King Fahd University of Petroleum and Minerals
Department of Mathematics

Math 106
Major Exam
211
11-October-2021

EXAM COVER

Number of versions: 4
Number of questions: 15
Number of Answers: 5

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Math 106
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Net Time Allowed: 90 Minutes

MASTER VERSION

1. $\displaystyle \lim_{x \to \infty} \frac{x^3 - 3x^5 + 21}{2x^3 + x^2 + 21x} =$

     (a) $-\infty$ (correct)

     (b) ∞

     (c) $-\dfrac{3}{2}$

     (d) 1

     (e) $\dfrac{1}{2}$

2.   The equation of the tangent line to the curve of the function

$$f(x) = \frac{\sqrt{x} + 2x^2}{x}$$

     when $x = 4$ is

     (a) $y = \dfrac{31}{16}x + \dfrac{3}{4}$ (correct)

     (b) $y = \dfrac{-1}{16}x + \dfrac{33}{4}$

     (c) $y = \dfrac{1}{16}x + \dfrac{11}{16}$

     (d) $y = \dfrac{2}{31}x - \dfrac{5}{16}$

     (e) $y = \dfrac{-8}{7}x + \dfrac{32}{7}$

3. $\lim\limits_{t \to 2} \dfrac{\sqrt{t} - \sqrt{2}}{t - 2}$

(a) $\dfrac{1}{2\sqrt{2}}$ (correct)

(b) ∞

(c) 0

(d) $\dfrac{1}{2 + \sqrt{2}}$

(e) $\dfrac{1}{4}$

4. How many points on the curve of $f(x) = x^3 - 6x^2 + 12x + 3$ where the tangent line is horizontal

(a) one point   (correct)

(b) none

(c) two points

(d) three points

(e) four points

5.   The average cost $\bar{c}$ for producing q units of a product is $\bar{c} = 99 + \dfrac{1200}{q}$. The marginal cost when producing 12 units is

(a)   99   (correct)

(b)   1200

(c)   100

(d)   8.75

(e)   21

6.   The slope of the tangent line to the curve of $f(x) = \dfrac{3x^2 - x}{x^2 + 1}$ at $x = 1$ is

(a) $\dfrac{3}{2}$ (correct)

(b)   1

(c)   0

(d) -1

(e) $\dfrac{1}{2}$

7.   If $w = (2u + 3)^2$ and $u = (t + 1)^3$, then $\dfrac{dw}{dt}$ at $t = 0$ is

   (a)   60   (correct)

   (b)   20

   (c)   15

   (d)   36

   (e)   90

8.   If $f(x) = \ln \sqrt{\dfrac{1 + x^2}{1 - x^2}}$, then $f'\left(\dfrac{1}{2}\right) - f'(0) =$

   (a) $\dfrac{16}{15}$ (correct)

   (b)   0

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

   (d) $\dfrac{7}{3}$

   (e) $\dfrac{12}{17}$

9.   If $y = \ln x^5 + \ln^5 x$ then $\dfrac{dy}{dx}$ at $x = 1$ is

   (a)   5   (correct)

   (b)   0

   (c)   10

   (d)   ln 5

   (e)   1

10.   The equation of the tangent line to the curve $x^2 + x^3 y + y^3 = 31$ at $(1, 3)$ is

   (a) $y = \dfrac{-11}{28} x + \dfrac{95}{28}$ (correct)

   (b) $y = -2x + 5$

   (c) $y = \dfrac{-3}{11} x + \dfrac{36}{11}$

   (d) $y = \dfrac{3}{11} x + \dfrac{30}{11}$

   (e) $y = \dfrac{-5}{7} x + \dfrac{26}{7}$

11.   The slope of the tangent line to the curve $f(x) = ee^x e^{x^3} + 1^x$ at $x = 1$ is

    (a) $4e^3$ (correct)

    (b) e^2

    (c)   4

    (d)   1

    (e) e^3

12.   If $f(x) = x^4 - 3x^2 + 1$, then $f''(1) =$

    (a)   6   (correct)

    (b)   12

    (c)   9

    (d)   3

    (e)   0

13.   Let $y = (5x)^x$ then the percentage rate of change of y is equal to 50 when x is

    (a) $\dfrac{1}{5}e^{-\frac{1}{2}}$ (correct)

    (b) $\dfrac{1}{2}e^{-\frac{1}{2}}$

    (c) $\dfrac{1}{5}$

    (d) $\dfrac{1}{5e^{49}}$

    (e) $e^{-\frac{1}{2}}$

14. $\displaystyle\lim_{x \to 3} \dfrac{x^2 - x - 6}{x - 3} =$

    (a)   5   (correct)

    (b)   3

    (c)   1

    (d) -2

    (e)   0

15.   If the function

$$f(x) = \begin{cases} 2x + a, & \text{if} \quad x \geq 3 \\ x^2 + bx, & \text{if} \quad x < 3 \end{cases}$$

is continuous on $(-\infty, \infty)$ and $f(-1) = 2$, then $a + b$

(a) -1 (correct)

(b) -4

(c) 2

(d) 7

(e) -7