

## MATHS

### BOOKS - BHARATI BHAWAN MATHS (HINGLISH)

#### Limit, Indetermine Form

##### Example

1.  $\lim_{x \rightarrow \infty} \left[ \sqrt{\sqrt{x + \sqrt{x + \sqrt{x}}}} - \sqrt{x} \right]$

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2. The value of

$$\lim_{n \rightarrow \infty} \frac{1. \sum_{r=1}^n (r) + 2. \sum_{r=1}^{n-1} (r) + 3 \sum_{r=1}^{n-2} (r) + \dots + n.1}{n^4}$$

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3. The value of  $\lim_{x \rightarrow \infty} \left\{ \frac{x^4 \sin\left(\frac{1}{x}\right) + x^2}{1 + |x^3|} \right\}$  is

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4. Using L'Hospital 's rule prove that  $\lim_{\theta \rightarrow 0} \frac{\theta - \sin \theta}{\theta^3} = \frac{1}{6}$

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5.  $\lim_{x \rightarrow \frac{\pi}{2}} \tan x \log_e \sin x =$

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6.  $\lim_{x \rightarrow \infty} \left\{ \frac{3x^2 + 1}{4x^2 - 1} \right\}^{\frac{x^3}{1+x}}$

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7. Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{\tan x}{x} \right)^{\frac{1}{x}}$

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8. The value of  $\lim_{x \rightarrow 1} \left( \frac{\sin x}{x} \right)^{\frac{\sin x}{x - \sin x}}$ , is



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9.  $\lim_{x \rightarrow \infty} \left( \frac{1^{\frac{1}{x}} + 2^{\frac{1}{x}} + 3^{\frac{1}{x}} + \dots + n^{\frac{1}{x}}}{n} \right)^{nx}, n \in \mathbb{N}$

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10. If  $f(1) = g(1) = 2$  and  $f'(1)$  and  $g'(1)$  exists then

$$\lim_{x \rightarrow 1} \frac{f(1)g(x) - f(1) - g(1)f(x) + g(1)}{(g(x) - f(x))} \text{ equals}$$

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11. Find the constant  $a$ ,  $b$  and  $c$  such that

$$\lim_{x \rightarrow 0} \frac{axe^x - b \log(1+x) + cxe^{-x}}{x^2 \sin x} = 2$$

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12. The value of  $\lim_{x \rightarrow 1} \frac{y^3}{x^3 - y^2 - 1}$  as  $(x, y) \rightarrow (1, 0)$  along the line  $y = x - 1$  is

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## Exercise

1.  $\lim_{x \rightarrow 1} \frac{\sqrt{x^2 + 8} - \sqrt{10 - x^2}}{\sqrt{x^2 + 3} - \sqrt{5 - x^2}} =$

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2. Evaluate:  $\lim_{x \rightarrow 0} \frac{\sqrt[3]{1 + x^2} - 1}{x^2}$

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3. Evaluate:  $\lim_{x \rightarrow 0} \frac{(1+x)^{\frac{1}{3}} - \sqrt[3]{1-\sin x}}{x}$



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4.  $\lim_{x \rightarrow 0} \frac{\sqrt[3]{1+\sin x} - \sqrt[3]{1-\sin x}}{x} =$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sqrt{\cos x} - \sqrt[3]{\cos x}}{\sin^2 x}$$



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6. The value of  $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sqrt{1 - \sqrt{\sin 2x}}}{\pi - 4x}$  is

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7. Evaluate:  $(\lim)_{x \rightarrow \infty} x^3 \left\{ \sqrt{x^2 + \sqrt{1 + x^4}} - x\sqrt{2} \right\}$

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8. Evaluate:  $\lim_{x \rightarrow -1} \frac{x + 1}{\sqrt[4]{x + 17} - 2}$

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9. Evaluate:  $(\lim)_{x \rightarrow 0} \frac{\sin^{-1} x - \tan^{-1} x}{x^3}$

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10. Evaluate:  $\lim_{x \rightarrow 0} \frac{2^x - 9^x - 3(x + 1)}{\sqrt{2} - \sqrt{1} + \cos x}$

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11. Find the limits:  $\lim_{x \rightarrow \infty} \left( \frac{x^2 - 2x + 2}{x^2 - 4x + 1} \right)^x$

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12. The value  $\lim_{x \rightarrow \pi/2} (\sin x)^{\tan x}$ , is

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13. Find the limits:  $\lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right)^{\frac{1}{x}}$

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14. Find the limits:  $\lim_{x \rightarrow 0} (\sin x + \cos x)^{\frac{1}{x}}$

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15. Find the limits:  $\lim_{x \rightarrow 0} (\sec \sqrt{x})^{\frac{10}{x}}$

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16.  $\left( \lim_{x \rightarrow 1} (2 - x)^{\frac{\tan(\pi x)}{2}} \right)$

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17.  $\lim_{x \rightarrow 0^+} (\ln \cot x)^{\tan x} =$

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18. If  $f$  is derivable at  $x = a$ , then  $\lim_{x \rightarrow a} \left( \frac{xf(a) - af(x)}{x - a} \right)$

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19.  $\lim_{x \rightarrow \infty} \left( \sqrt{x^2 - x + 1} - ax - b \right) = 0$ , then  $a + b =$

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20. The value of  $\lim_{x \rightarrow 1} \frac{x^n + x^{n-1} + x^{n-2} + \dots + x^2 + x - n}{x - 1}$

is

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21. The value of  $\lim_{n \rightarrow \infty} \frac{\sum_{r=1}^{100} (n+r)^{10}}{n^{10} + 10^{10}}$  is equal to

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22.  $\lim_{x \rightarrow 1} (1-x) \tan\left(\frac{\pi x}{2}\right)$

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23. The value of  $\lim_{h \rightarrow 0} \frac{(a+h)^2 \sin(a+h) - a^2 \sin a}{h} =$



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$$24. \lim_{x \rightarrow 0} \frac{2x}{\sqrt{1+x} - 1}$$



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$$25. \lim_{n \rightarrow \infty} \frac{n!}{(n+1)! - n!}$$



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$$26. \lim_{\theta \rightarrow \pi/2} \frac{\sec \theta - \tan \theta}{\pi - 2\theta}$$



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27. Fill in the blanks:  $\lim_{n \rightarrow \infty} \frac{4^n + 3^n}{4^n - 3^n} = \_ \_ \_$

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28.  $\lim_{x \rightarrow \infty} \left( x - \sqrt{x^2 + x} \right)$

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29. Fill in the blanks:  $\lim_{x \rightarrow \infty} \frac{\sqrt{x}}{\sqrt{x} + \sqrt{x} + \sqrt{x}} = \_ \_$

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30.  $\lim_{h \rightarrow 0} \frac{\log(1 + 2h) - 2\log(1 + h)}{h^2} = \dots\dots\dots$

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31. Fill in the blanks:  $\lim_{x \rightarrow 0} (1 + \sin x)^{\cos ecx}$  \_\_\_\_.

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32.  $\lim_{x \rightarrow \infty} \left\{ \frac{x + 6}{x + 1} \right\}^{x+4}$

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33. Fill in the blanks:  $\lim_{n \rightarrow \infty} \left( \frac{3x - 4}{3x + 2} \right)^{\frac{x+1}{3}}$  \_ \_ .

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34.  $(\lim)_{x \rightarrow 0} \left( \frac{1 + 5x^2}{1 + 3x^2} \right)^1 / x^2 =$  \_ \_



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35. Fill in the blanks:  $\lim_{x \rightarrow \infty} \left( \frac{x^2 + 1}{x^2 - 1} \right)^{x^2} = \text{-----}$



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36.  $\lim_{x \rightarrow 0} \frac{x(1 + a \cos x) - b \sin x}{x^3} = 1$  then



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37. If  $f'(2) = 2$ ,  $f''(2) = 1$ , then  $\lim_{x \rightarrow 2} \frac{2x^2 - 4f'(x)}{x - 2}$ , is



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38. If  $f(9) = 9$ ,  $f'(9) = 4$  then  $\lim_{x \rightarrow 9} \frac{\sqrt{f(x)} - 3}{\sqrt{x} - 3} = \text{-----}$ .

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39. If  $G(x) = -\sqrt{25 - x^2}$ , then  $(\lim_{x \rightarrow 1} \frac{G(x) - G(1)}{x - 1})$  is  $\frac{1}{24}$  (b)  $\frac{1}{5}$  (c)  $-\sqrt{24}$  (d) none of these

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40. If  $f(a) = 2$ ,  $f'(a) = 1$ ,  $g(a) = -1$ ,  $g'(a) = 2$ , then the value of  $\lim_{x \rightarrow a} \frac{g(x)f(a) - g(a)f(x)}{x - a}$ , is

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41. If  $\lim_{x \rightarrow a} \frac{px + q}{qx + p} = l$  and  $\lim_{x \rightarrow 0} \frac{px + q}{qx + p} = m$  where  $p, q \neq 0$  then  $lm$  is

A. 1

B.  $\frac{p^2}{q^2}$

C.  $\frac{q^2}{p^2}$

D. none of these

**Answer:**



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42. If  $f(x) = \sqrt{\frac{x - \sin x}{x + \cos^2 x}}$ , then  $\lim_{(x \rightarrow \infty)} f(x)$  is

A. 0

B.  $\infty$

C. 1

D. none of these

**Answer:**



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43.  $\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$  equals

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

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

C. 0

D. 1

**Answer:**



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44.  $\lim_{x \rightarrow 0} \frac{x(1 + a \cos x) - b \sin x}{x^3} = 1$  then

A.  $a=b$

B.  $a+b=0$

C.  $2a=b$

D. none of these

**Answer:**



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45. Let  $f(x)$  be a twice-differentiable function and  $f(0) = 2$ .

The evaluate:  $(\lim)_{x \rightarrow 0} \frac{2f(x) - 3f(2x) + f(4x)}{x^2}$

A.  $2p$

B.  $3p$

C.  $p$

D.  $-3p$

**Answer:**



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46.  $\lim_{x \rightarrow \frac{\pi}{2}} \frac{2x - \pi}{\cos x}$  is equal to

A. 5

B. -2

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

D. none of these

**Answer: B**



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47. evaluate  $\lim_{\theta \rightarrow \frac{\pi}{4}} \frac{\sqrt{2} - \cos \theta - \sin \theta}{(4\theta - \pi)^2}$

A.  $\frac{\sqrt{2}}{4}$

B.  $\frac{\sqrt{2}}{8}$

C.  $\frac{\sqrt{2}}{16}$

D.  $\frac{\sqrt{2}}{32}$

**Answer:**



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48. If  $f(x) = \cot^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$  and  $g(x) = \cos^{-1}\left(\frac{1 - x^2}{1 + x^2}\right)$  then  $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{g(x) - g(a)}$

A.  $\frac{2}{3}(1 + a^2)$

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

C.  $\frac{3}{2}(1 + a^2)$

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

**Answer:**



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49.23. The value of  $\lim_{h \rightarrow 0} \left( \frac{1}{h(8+h)^{\frac{1}{3}}} - \frac{1}{2h} \right)$  equals

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

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

C.  $-\frac{16}{3}$

D.  $\frac{1}{48}$

**Answer:**



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50. Evaluate:  $(\lim)_{h \rightarrow 0} \frac{2 \left[ \sqrt{3} \sin\left(\frac{\pi}{6} + h\right) - \cos\left(\frac{\pi}{6} + h\right) \right]}{\sqrt{3}h(\sqrt{3} \cosh - \sinh)}$

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

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

C.  $-2\sqrt{3}$

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

**Answer:**



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51.  $\lim_{x \rightarrow 0} \frac{\sqrt{\frac{1 - \cos 2x}{2}}}{x}$

A. 1

B. -1

C. 0

D. none of these



**Answer:**



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$$52. \lim_{x \rightarrow 0} \frac{\log(1+x)}{3^x - 1} = \frac{1}{\log_e(3)}$$



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$$53. \lim_{x \rightarrow a} \frac{\cos x - \cos a}{\cot x - \cot a} =$$



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$$54. \lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$$



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55.  $\lim_{x \rightarrow 0} \frac{x^2}{y} = 0$

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56.  $\lim_{x \rightarrow \infty} (\sin \sqrt{x+1} - \sin \sqrt{x})$  is equal to

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57. Evaluate:  $(\lim_{x \rightarrow 0} x)^x$

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58. If  $\lim_{x \rightarrow a} \frac{a^x - x^a}{x^x - a^a} = -1$  then

A. e

B. 0

C. 1

D. none of these

**Answer:**



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**59.**

$$\lim_{n \rightarrow \infty} [\log_{n-1}(n) \log_n(n+1) \cdot \log_{n+1}(n+2) \dots \cdot \log_{n^k-1}(n^k)]$$

is equal to :

A.  $\frac{1}{5}$

B. 5

C. 1

D. none of these

**Answer:**

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**60.** if

$$f(x) = \lim_{n \rightarrow \infty} (1 + x)(1 + x^2)(1 + x^4) \dots \dots \dots (1 + x^{2^{n-1}})$$

then

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**61.** Find  $\lim_{x \rightarrow 0.4} \frac{f(x) - f(0.4)}{g(x) - g(0.4)}$

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62. Evaluate  $\lim_{x \rightarrow 1} (1 + \sin \pi x)^{\cot \pi x}$ .

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63. find  $a$  &  $b$  if  $\lim_{x \rightarrow \infty} \left( \frac{x^2 + 1}{x + 1} - ax - b \right) = 0$

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64. Q.  $\lim_{x \rightarrow 0, y \rightarrow 0} \frac{y^2 + \sin x}{x^2 + \sin y^2}$ , when  $(x, y) \rightarrow (0, 0)$  along the curve  $x = y^2$  is

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