(2x + 1)^3(x^2 - 1)^2}{x + 3}$, then $\frac{dy}{dx}$ at $x = 0$ equals

- (a) $\frac{17}{9}$ _____(correct)
- (b) $\frac{-17}{9}$
- (c) $\frac{9}{17}$
- (d) $\frac{-9}{17}$
- (e) 1

Question 86/ Review Chapter 3 Page 201

16. The slope of the graph of the function $f(x) = \frac{3x + 1}{(4x - 3)^3}$ at the point $(1, 4)$ is

- (a) -45 _____(correct)
- (b) 45
- (c) -54
- (d) 54
- (e) 55

Questions 23,24/ Section 4.5 Page 246

$$17. \lim_{x \rightarrow \infty} \left(\frac{-4}{3 + 3e^{2x}} + \frac{6}{5 + 2e^{-4x}} \right)$$

(a) $\frac{6}{5}$ _____(correct)

(b) $\frac{-4}{3}$

(c) $\frac{-12}{5}$

(d) $\frac{2}{15}$

(e) 0

Questions 92, 93/ Review Chapter 2 Page 116

$$18. \lim_{x \rightarrow 0^+} \left(\ln(\sin x) - \frac{\cos^2 x}{x} \right) =$$

(a) $-\infty$ _____(correct)

(b) ∞

(c) 0

(d) 1

(e) -1

Question 92/ Review Chapter 3 Page 200

19. If $f(x) = x \sin^2 x$, then $f''\left(\frac{\pi}{4}\right) =$

- (a) 2 _____(correct)
- (b) 2π
- (c) $2 + \pi$
- (d) $2 - \pi$
- (e) π

Question 106/ Review Chapter 3 Page 202

20. The equation of the normal line to the graph of the equation $\ln(x + y) = x$ at the point $(0, 1)$ is

- (a) $x = 0$ _____(correct)
- (b) $y = 1$
- (c) $x = 1$
- (d) $y = 0$
- (e) $y = x + 1$