



## MATHS

### BOOKS - ACCURATE PUBLICATION

### CONTINUITY

#### Questions Carrying 4 Marks Examples

1. Discuss the continuity of following at  $x = 0$  if

$$f(x) = \begin{cases} \frac{\sqrt{1+3x} - \sqrt{1-3x}}{\sin x}, & x \neq 0 \\ 3, & x = 0 \end{cases}$$



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2. Discuss the continuity of the function

$$f(x) = \begin{cases} \frac{|x-2|}{2-x}, & x \neq 2 \\ -1, & x = 2 \end{cases} \text{ at } x = 2.$$



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3. Examine the continuity of  $f(x) = \begin{cases} \frac{|x-3|}{x-1} & , \quad x \neq 3 \\ 1 & , \quad x = 3 \end{cases}$  at  $x=3$ .

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4. Examine the continuity of the function '  $f$  ' at  $x = 4$ , if  $f(x) = \begin{cases} (|x-4|/(x-4)), (x \neq 4) \\ 1, (x = 4) \end{cases}$

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5. Test the continuity of the following functions at indicated points :

$f(x) = \begin{cases} x^2 \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$  at  $x = 0$

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6. Test the continuity of the following functions at indicated points :

$$f(x) = \begin{cases} (x)\sin\frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases} \text{ at } x = 0$$

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7. Show that the following function are continuous at  $x=0$ :

$$f(x) = \begin{cases} x \cos\left(\frac{1}{x}\right) & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$$

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8. Determine the constant  $k$ , so that the function

$$f(x) = \begin{cases} \frac{x^2-9}{x-3}, & x \neq 3 \\ k, & x = 3 \end{cases} \text{ is continuous at } x=3.$$

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9. Determine the constant  $k$ , so that function  $f(x)$  is continuous at the

indicated points :  $f(x) = \begin{cases} \frac{x^2-3x+2}{x-1} & \text{if } x \neq 1 \\ k & \text{if } x = 1 \end{cases}$  at  $x=1$ .



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10. (a) Determine the value of  $k$  so that the following function  $f(x)$  is continuous at  $x=0$

$$f(x) = \begin{cases} \frac{\sin 2x}{x} & , \text{ if } x \neq 0 \\ k & , \text{ if } x = 0 \end{cases}$$

(b) Determine  $k$ , if the following function is continuous at  $x=0$ :

$$f(x) = \begin{cases} \frac{\sin 3x}{4x} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$$

(c) Determine  $k$  so that the following function  $f(x)$  is continuous at  $x=0$

$$f(x) = \begin{cases} \frac{\sin 5x}{3x} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$$



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11. Determine the value of constant A so that the function

$$f(x) = \begin{cases} \frac{1 - \cos x}{x^2} & , \quad x \neq 0 \\ A & , \quad x = 0 \end{cases} \text{ is continuous at } x=0$$

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12. (i) Given  $f(x) = \begin{cases} \frac{1 - \cos 4x}{x^2} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$

If  $f(x)$  is continuous at  $x=0$ , find the value of  $k$ .

(ii) Given  $f(x) = \begin{cases} \frac{1 - \cos 4x}{8x^2} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$

If  $f(x)$  is continuous at  $x=0$ , find the value of  $k$ .

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13. If  $f(x)$  is continuous at  $x = 0$ , find  $a$ , where

$$f(x) = \begin{cases} \frac{1 - \cos ax}{x \sin x}, & x \neq 0 \\ \frac{1}{2}, & x = 0 \end{cases}$$

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14. Find the value of A ' if the function 'f' at  $y = 0$  is continuous when

$$f(x) = \begin{cases} \frac{1 - \cos y}{y \sin y} & y \neq 0 \\ \left(\frac{1}{2}\right)A & y = 0 \end{cases}$$



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15. If  $f(x)$  is continuous at  $x = 0$  , find a, where

$$f(x) = \begin{cases} \frac{1 - \cos ax}{x \sin x}, & x \neq 0 \\ \frac{1}{2}, & x = 0 \end{cases}$$



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16. For what value of 'k' the function 'f ' defined by

$$f(x) = \begin{cases} kx^2 & x \leq 4 \\ 3 & x > 4 \end{cases} \text{ is continuous at } x = 4.$$



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17. Examine the continuity of the function  $f(x) = \begin{cases} x + 1 & x \leq 2 \\ 2x - 1 & x > 2 \end{cases}$  at  $x = 2$

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18. Examine the continuity of the following function at  $x = 2$ :

$$f(x) = \begin{cases} 2x + 1, & x \leq 2 \\ 3x - 1, & x > 2 \end{cases}$$

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19. Examine the continuity of the following function at  $x = 2$ :

$$f(x) = \begin{cases} 3x + 1, & x \leq 2 \\ 4x - 1, & x > 2 \end{cases}$$

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Questions Carrying 1 Marks Mcq S Type I

1.  $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$  is equal to :

A. 0

B. 1

C. e

D. 2

**Answer: B**



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

A. 2

B. 1

C. e

D. 0



**Answer: B**



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3.  $\lim_{x \rightarrow 0} \left( \frac{\log(1+x)}{\sin x} \right)$  is equal to :

A. 0

B. 1

C. e

D. 2

**Answer: B**



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4. If  $f(x) = \begin{cases} \frac{x^2-25}{x-5} & , \quad x \neq 5 \\ k & , \quad x = 5 \end{cases}$  is continuous at  $x=5$ , then  $k$  is equal

to:

A. 10

B. 5

C. 0

D. 4

**Answer: A**



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5. If  $f(x) = \begin{cases} \frac{x^2-9}{x-3} & x \neq 3 \\ m & x = 3 \end{cases}$  is continuous at  $x = 3$ , then value of  $m$

is :

A. 3

B. 6

C. 2

D. 1

**Answer: B**



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6. If the function  $f$  is defined by  $f(x) = \begin{cases} 3 & x \neq 0 \\ a + 1 & x = 0 \end{cases}$  and  $f$  is continuous at  $x = 0$ , then value of  $a$  is :

A. 1

B. 2

C. 3

D. 4

**Answer: B**



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7. If the function  $f$  is defined by  $f(x) = \begin{cases} 5 & x \neq 0 \\ a - 1 & x = 0 \end{cases}$  and  $f$  is continuous at  $x = 0$ , then value of  $a$  is :

A. 4

B. 5

C. 6

D. 7

**Answer: C**



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8. If  $f(x) = \begin{cases} kx - 1 & , \quad x \leq 5 \\ 3x - 5 & , \quad x > 5 \end{cases}$  is continuous at  $x=5$  then value of  $k$

is:

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

B.  $\frac{11}{5}$

C.  $\frac{8}{5}$

D.  $\frac{9}{5}$

**Answer: B**



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9. If  $f(x) = \begin{cases} kx + 2 & , \quad x \leq 5 \\ 3x - 4 & , \quad x > 5 \end{cases}$  is continuous at  $x=5$  then value of  $k$

is:

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

B.  $\frac{4}{5}$

C.  $\frac{8}{5}$

D.  $\frac{9}{5}$

**Answer: D**



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10. If  $f(x) = \begin{cases} mx + 1 & x \leq 5 \\ 3x - 5 & x > 5 \end{cases}$  is continuous, then the value of  $m$

is :

A.  $\frac{9}{5}$

B.  $\frac{5}{9}$

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

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

**Answer: A**



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11. If  $f(x) = \begin{cases} mx - 1 & x \leq 5 \\ 3x - 5 & x > 5 \end{cases}$  is continuous, then the value of  $m$  is :

A.  $\frac{11}{5}$

B.  $\frac{5}{11}$

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

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

**Answer: A**



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12. If  $f(x) = \begin{cases} kx^2 & x < 2 \\ 3 & x \geq 2 \end{cases}$  is continuous at  $x = 2$ , then the value of

'k' is :

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

B.  $\frac{4}{3}$

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

D.  $\frac{3}{4}$

**Answer: D**



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13. If  $f(x) = \begin{cases} kx^2 & (x < 3) \\ 3 & (x \geq 3) \end{cases}$  and  $f$  is continuous at  $x = 3$  then value of

k is :

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

B.  $\frac{1}{9}$

C.  $\frac{3}{7}$

D.  $\frac{7}{3}$

**Answer: A**



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14.  $f(x) = \begin{cases} \frac{\sin x}{x} & x \neq 0 \\ k - 1 & x = 0 \end{cases}$  is continuous at  $x = 0$ , then  $k$  is :

A. 2

B. 0

C. -1

D. 1, 1

**Answer: A**



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15. If function defined by :  $f(x) = \begin{cases} \frac{\sin 3x}{2x} & x \neq 0 \\ k + 1 & x = 0 \end{cases}$  is continuous

at  $x = 0$ , then value of  $k$  is :

A. 0

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

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

D. 1

**Answer: C**



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16. If function defined by :  $f(x) = \begin{cases} \frac{\sin 3x}{4x} & x \neq 0 \\ k + 1 & x = 0 \end{cases}$  is continuous

at  $x = 0$ , then value of  $k$  is :

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

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

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

D.  $-\frac{1}{4}$

**Answer: D**



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17. If  $f(x) = \begin{cases} \frac{\sin 5x}{2x} & x \neq 0 \\ k & x = 0 \end{cases}$  is continuous at  $x = 0$  then value of  $k$

is :

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

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

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

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

**Answer: B**



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18. The function  $f(x) = \begin{cases} \frac{\sin x}{x} + \cos x & \text{if } x \neq 0 \\ k & \text{if } x = 0 \end{cases}$  is continuous at  $x = 0$ , then the value of ' $k$ ' is

A. 3

B. 2

C. 1

D. 1.5

**Answer: B**



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19. The function  $f(x) = [x]$ , where  $[x]$  denotes the greatest integer function, is continuous at

A. 4

B. 2

C. 1

D. 1.5

**Answer: D**



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20. The number of points at which the function  $f(x) = \frac{1}{x - [x]}$  is not continuous is

A. 1

B. 2

C. 3

D. none of these

**Answer: D**



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21. The function given by  $f(x) = \tan x$  is discontinuous on the set

A.  $\{n\pi : n \in \mathbb{Z}\}$

B.  $\{2n\pi : n \in \mathbb{Z}\}$

C.  $\left\{(2n + 1)\frac{\pi}{2} : n \in \mathbb{Z}\right\}$

D.  $\left\{\frac{n\pi}{2} : n \in \mathbb{Z}\right\}$

**Answer: C**



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22. The function  $f(x) = |x| + |x - 1|$  is

A. continuous at  $x=0$  as well as at  $x=1$

B. continuous at  $x=1$  but not at  $x=0$

C. discontinuous at  $x=0$  as well as at  $x=1$

D. continuous at  $x=0$  but not at  $x=1$

**Answer: A**



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23. The value of 'k' which makes the function defined by :

$$f(x) = \begin{cases} \sin\left(\frac{1}{x}\right) & \text{if } x \neq 0 \\ k & \text{if } x = 0 \end{cases} \text{ continuous at } x=0 \text{ is}$$

A. 8

B. 1

C. -1

D. none of these

**Answer: D**



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24. If  $f(x) = 2x$  and  $g(x) = \frac{x^2}{2} + 1$ , then which of the following can be a discontinuous function

A.  $f(x) + g(x)$

B.  $f(x) - g(x)$

C.  $f(x) \cdot g(x)$

D.  $\frac{g(x)}{f(x)}$

**Answer: D**



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25. The function  $f(x) = \frac{4 - x^2}{4x - x^3}$  is

A. discontinuous at only one point

B. discontinuous at exactly two points

C. discontinuous at exactly three points

D. none of these

**Answer: C**

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26. The function  $f(x) = \cot x$  is discontinuous on the set

A.  $\{x = n\pi : n \in \mathbb{Z}\}$

B.  $\{x = 2n\pi : n \in \mathbb{Z}\}$

C.  $\{x = (2n + 1)\frac{\pi}{2}, n \in \mathbb{Z}\}$

D.  $\{x = \frac{n\pi}{2}, n \in \mathbb{Z}\}$

**Answer: A**

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27. If  $f(x) = x^2 \sin \frac{1}{x}$ , where  $x \neq 0$  then the value of the function  $f$  at  $x=0$ , so that the function is continuous at  $x=0$ , is

- A. 0
- B. -1
- C. 1
- D. none of these

**Answer: A**



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28. If  $f(x) = \begin{cases} mx + 1 & , \text{ if } x \leq \frac{\pi}{2} \\ \sin x + n & , \text{ if } x > \frac{\pi}{2} \end{cases}$ , is continuous at  $x = \frac{\pi}{2}$ , then

A.  $m = 1, n = 0$

B.  $m = \frac{n\pi}{2} + 1$

C.  $n = \frac{m\pi}{2}$

$$D. m = n = \frac{\pi}{2}$$

**Answer: C**

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## Questions Carrying 1 Marks Fill In The Blanks Questions Type Ii

1. If  $f(x) = \begin{cases} \frac{x^2-9}{x-3} & x \neq 3 \\ m & x = 3 \end{cases}$  is continuous at  $x = 3$ , then value of  $m$  is :

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2. If the function  $f$  is defined by  $f(x) = \begin{cases} 7 & , \quad x \neq 0 \\ a - 1 & , \quad x = 0 \end{cases}$  and  $f$  is continuous at  $x=0$  then value of 'a' is \_\_\_\_\_

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3. If  $f(x) = \begin{cases} kx + 1 & x \leq 5 \\ 3x - 5 & x > 5 \end{cases}$  is a continuous function then the value of k is

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4. If  $f(x) = \begin{cases} mx + 1 & x \leq 5 \\ 3x + 5 & x > 5 \end{cases}$  is continuous, then the value of m is :

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5. If  $f(x) = \begin{cases} kx^2 & (x < 4) \\ 4 & (x \geq 4) \end{cases}$  and f is continuous at  $x = 4$  then value of k is :

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6. If function defined by :  $f(x) = \begin{cases} \frac{\sin 5x}{3x} & x \neq 0 \\ k + 1 & x = 0 \end{cases}$  is continuous at  $x = 0$ , then value of k is :



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7. The number of points at which the function  $f(x) = \frac{1}{\log|x|}$  is discontinuous is \_\_\_

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8. If  $f(x) = \begin{cases} ax + 1 & \text{if } x \geq 1 \\ x + 2 & \text{if } x < 1 \end{cases}$  is continuous, then 'a' should be equal to \_\_\_\_

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### Questions Carrying 1 Marks True Or False Questions Type Iii

1. For continuity, at  $x=a$ , each of  $\lim_{x \rightarrow a^+} f(x)$  and  $\lim_{x \rightarrow a^-} f(x)$  is equal to  $f(a)$ .

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2. True or False :

The function  $f(x) = |x-1|$  is a continuous function.

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3. A continuous function can have some points where limit does not exist.

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4. If  $f$  is continuous on its domain  $D$ , then  $|f|$  is also continuous on  $D$ .

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5. The composition of two continuous function is a continuous function.

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6. If  $f \cdot g$  is continuous at  $x=a$ , then  $f$  and  $g$  are separately continuous at  $x=a$ .

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7. If  $f$  is not continuous at  $a$ , then  $f$  is discontinuous at  $a$  and  $a$  is called a point of discontinuity of  $f$ .

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8. Prove that every rational function is continuous.

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9. If  $f(x)$  and  $g(x)$  are non-periodic functions, then  $h(x)=f(g(x))$  is

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10. Determine the constant  $k$ , so that the function

$$f(x) = \begin{cases} \frac{x^2-9}{x-3}, & x \neq 3 \\ k, & x = 3 \end{cases} \text{ is continuous at } x=3.$$



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11. The value of  $k$  so that the function  $f(x) = \begin{cases} \frac{\sin 2x}{x} & \text{if } x \neq 0 \\ k & \text{if } x = 0 \end{cases}$  is continuous at  $x=0$  is:



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12. Prove that  $f(x) = |\sin x|$  is continuous at all point of its dominin.



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13. If  $f$  is continuous and  $g$  is a discontinuous function then  $f+g$  is continuous function.



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## Questions Carrying 4 Marks

1. Discuss the continuity of the function (x) at  $x = 1$  if

$$f(x) = \begin{cases} \frac{x-1}{\sqrt{x^2-1}}, & x \neq 1 \\ 0, & x = 1 \end{cases}$$

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2. Discuss the continuity of the function :

$$f(x) = \begin{cases} \frac{|x-a|}{x-a} & \text{when } x \neq a \\ 1 & \text{when } x = a \end{cases} \text{ at } x = a$$

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3. Discuss the continuity of  $f(x)$  at  $x = 0$  if:

$$f(x) = \begin{cases} \frac{\sqrt{1+x} - \sqrt{1-x}}{\sin x} & \text{when } x \neq 0 \\ 0 & \text{when } x = 0 \end{cases}$$

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4. Determine the value of constant A so that the function

$$f(x) = \begin{cases} \frac{1 - \cos x}{x^2} & , \quad x \neq 0 \\ A & , \quad x = 0 \end{cases} \text{ is continuous at } x=0$$



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5. The function  $f(x) = \begin{cases} e^{\frac{1}{x}} - 1 & , \quad x \neq 0 \\ 0 & , \quad x = 0 \end{cases}$

a. is continuous at  $x = 0$

b. is not continuous at  $x = 0$

c. is not continuous at  $x = 0$ , but can be made continuous at  $x = 0$

(d) none of these



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6. Determine k, so that  $f(x) = \begin{cases} \frac{x^2 - 36}{x - 6} & , \quad \text{if } x \neq 6 \\ k & , \quad \text{if } x = 6 \end{cases}$  is continuous at  $x = 6$ .



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7. (a) Determine the value of  $k$  so that the following function  $f(x)$  is continuous at  $x=0$

$$f(x) = \begin{cases} \frac{\sin 2x}{x} & , \text{ if } x \neq 0 \\ k & , \text{ if } x = 0 \end{cases}$$

(b) Determine  $k$ , if the following function is continuous at  $x=0$ :

$$f(x) = \begin{cases} \frac{\sin 3x}{4x} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$$

(c) Determine  $k$  so that the following function  $f(x)$  is continuous at  $x=0$

$$f(x) = \begin{cases} \frac{\sin 5x}{3x} & , \quad x \neq 0 \\ k & , \quad x = 0 \end{cases}$$



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8. Find the value of ' $k$ ', for which:

$$f(x) = \left\{ \frac{\sqrt{1+kx} - \sqrt{1-kx}}{x}, \text{ if } -1 \leq x < 0 \right\}, \left( \frac{2x+1}{x-1}, \text{ if } 0 \leq x \right)$$

is continuous at  $x=0$



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9. Find the values of  $k$  so that the function  $f$  is continuous at the

$$\text{indicated point : } f(x) = \begin{cases} k \frac{\cos x}{\pi - 2x} & \text{if } x \neq \frac{\pi}{2} \\ 3 & \text{if } x = \frac{\pi}{2} \end{cases} \text{ at } x = \frac{\pi}{2}$$



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10. For what value of 'a' and 'b', the function 'f' defined as:

$$f(x) = \begin{cases} 3ax + b & \text{if } x < 1 \\ 11 & \text{if } x = 1 \\ 5ax - 2b & \text{if } x > 1 \end{cases} \text{ is continuous at } x = 1$$



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11. For what value of  $k$  is the following function continuous at  $x = 2$ ?

$$f(x) = \begin{cases} 2x + 1, & x < 2 \\ k, & x = 2 \\ 3x - 1 & x > 2 \end{cases}$$



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12. If the function defined by :

$$f(x) = \begin{cases} 2x - 1 & x < 2 \\ a & x = 2 \\ x + 1 & x > 2 \end{cases} \text{ is continuous at } x = 2, \text{ find the value of 'a'. Also}$$

discuss the continuity of  $f(x)$  at  $x = 3$ .

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13. If  $f(x) = \begin{cases} \frac{x-5}{|x-5|} + a & , \text{ if } x < 5 \\ a + b & , \text{ if } x = 5 \\ \frac{x-5}{|x-5|} + b & , \text{ if } x > 5 \end{cases}$  is a continuous function, find

'a' and 'b'.

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14. Find the values of a and b such that the function defined by

$$f(x) \begin{cases} 5 & \text{if } x \geq 2 \\ ax + b & \text{if } 2 < x < 10 \\ 21 & \text{if } x \geq 10 \end{cases} \text{ is continuous.}$$

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15. Let  $f(x) = \begin{cases} \frac{1 - \cos 4x}{x^2}, & x < 0 \\ a, & x = 0 \\ \frac{\sqrt{x}}{\sqrt{16 + \sqrt{x} - 4}}, & x > 0 \end{cases}$  Then, the value of  $a$  if possible, so

that the function is continuous at  $x = 0$ , is.....



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16. For what value of 'k' is the function defined by

$$f(x) = \begin{cases} k(x^2 + 2) & \text{if } x \leq 0 \\ 3x + 1 & \text{if } x > 0 \end{cases} \text{ continuous at } x = 0? \text{ Also write}$$

whether the function is continuous at  $x = 1$ .



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17. Find all points of discontinuity of  $f$ , where  $f$  is defined as follows:

$$f(x) = \begin{cases} |x| + 3, & x \leq -3 \\ -2x, & -3 < x < 3 \\ 6x + 2, & x \geq 3 \end{cases}$$



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