Kink Fahd University of Petroleum and Minerals
Department of Mathematics
MATH 106
Major Exam I
213
22 June 2022
Net Time Allowed: 120 minutes

MASTER VERSION

1. $$\lim_{x \to 0} \frac{x^2}{\sqrt{1-x^2} - \sqrt{1+x^2}} =$$

   (a) -1 (correct)

   (b) 0

   (c) -2

   (d) does not exist

   (e) ∞

2. $$\lim_{x \to -2^-} \frac{x^2 - x - 6}{|x+2|} =$$

   (a) 5 (correct)

   (b) -5

   (c) 1

   (d) 0

   (e) -1

3. $\lim\limits_{x \to -1^-} \dfrac{x-6}{x(x+1)} =$

  (a) $-\infty$ (correct)

  (b) ∞

  (c) 0

  (d) -7

  (e) 7

4. For what value of c, the $\lim\limits_{x \to 2} \dfrac{x^2 + x + c}{x^2 - 5x + 6}$ does exist ?

  (a) -6 (correct)

  (b) 6

  (c) 0

  (d) -1

  (e) 1

5.   The value(s) of the constant a that make the fucntion

$$f(x) = \begin{cases} 2x^2 + a & \text{if} \quad x < 2 \\ 2ax - 1 & \text{if} \quad x \geq 2 \end{cases}$$

continuous on $(-\infty, \infty)$ is (are)

(a)   3   (correct)

(b) -1 and 1

(c)   1

(d) -2 and 2

(e) -5

6.   Which of the following statement is **True** about $f(x) = \sqrt{x}$?

(a) f has a vertical tangent line at $(0, 0)$.   (correct)

(b) f has no vertical tangent line.

(c) f is differentiable on $(-\infty, \infty)$.

(d) f has a horizontal tangent line at $(0, 0)$.

(e) f has a vertical tangent line at $x = 1$.

7. How many points on the curve of $f(x) = \dfrac{x^5}{5} - x + 1$, where the tangent line is horizontal ?

    (a)   two points   (correct)

    (b)   one point

    (c)   none

    (d)   three points

    (e)   four points

8. The point(s) to the curve $y = 2x^3 + 3x^2 - 12x + 1$ where the tangent line parallel to $x - axis$ is (are)

    (a) $x = 1$ and $x = -2$ (correct)

    (b) $x = 2$ and $x = -1$

    (c) $x = 1$ and $x = -1$

    (d) $x = -2$

    (e) $x = 1$

9.   The equation of the tangent line to the curve $y = x^4 + 1$ that is parallel to the line $32x - y = 15$ is

   (a) $y = 32x - 47$ (correct)

   (b) $y = 32x + 47$

   (c) $y = 32x - 17$

   (d) $y = -32x - 17$

   (e) $y = 32x + 17$

10.   Find all the point(s) on the curve $y = x^3 - 3x^2 - 8x + 7$ where the slope of the tangent line is 1.

   (a) $(-1, 11)$ & $(3, -17)$ (correct)

   (b) $(-1, -11)$ & $(-3, -17)$

   (c) $(1, 11)$ & $(3, 17)$

   (d) $(1, -11)$ & $(-3, 17)$

   (e) $(1, 11)$ & $(-3, -17)$

11.   The equation of the tangent line to the curve $y = x^4 + 2x^2 - x$ at $(1, 2)$ is

      (a) $y = 7x - 5$ (correct)

      (b) $y = -7x + 5$

      (c) $y = 7x$

      (d) $y = 7x + 5$

      (e) $y = -7x - 5$

12.   If $y = \dfrac{x + 1}{x^3 + x - 2}$ then $\left.\dfrac{dy}{dx}\right|_{x=-1}$

      (a) $-\dfrac{1}{4}$ (correct)

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

      (c) $-\dfrac{1}{2}$

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

      (e) $-\dfrac{3}{4}$

13.   Suppose that $f(5) = 1,\ f'(5) = 6,\ g(5) = -3,\ g'(5) = 2$ then $\left(\dfrac{g}{f}\right)'(5)=$

      (a)   20   (correct)

      (b) -20

      (c) $\dfrac{20}{9}$

      (d) $-\dfrac{20}{9}$

      (e) $\dfrac{1}{20}$

14.   The average cost $\bar{c}$ for producing q units of a product is given by $\bar{c} = 0.01q^2 + 11 + \dfrac{1000}{q}$. Then the rate of change of marginal cost for $q = 100$ is

      (a)   6   (correct)

      (b)   311

      (c)   0.06

      (d)   0.6

      (e)   300

15.   The percentage rate of change of $f(x) = 3x^2 + 5x + 2$ at $x = 1$ is

    (a)   110%   (correct)

    (b)   11%

    (c)   100%

    (d)   10%

    (e)   101%

16.   Suppose a manufacturer sells q units of a product, where the total revenue fucntion is $r = 250q + 45q^2 - q^3$. Find the marginal-revenue when 5 units sold.

    (a)   625   (correct)

    (b)   850

    (c)   700

    (d)   675

    (e)   725

17.   Find the derivative of $\dfrac{\frac{1}{x} - \frac{7x}{x^2+1}}{\frac{2}{x} - \frac{3x}{x^2+1}}$

(a) $\dfrac{-22x}{(2 - x^2)^2}$ (correct)

(b) $\dfrac{-22x}{(2 - x^2)}$

(c) $\dfrac{22x}{(2 - x)^2}$

(d) $\dfrac{x}{(2 - x^2)}$

(e) $\dfrac{x}{(x + 2)^2}$

18.   If $f(x) = \ln(x) \log_2(x)$ then $f'(2) =$

(a)   1   (correct)

(b)   0

(c) ∞

(d) $\frac{1}{2}$

(e) -1

19.   If $f(x) = x^3 g(x)$, $g(-1) = 7$, $g'(-1) = -9$ then $f'(-1) =$

    (a)   30   (correct)

    (b)   12

    (c)   21

    (d)   9

    (e) -12

20.   If $y = u^5 - 8u^2 + 2u - 1$ and $u = \sqrt{x + 10}$ then $\left.\dfrac{dy}{dx}\right|_{x=-9} =$

    (a) $\dfrac{-9}{2}$ (correct)

    (b)   0

    (c) -1

    (d) -9

    (e)   1