

Instructions: Keep all devices capable of communication turned off and out of sight. **Multiple Choice Questions (85 points)**

Q1 Let $A = \{a, b, c, d\}$ and $B = \{1, 2, 3\}$ be finite sets. How many functions are there from A to B ?

- | | | |
|--------|--------|----------|
| (A) 64 | (C) 81 | (E) None |
| (B) 32 | (D) 12 | |

Q2 Find a constant c that makes $g(x)$ continuous on $(-\infty, \infty)$.

$$g(x) = \begin{cases} cx + 1 & \text{if } x \leq 2 \\ x + c & \text{if } x > 2 \end{cases}$$

- | | | |
|------------------------|-------------|----------|
| (A) $c = 1$ | (C) $c = 2$ | (E) None |
| (B) $c = -\frac{1}{2}$ | (D) $c = 3$ | |

Q3 What is $\lim_{h \rightarrow 0} \frac{(2+h)^5 - 2^5}{h}$?

- | | | |
|--------|--------|----------|
| (A) 20 | (C) 60 | (E) None |
| (B) 40 | (D) 80 | |

Q4 Suppose $f(x) = \frac{1}{x^2 - 5}$. What is the largest value of A such that $f(x)$ is defined on the interval $[-10, A)$?

- | | | |
|-----------------|----------------|----------|
| (A) $-\sqrt{5}$ | (C) -2 | (E) None |
| (B) $2\sqrt{6}$ | (D) $\sqrt{5}$ | |

Q5 If $f(x) = |x - 1|$ then find $\lim_{x \rightarrow 1} \frac{f(1+h) - f(1)}{h}$

- | | | |
|-------|-------|---------|
| (A) 4 | (C) 0 | (E) DNE |
| (B) 1 | (D) 2 | |

Q6 The graph of a function f is reflected across the x -axis and then shifted up 2 units. Which of the following describes this transformation on f ?

- | | | |
|---------------------|-----------------|----------|
| (A) $-f(x)$ | (C) $-f(x) + 2$ | (E) None |
| (B) $-f(x - 2) + 2$ | (D) $-f(x - 2)$ | |

Q7 $\lim_{x \rightarrow 1} \frac{\ln x}{x}$ is

- | | | |
|-------|----------|----------|
| (A) 0 | (C) e | (E) None |
| (B) 1 | (D) $-e$ | |

Q8 $\lim_{x \rightarrow 0} \frac{\tan x}{x}$ is

- | | | |
|--------------|-----------|----------|
| (A) -1 | (C) π | (E) None |
| (B) $-\pi/2$ | (D) 1 | |

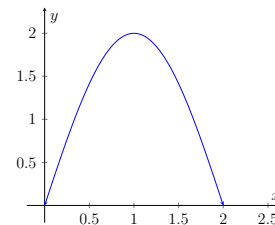
Q9 $\lim_{x \rightarrow 0} \frac{\sin x}{\sqrt{x}}$ is

- | | | |
|----------|-----------|----------|
| (A) -1 | (C) 1 | (E) None |
| (B) 0 | (D) π | |

Q10 The Intermediate Value Theorem states that given a continuous function f defined on the closed interval $[a, b]$ for which 0 is between $f(a)$ and $f(b)$, there exists a point c between a and b such that

- | | | |
|-----------------|-------------------|----------|
| (A) $f(c) = 0$ | (C) $f(a) = f(b)$ | (E) None |
| (B) $c = a - b$ | (D) $f(0) = c$ | |

Q11



The figure shows the graph of a sine function for one complete period. Which of the following is an equation for the graph?

- | | |
|-------------------------------------|----------------------------|
| (A) $f(x) = \sin x$ | (C) $f(x) = \sin(\pi x)$ |
| (B) $f(x) = 2 \sin(\frac{\pi}{2}x)$ | (D) $f(x) = 2 \sin(\pi x)$ |

Q12 Suppose that f is a function that is defined for all real numbers. Which of the following conditions assures that f has an inverse function.

- | | |
|--|---|
| (A) The function f is periodic. | (C) The function is strictly increasing function. |
| (B) The graph of f is symmetric with respect to the y -axis. | (D) The function is continuous. |

Q13 Compute $\lim_{x \rightarrow 0} \frac{\tan x - x}{\sin x}$.

(A) 0 (C) 4/7 (E) None

(B) 1 (D) 5/9

Q14 Let $\frac{1}{5}x + \frac{5}{x} + 2 \leq f(x) \leq x^2 - 10x + 29$. Find the $\lim_{x \rightarrow 5} f(x)$

(A) -1 (C) 4 (E) 11

(B) 0 (D) 5

Q15 An object is moving along a straight line. Its position after $t \geq 0$ is given by $s(t) = t^2 + 5t$ meters. Find the average velocity of the object for the time interval $2 \leq t \leq 4$.

(A) -1 (C) 4 (E) 11

(B) 0 (D) 5

Q16 The slope of the line tangent to the graph of $y = x^3 - x^2 + 1$ at $x = 2$ is

(A) 8 (C) 11 (E) None

(B) 9 (D) 12

Q17 $\lim_{x \rightarrow \infty} \frac{5 + 7^x}{2 + 9^x}$

(A) ∞ (C) 5/2 (E) None

(B) 0 (D) 7/9

True/False questions(10 pts) . No justifications are needed.

Q1 If $f(x)$ is continuous on $[a, b]$ and if $f(b) = f(a)$ then $f(x)$ must have a zero in $[a, b]$.

T

F

Q2 If $f'(x) = g'(x)$, then $f(x) = g(x)$.

T

F

Q3 If $\lim_{x \rightarrow \infty} f(x)$ exists, then $f(x)$ must have a horizontal asymptote.

T

F

Q4 Speed is the rate of change of acceleration over time.

T

F

Q5 It is impossible for a function to have both a horizontal asymptote and a vertical asymptote.

T

F

Q6 If $f(x)$ is a continuous function then f is differentiable.

T

F

Q7 The derivative of $\tan(x)$ is $\sec(x) \tan(x)$.

T

F

Q8 A circle can be the graph of a function.

T

F

Q9 The equation $x^4 + x - 3 = 0$ has a solution in $[1, 2]$.

T

F

Q10 If $f(x) = 7 + x + e^x$. Then $f^{-1}(8) = 0$.

T

F

Fill in the Blank questions(10 pts) .

Q1 The quantity $|y - x|$ is called the _____ between _____ and _____ .

Q2 The function $f : x \rightarrow 3 - x$ _____ 2 onto 1.

Q3 A function associates with each member of its _____ precisely one member of its _____

Q4 A point (x, y) lies on the x -axis if and only if _____

Q5 A point (x, y) lies in the first quadrant if and only if both x and y are _____ .