

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

(a) -1

(correct)

(b) 0

(c) -2

(d) does not exist

(e) ∞

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

(a) 5

(correct)

(b) -5

(c) 1

(d) 0

(e) -1

3. $\lim_{x \rightarrow -1^-} \frac{x - 6}{x(x + 1)} =$

(a) $-\infty$

(correct)

(b) ∞

(c) 0

(d) -7

(e) 7

4. For what value of c , the $\lim_{x \rightarrow 2} \frac{x^2 + x + c}{x^2 - 5x + 6}$ does exist ?

(a) -6

(correct)

(b) 6

(c) 0

(d) -1

(e) 1

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

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

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

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

(correct)

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

- (a) f has a vertical tangent line at $(0, 0)$.
- (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 $x = 1$.

(correct)

7. How many points on the curve of $f(x) = \frac{x^5}{5} - x + 1$, 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 $y = \frac{x+1}{x^3+x-2}$ then $\frac{dy}{dx}\Big|_{x=-1}$

(a) $-\frac{1}{4}$

(correct)

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

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

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

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

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

(a) 20

(correct)

(b) -20

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

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

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

14. The average cost \bar{c} for producing q units of a product is given by $\bar{c} = 0.01q^2 + 11 + \frac{1000}{q}$. 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 function 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 $\frac{\frac{1}{x} - \frac{7x}{x^2+1}}{\frac{2}{x} - \frac{3x}{x^2+1}}$

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

(correct)

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

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

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

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

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

- (a) 30
- (b) 12
- (c) 21
- (d) 9
- (e) -12

(correct)

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

- (a) $\frac{-9}{2}$
- (b) 0
- (c) -1
- (d) -9
- (e) 1

(correct)