



## MATHS

### BOOKS - SAI MATHS (TELUGU ENGLISH)

### LIMITS AND CONTINUITY

#### Problems

1. The value that should be assigned to  $f(0)$  so that the function

$f(x) = (x + 1)^{\cot x}$  is continuous

A.  $e$

B. 1

C. 2

D.  $e^{-1}$

**Answer: A**



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2.  $\lim_{x \rightarrow 0} \left\{ \tan\left(x + \frac{\pi}{4}\right) \right\}^{1/x}$

A.  $e^2$

B.  $e$

C.  $e^{\frac{1}{2}}$

D.  $e^{-1}$

**Answer: A**



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3. If  $g(x) = \frac{x}{x}$  for  $x > 2$  then  $\lim_{x \rightarrow 2} \frac{g(x) - g(2)}{x - 2}$

A.  $-1$

B. 0

C.  $\frac{1}{2}$

D. 1

**Answer: C**



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4.  $\lim_{x \rightarrow \frac{\pi}{2}} \left( \frac{2x - \pi}{\cos X} \right) =$

A. 0

B.  $\frac{1}{2}$

C. -2

D. 5

**Answer: C**



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5. If  $f$  is defined by  $f(x) = \begin{cases} x & \text{for } 0 \leq x < 1 \\ 2 - x & \text{for } x \leq 1 \end{cases}$  then at  $x=1$

- A. Continuous and differentiable
- B. Continuous but not differentiable
- C. Discontinuous but differentiable
- D. Neither continuous nor differentiable

**Answer: B**



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6.  $\lim_{x \rightarrow 0} \left( \sqrt{1 + x^2} - \frac{\sqrt{1 - x + x^2}}{3^x - 1} \right)$  is equal to

- A.  $\frac{1}{\log_e 3}$
- B.  $\log_e 9$
- C.  $\frac{1}{\log_e g}$
- D.  $\log_e 3$

**Answer: C**



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7. If  $f : [-2, 2] \rightarrow \mathbb{R}$  is defined by

$$f(x) = \begin{cases} \frac{\sqrt{1+cx} - \sqrt{1-cx}}{x} & \text{for } -2 \leq x < 0 \\ \frac{x+3}{x+1} & \text{for } 0 \leq x \leq 2 \end{cases}$$

continuous on  $[-2, 2]$  then  $c$  is equal to

A.  $\frac{2}{\sqrt{3}}$

B. 3

C.  $\frac{3}{2}$

D.  $\frac{3}{\sqrt{2}}$

**Answer: B**



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8. If  $f(x) = x \tan^{-1} x$ , then  $\lim_{x \rightarrow 1} \frac{f(x) - f(1)}{x - 1}$  equals to

A.  $\frac{\pi + 3}{4}$

B.  $\frac{\pi}{4}$

C.  $\frac{\pi + 1}{4}$

D.  $\frac{\pi + 2}{4}$

**Answer: D**



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9.  $\lim_{x \rightarrow 0} \frac{\tan^3 x - \sin^3 x}{x^5}$  is equal to

A.  $\frac{5}{2}$

B.  $\frac{3}{2}$

C.  $\frac{3}{5}$

D.  $\frac{2}{5}$

**Answer: B**



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10.  $\lim_{x \rightarrow \infty} \left( \frac{x+6}{x+1} \right)^{x+4}$  is equal to

A.  $e^4$

B.  $e^6$

C.  $e^5$

D.  $e$

**Answer: C**



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11. Let  $F : R \rightarrow R$  be defined by

$$f(x) = \begin{cases} \alpha + \frac{\sin [x]}{x} & \text{if } x > 0 \\ 2 & \text{if } x = 0 \\ \beta + \left[ \frac{\sin x - x}{x^3} \right] & \text{if } x < 0 \end{cases}$$

where,  $[x]$  denotes the integral part of  $x$ . If  $f$  continuous at  $x = 0$ , then

$\beta = \alpha$  is equal to

A.  $-1$

B.  $1$

C.  $0$

D.  $2$

**Answer: B**



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12.  $\lim_{x \rightarrow 8} \left( \frac{\sqrt{1 + \sqrt{1 + x - 2}}}{x - 8} \right)$  is equal to



A.  $\frac{3}{2}$

B.  $\frac{1}{4}$

C.  $\frac{1}{24}$

D.  $\frac{1}{12}$

**Answer: C**



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13. If  $[x]$  denotes the greatest integer not exceeding  $x$  and if the function

$f$  defined by  $f(x) = \begin{cases} \frac{a+2\cos x}{x^2} & x < 0 \\ b \tan \frac{\pi}{x+4} & x \geq 0 \end{cases}$  is continuous at  $x = 0$ , then

the ordered pair  $(a,b)$  is equal to

A.  $(-2, 1)$

B.  $(-2, -1)$

C.  $(-1, \sqrt{3})$

D.  $(-2, -\sqrt{3})$

**Answer: B**



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14.  $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^2}$  is equal to

A. 0

B. 1

C.  $\frac{1}{2}$

D.  $\frac{-1}{2}$

**Answer: A**



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15. If  $f : \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = \begin{cases} \frac{1 + 3x^2 - \cos 2x}{x^2} & \text{for } x \neq 0 \\ k & \text{for } x = 0 \end{cases}$  is

continuous at  $x = 0$ , then  $k$  is equal to

A. 1

B. 5

C. 6

D. 0

**Answer: B**



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16.  $\lim_{x \rightarrow \infty} \left( \frac{x+5}{x+2} \right)^{x+3}$  equals

A. e

B.  $e^2$

C.  $e^3$

D.  $e^5$

**Answer: C**



17. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = \begin{cases} \frac{2 \sin x - \sin 2x}{2x \cos x} & \text{if } x \neq 0 \\ a & \text{if } x = 0 \end{cases}$

then the value of 'a' so that f is continuous at 0 is

A. 2

B. 1

C. -1

D. 0

**Answer: D**



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18.  $\lim_{x \rightarrow 0} \frac{1 - e^x \sin x}{x^2 + x^3}$  is equal to

A. -1

B. 0

C. 1

D. 2

**Answer: C**



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19. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = [x - 3] + |x - 4|$  for  $x \in \mathbb{R}$

then  $\lim_{x \rightarrow 3} f(x)$  is equal to

A.  $-2$

B.  $-1$

C.  $0$

D.  $1$

**Answer: C**



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20. If  $f : \mathbb{R} \rightarrow \mathbb{R}$  is defined by

$$f(x) = \begin{cases} \frac{\cos 3x - \cos x}{x^2} & \text{for } x \neq 0 \\ \lambda & \text{for } x = 0 \end{cases}$$

and if  $f$  is continuous at  $x = 0$ , then  $\lambda$  is equal to

A.  $-2$

B.  $-4$

C.  $-6$

D.  $-8$

**Answer: B**



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21. If  $f(2) = 4$  and  $f'(2) = 1$ , then  $\lim_{x \rightarrow 2} \frac{xf(2) - 2f(x)}{x - 2}$  is equal to

A.  $-2$

B.  $1$

C. 2

D. 3

**Answer: C**



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22.  $\lim_{x \rightarrow 0} \left( e^x - \frac{e^{\sin x}}{(x - \sin x)} \right)$  is equal to

A.  $-1/2$

B.  $1/2$

C. 1

D.  $3/2$

**Answer: B**



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23. if  $f(x) = \begin{cases} x - 5 & \text{for } x \leq 1 \\ 4x^2 - 9 & \text{for } 1 < x < 2 \\ 3x + 4 & \text{for } x > 2 \end{cases}$  then  $f(2^+)$  is equal to

A. 0

B. 2

C. 3

D. 4

Answer: C



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24. If  $f(x) = \begin{cases} \frac{\sin(1 + [x])}{x} & \text{for } [x] \neq 0 \\ 0 & \text{for } [x] = 0 \end{cases}$

when  $[x]$  denotes the greatest integer not exceeding  $x$ , the  $\lim_{x \rightarrow 0} f(x)$  is equal to

A. -1

B. 0



C. 1

D. 2

**Answer: B**



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25. If  $0 < p < 1$

A.  $e$

B.  $p$

C.  $q$

D. 0

**Answer: C**



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26.  $\lim_{x \rightarrow \infty} [\sqrt{x^2 + 2x - 1} - x]$  is equal to

A.  $\infty$

B.  $\frac{1}{2}$

C. 4

D. 1

Answer: D



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27. If  $\lim_{x \rightarrow 0} \left( \frac{\cos 4x + a \cos 2x + b}{x^4} \right)$  is finite, then the values, of  $a, b$  are respectively .

A. 5,-4

B. -5, -4

C. -4, 3

D. 4,5

Answer: C



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28.

If

$$l_1 = \lim_{x \rightarrow 2^+} (x + [x]), l_2 = \lim_{x \rightarrow 2^-} (2x - [x]) \text{ and } l_3 = \lim_{x \rightarrow \pi/2} \frac{\cos x}{x - \pi/2}$$

is

A.  $l_1 < l_2 < l_3$

B.  $l_2, l_3, l_1$

C.  $l_3 < l_2 < l_1$

D.  $l_1, < l_3 < l_2$

Answer: C



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29. If  $f(x) = \begin{cases} \frac{1 - \sqrt{2}e \sin x}{\pi - 4x} & \text{if } x \neq \frac{\pi}{4} \\ a & \text{if } x = \frac{\pi}{4} \end{cases}$  is continuous at  $\pi/4$  then  $a$  is

equal to

A. 4

B. 2

C. 1

D.  $1/4$

**Answer: D**



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30.  $\lim_{x \rightarrow 0} x^2 \sin\left(\frac{\pi}{x}\right)$  is equal to

A. 1

B. 0

C. does not exist

D.  $\infty$

**Answer: B**



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31. If  $f: R \rightarrow R$  is defined by

$$f(x) = \begin{cases} \frac{x-2}{x^2-3x+2} & \text{if } x \in R - \{1, 2\} \\ 2 & \text{if } x = 1 \\ 1 & \text{if } x = 2 \end{cases}$$

A. 0

B. -1

C. 1

D.  $\frac{1}{2}$

**Answer: B**



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32. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by

$$f(x) = \begin{cases} \frac{x+2}{x^2+3x+2} & \text{if } x \in \mathbb{R} - \{1, -2\} \\ -1 & \text{if } x = -2 \\ 0 & \text{if } x = -1 \end{cases}$$

then  $f$  is continuous on the set

A.  $\mathbb{R}$

B.  $\mathbb{R} - \{-2\}$

C.  $\mathbb{R} - \{-1\}$

D.  $\mathbb{R} - \{-1, -2\}$

**Answer: C**



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33. The value of  $\lim_{n \rightarrow \infty} \frac{1}{n^3} \sum_{k=1}^n (k^2 x)$  is

A.  $x$

B.  $\frac{x}{2}$

C.  $\frac{x}{3}$

D.  $\frac{x}{4}$

**Answer: C**



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34. If  $f(x) = \begin{cases} \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x}, & \text{for } -1 \leq x < 0 \\ 2x^2 + 3x - 2, & \text{for } 0 \leq x \leq 1 \end{cases}$

continuous at  $x = 0$ , then  $k$  is equal to

A.  $-1$

B.  $-2$

C.  $-3$

D.  $-4$

**Answer: B**



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35. If  $f(x) = \begin{cases} \frac{x-1}{2x^2-7x+5} & \text{for } x \neq 1 \\ -\frac{1}{3} & \text{for } x = 1 \end{cases}$  then  $f(1)$  is equal to

A.  $-\frac{1}{9}$

B.  $-\frac{2}{9}$

C.  $-\frac{1}{3}$

D.  $\frac{1}{3}$

**Answer: B**



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36. If  $f(x) = \frac{x}{1+|x|}$  for  $x \in R$  then  $f(0)$  is equal to

A. 0

B. 1

C. 2



D. 3

**Answer: B**



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37.  $\lim_{x \rightarrow \frac{\pi}{6}} \left\{ \frac{3 \sin x - \sqrt{3} \cos x}{6x - \pi} \right\}$  is equal to

A.  $\sqrt{3}$

B.  $\frac{1}{\sqrt{3}}$

C.  $-\frac{1}{\sqrt{3}}$

D.  $-\frac{1}{3}$

**Answer: B**



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38. If  $a > 0$ ,  $\lim_{x \rightarrow a} \frac{a^x - x^a}{x^x - a^a} = -1$  then  $a$  is equal to

A. 0

B. 1

C. e

D. 2e

**Answer: B**



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39.  $\lim_{x \rightarrow 0} \frac{4^x - 9^x}{x(4^x + 9^x)}$  is equal to

A.  $\frac{\log 2}{3}$

B.  $\frac{\log 3}{2}$

C.  $\frac{1}{2} \frac{\log 2}{3}$

D.  $\frac{1}{2} \frac{\log 2}{3}$

**Answer: A**



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40. The quadratic equation whose roots are  $l$  and  $m$ , where

$$l = \lim_{\theta \rightarrow 0} \left( \frac{3 \sin \theta - 4 \sin^2 \theta}{\theta} \right) \text{ and } m = \lim_{\theta \rightarrow 0} \frac{2 \tan \theta}{\theta(1 - \tan^2 \theta)} \text{ is}$$

A.  $X^2 + 5x + 6 = 0$

B.  $x^2 - 5x + 6 = 0$

C.  $x^2 - 5x - 6 = 0$

D.  $x^2 + 5x - 6 = 0$

**Answer: B**



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41. If  $f : \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = x - [x]$ , where  $[x]$ , is the greatest integer not exceeding  $x$ , then the set of discontinuous of  $f$  is

A. The empty set

B. R

C. Z

D. N

**Answer: C**



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**42.** If  $f: R \rightarrow R$  is defined by

$$f(x) = \begin{cases} a^2 \cos x + b^2 \sin^2 x & x \leq 0 \\ e^{ax+b} & x > 0 \end{cases}$$

is a continuous function, then

A.  $b = 2 \log |a|$

B.  $2b = \log |a|$

C.  $b = \log |2a|$

D.  $b^2 = \log |a|$

**Answer: A**



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43.  $\lim_{x \rightarrow \infty} \left( \frac{x+a}{x+b} \right)^{a+b}$  is equal to

A. 1

B.  $e^{b-a}$

C.  $e^{a-b}$

D.  $e^b$

Answer: A



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44.  $\lim_{x \rightarrow 0} \left( \frac{x10^x - x}{1 \cos x} \right)$  is equal to

A.  $\log 10$

B.  $2 \log 10$

C.  $3 \log 10$

D.  $4 \log 10$

**Answer: B**



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45. If  $f(x) = \frac{x^2 - 10x + 25}{x^2 - 7x + 10}$  and  $f$  is continuous at  $x = 5$ , then  $f(5)$  is equal to

A. 0

B. 5

C. 10

D. 25

**Answer: A**



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46.  $\lim_{x \rightarrow 0} \frac{\sin x \sin^{-1} x}{x^2}$  is equal to

A. 0

B. 1

C. -1

D.  $\infty$

**Answer: B**



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