King Fahd University of Petroleum and Minerals
Department of Mathematics
Math 106
Exam II
TERM 232
May 01, 2024
Net Time Allowed: 120 Minutes

USE THIS AS A TEMPLATE

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

1. Which statement is **FALSE** about the function $f(x) = (x^2 + 1)\, e^{-x}$?

   (a) f has relative minimum at $x = 1$
   (b) f is decreasing on $(-\infty, 1)$ and $(1, \infty)$
   (c) f is never increasing
   (d) f has no relative extremum
   (e) f has only one critical point

52/13.1

2. The slope of the tangent line to $y = \dfrac{x^2(5 + x^2)}{\sqrt{x^2 + 3}}$ at $x = 1$ is equal to
   (HINT: You may use Logarithmic differentiation)

   (a) $\dfrac{25}{4}$
   (b) $\dfrac{36}{7}$
   (c) 3
   (d) 5
   (e) $\dfrac{5}{3}$

Simililar to 10/12.5
(suggested problem)

3. If $xy + y - x = 4$, then $\dfrac{d^2y}{dx^2}$ when $x = 2$ and $y = 2$ is

(a) $\dfrac{2}{9}$
(b) 2
(c) 4
(d) $\dfrac{7}{11}$
(e) $\dfrac{12}{13}$

29/12.7

4. The function $f(x) = 2x^2 - x^4$ has

(a) only three relative extrema
(b) only one relative maximum
(c) only two relative minimum
(d) only two critical points
(e) only one critical point

Example 4/ 3.1

5. The absolute minimum of $f(x) = 3x^4 - x^6$ over the interval $[-1, 2]$ is equal to

(a) -16
(b) 3
(c) 4
(d) -6
(e) -43

9/13.2

6. The function $f(x) = x^{2/3}$ over the interval $[-8, 8]$ has the absolute minimum at $x =$

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

6/13.2

7. The curve of the function $f(x) = x^3 - 30x^2$ concave up on the interval

(a) $(10, \infty)$
(b) $(-\infty, 10)$
(c) $(0, 20)$
(d) $(-10, 10)$
(e) $(0, 100)$

similar to 40/13.3

8. The number of inflection points of the function $f(x) = 1 - \dfrac{1}{x^2}$ is equal to

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

24/13.3

9. The number of relative minimum of the function $f(x) = (x^2 + 7x + 10)^2$ is equal to

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

13 /sec13.4

10. At $x = 2$, the function $y = -2x^4 + 64x$ has

(a) an absolute maximum
(b) a relative minimum
(c) neither maximum nor minimum
(d) an absolute minimum
(e) an inflection point

similar to 3 and 8 /sec13.4

11. The function $f(x) = \dfrac{x^4+1}{1-x^4}$ has

(a) two vertical and one horizontal asymptotes
(b) only one vertical asymptotes
(c) only two horizontal asymptotes
(d) no asymptotes
(e) one horizontal and one oblique asymptote

20/13.5

12. The equation of the oblique asymptote of the graph of

$$f(x) = \frac{3x^2-5x-1}{x-2}$$

is

(a) $y = 3x+1$
(b) $y = 3x-5$
(c) $y = x-2$
(d) $y = -5x-1$
(e) $y = \dfrac{3}{2}x - \dfrac{5}{2}$

30/sec13.5

13. Suppose that the demand equation for a monopolist's is $p = 200 - 0.5q$ and the average-cost function is $\bar{c} = 0.5q + 8 + (200/q)$, where q is number of units, and both p and $\bar{c}$ are expressed in dollars per unit. The maximum profit occur when $q =$

(a) 96
(b) 200
(c) 104
(d) 86
(e) 108

similar to Example 8/sec13.6

14. The demand equation for a manufacturer's product is

$$p = \frac{80 - q}{4}, \qquad 0 \leq q \leq 80$$

where q is the number of units and p is the price per unit. The absolute maximum revenue is equal to

(a) 400
(b) 480
(c) 380
(d) 840
(e) 390

Example 2/sec13.6

15. Let $y(x) = e^{8-2x}$, then by using differentials $y(4.01) \approx$

(a) 0.980
(b) 0.982
(c) 1.020
(d) 1.080
(e) 0.990

similar to 32/sec14.1

16.

$$\int \left(\frac{1}{2x^3} - \frac{1}{x^4}\right)\, dx \;=$$

(a) $-\frac{1}{4x^2} + \frac{1}{3x^3} + C$
(b) $\frac{x^2}{2} - \frac{3}{x^4} + C$
(c) $-\frac{3}{x^2} + \frac{2}{x^3} + C$
(d) $\frac{x^4}{4} + \frac{2}{x^2} + C$
(e) $-\frac{2}{x^4} - \frac{4}{x^2} + C$

30/14.2

17.

$$\int \frac{e^x + e^{2x}}{e^x}\, dx =$$

(a) $x + e^x + C$
(b) $x + x^2 + C$
(c) $x + 2\ln x + C$
(d) $1 + 2e^x + C$
(e) $e^x + e^{2x} + C$

51/sec14.2

18. A manufacturer has determined that the marginal-cost function is

$$\frac{dc}{dq} = 0.003q^2 - 0.4q + 40.$$

where q is the number of units produced. If the fixed costs are \$5000, what is the average cost of producing 100 units?

(a) \$80
(b) \$30
(c) \$90
(d) \$70
(e) \$110

21 /sec14.3

19. If $y'' = -12x^2 + 12x$, $y(1) = 0$, and $y'(1) = 0$ then $y(2) =$

(a) -3
(b) 2
(c) 1
(d) 4
(e) -5

similar to 5/sec14.3

20. If $y = \frac{1}{x}$, then $y'''(3) =$

(a) $-\frac{2}{27}$
(b) $-\frac{5}{16}$
(c) $\frac{1}{3}$
(d) $-\frac{5}{9}$
(e) $\ln 3$

8/12.7