



MATHS

BOOKS - S CHAND MATHS (ENGLISH)

LIMITS

Examples

1. If $G(x) = -\sqrt{25 - x^2}$, then $\lim_{x \rightarrow 1} \frac{G(x) - G(1)}{x - 1}$ is

(a) $\frac{1}{24}$

(b) $\frac{1}{5}$

(c) $-\sqrt{24}$

(d) none of these

A. $\frac{1}{4\sqrt{6}}$

B. $\frac{1}{2\sqrt{6}}$

C. $\frac{1}{\sqrt{6}}$

D. $-\frac{1}{2\sqrt{6}}$

Answer: B



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2. $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{\cos x}$ is equal to

A. 0

B. -1

C. 1

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

Answer: A



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3. $\lim_{x \rightarrow 2} [x]$ where $[\cdot]$ denotes the greatest integer function is equal to

A. A. 2

B. B. 1

C. C. 0

D. D. does not exist

Answer: D



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4. $\lim_{x \rightarrow 0} \frac{a^x - 1}{\sqrt{1+x} - 1}$ is equal to

A. $\log_e a$

B. $2 \log_e a$

C. $-2 \log_e a$

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

Answer: B



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5. $\lim_{x \rightarrow 0} \frac{\log(1 + 3x)}{\sin 4x}$ is equal to

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

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

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

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

Answer: C



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6. If $y = \frac{\sin x + \cos x}{\sin x - \cos x}$, then $\frac{dy}{dx}$ at $x = 0$ is

A. -2

B. 0

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

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

Answer: A



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

is equal to

A. 2

B. 3

C. 4

D. -4

Answer: C



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Multiple Choice Questions

1. $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$ is equal to

(i) 0

(ii) 1

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

(iv) 2

A. 0

B. 1

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

D. 2

Answer: C



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2. $\lim_{x \rightarrow 0} \frac{x}{\sin 3x}$ is equal to

(i) 3

(ii) $\frac{1}{3}$

(iii) 0

(iv) 1

A. 3

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

C. 0

D. 1

Answer: B



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3. $\lim_{x \rightarrow 0} \frac{\sqrt{4+x} - 2}{\sin x}$ is equal to

(i) 4

(ii) 1

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

(iv) 0

A. 4

B. 1

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

D. 0

Answer: C



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4. If $\lim_{x \rightarrow a} \frac{x^9 - a^9}{x - a} = \lim_{x \rightarrow 5} (x + 4)$ then all possible

values of a are

(i) 2, 3

(ii) -2, 2

(iii) -1, 1

(iv) -3, 3

A. 2,3

B. - 2, 2

C. - 1, 1

D. - 3, 3

Answer: C



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5. Let $f(x) = \begin{cases} x + 2, & x \leq -1 \\ cx^2, & x > -1 \end{cases}$ If $\lim_{x \rightarrow -1} f(x)$

exists, then c is

(i) -1

(ii) 1

(iii) 2

(iv) -2

A. - 1

B. 1

C. 2

D. - 2

Answer: B



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

A. (a) 2

B. (b) -2

C. (c) $\frac{1}{2}$

D. (d) $-\frac{1}{2}$

Answer: C



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7. $\lim_{x \rightarrow 0} \frac{\tan 3x - 2x}{3x - \sin^2 x}$ is equal to

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

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

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

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

Answer: A



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8. $\lim_{x \rightarrow 0} \frac{1 - \cos mx}{1 - \cos nx}$ is equal to

A. (a) $\frac{n^2}{m^2}$

B. (b) $\frac{m^2}{n^2}$

C. (c) $\frac{m}{n}$

D. (d) $\frac{n}{m}$

Answer: B



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9. $\lim_{x \rightarrow 0} \frac{\cos x - \cos 3x}{x(\sin 3x - \sin x)}$ is equal to

A. (a) $-\frac{2}{3}$

B. (b) $\frac{1}{3}$

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

D. (d) 2

Answer: D

10. $\lim_{x \rightarrow 0} \frac{(1 - \cos 2x)\sin 5x}{x^2 \sin 3x}$ is equal to

(i) $\frac{6}{5}$

(ii) $\frac{5}{6}$

(iii) $\frac{10}{3}$

(iv) $\frac{3}{10}$

A. $\frac{6}{5}$

B. $\frac{5}{6}$

C. $\frac{10}{3}$

D. $\frac{3}{10}$

Answer: C



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11. If $\lim_{x \rightarrow 0} k \cdot \cos ecx = \lim_{x \rightarrow 0} x \cos eckx$, then k is

(i) $-1, 1$

(ii) $-2, 2$

(iii) $-\frac{1}{2}, \frac{1}{2}$

(iv) none of these

A. $-1, 1$

B. $-2, 2$

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

D. none of these

Answer: A



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12. $\lim_{x \rightarrow \pi} \frac{\sin x}{x - \pi}$ is equal to

A. A. 0

B. B. 1

C. C. -1

D. D. none of these

Answer: C



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13. $\lim_{x \rightarrow 1} \frac{\sin \pi x}{x - 1}$ is equal to

A. π

B. $-\pi$

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

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

Answer: B



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

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

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

C. 2

D. -2

Answer: D



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15. $\lim_{x \rightarrow \frac{\pi}{2}} \left(\frac{\pi}{2} - x \right) \tan x$ is equal to (i) 1 (ii) -1 (iii) $\frac{\pi}{2}$

(iv) $\frac{2}{\pi}$

A. 1

B. -1

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

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

Answer: A



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16. $(\lim)_{x \rightarrow \frac{\pi}{2}} \frac{\tan 2x}{x - \frac{\pi}{2}}$

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

B. B. 2

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

D. D. 3

Answer: B

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17. $\lim_{x \rightarrow 0} \frac{e^x + \sin x - 1}{3x}$ is equal to (i) $\frac{1}{3}$ (ii) $-\frac{1}{3}$ (iii) $\frac{2}{3}$ (iv) $-\frac{2}{3}$

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

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

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

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

Answer: C

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18. $\lim_{x \rightarrow 2} \frac{\log(x - 1)}{x - 2}$ is equal to

A. A. 0

B. B. -1

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

D. D. 1

Answer: D



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19. $\lim_{x \rightarrow 0} \frac{3^{2x} - 2^{3x}}{x}$ is equal to

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

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

C. C. $\log \frac{9}{8}$

D. D. $\log \frac{8}{9}$

Answer: C



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20. $\lim_{x \rightarrow 0} \frac{|x|}{x}$ is equal to (i) 1 (ii) -1 (iii) 0 (iv) does not exist

A. 1

B. -1

C. 0

D. does not exist

Answer: D



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21. $\lim_{x \rightarrow \frac{3}{2}} [x]$ is equal to (i) 1 (ii) -1 (iii) 2 (iv) does not exist

A. 1

B. -1

C. 2

D. does not exist

Answer: A



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22. $\lim_{x \rightarrow 0} \frac{\cos^2 x - \sin^2 x - 1}{\sqrt{x^2 + 4} - 2}$ is equal to

(i) 4

(ii) -4

(iii) 8

(iv) -8

A. 4

B. -4

C. 8

D. -8

Answer: D



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

A. 2

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

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

D. 1

Answer: A

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24. $\lim_{x \rightarrow 0} \frac{\sin x}{\sqrt{x+1} - \sqrt{1-x}}$ is equal to

A. 2

B. 0

C. 1

D. -1

Answer: C

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25. $\lim_{x \rightarrow 0} \frac{|\sin x|}{x}$ is equal to (i) 1 (ii) -1 (iii) does not exist (iv) none of these

A. 1

B. -1

C. does not exist

D. none of these

Answer: C



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26. The derivative of $2x^3 - 3x^2 - 5x + 6$ at $x = 1$ is

A. A. 0

B. B. -6

C. C. -5

D. D. 5

Answer: C



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27. If $f(x) = 1 - x + x^2 - x^3 + \dots - x^{99} + x^{100}$

then $f'(1)$ is equal to

A. A. 100

B. B. 50

C. C. 49

D. D. 51

Answer: B



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28. If $f(x) = \frac{(3x + 1)(2\sqrt{x} - 1)}{\sqrt{x}}$, then $f'(1)$ is equal

to

A. 5

B. -5

C. 6

D. $\frac{11}{2}$

Answer: A



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29. If $f(x) = \frac{2 - 3 \cos x}{\sin x}$, then $f' \left(\frac{\pi}{4} \right)$ is equal to

A. $2\sqrt{2} - 6$

B. $6 - 2\sqrt{2}$

C. $3 - \sqrt{2}$

D. $\sqrt{2} - 3$

Answer: B



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30. If $y = \sqrt{x} + \frac{1}{\sqrt{x}}$, then $\frac{dy}{dx}$ at $x = 1$ is

A. 1

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

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

D. 0

Answer: D



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31. If $y = \frac{1 + \frac{1}{x^2}}{1 - \frac{1}{x^2}}$, then $\frac{dy}{dx}$ is

A. A. $-\frac{4x}{(x^2 - 1)^2}$

B. B. $-\frac{4x}{x^2 - 1}$

C. C. $\frac{1 - x^2}{4x}$

D. D. $\frac{4x}{x^2 - 1}$

Answer: A



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Example

1. If $f(x) = \frac{x^2 - 9}{x - 3}$, find if $\lim_{x \rightarrow 3} f(x)$ exists .



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2. Prove that $\lim_{x \rightarrow 0} \frac{|x|}{x}$, $x \neq 0$ does not exist .



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3. Examine $\lim_{x \rightarrow 2} [x]$, where $[x]$ denotes the greatest integer less than or equal to x .



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4. Let a function f be defined as

$$f(x) = \begin{cases} x & \text{if } 0 \leq x < \frac{1}{2} \\ 0 & \text{if } x = \frac{1}{2} \\ x - 1 & \text{if } \frac{1}{2} < x \leq 1 \end{cases}$$

Establish the existence of $\lim_{x \rightarrow \frac{1}{2}} f(x)$.



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5. If f is an odd function and if $\lim_{x \rightarrow 0} f(x)$ exists, prove that this limit must be zero.



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6. A function $f(x)$ is defined as $f(x) = \begin{cases} 1 & \text{when } x \neq 0 \\ 2 & \text{when } x = 0 \end{cases}$ does the Limit of $f(x)$ as $x \rightarrow 0$

exist ? Explain your answer .



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7. Evaluate the following limits :

$$\lim_{x \rightarrow 1} [(x - 1)^2 + 5]$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow 0^-} \left\{ \frac{|x|}{x} + x^2 + 3 \right\}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow 3^-} ([x] - x)$$



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10. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x^2 - 1}{x - 1}$$



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11. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x - 1}{2x^2 - 7x + 5}$$



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12. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x^4 - 3x^3 + 2}{x^3 - 5x^2 + 3x + 1}$$



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13. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x - 1}{2x^2 - 7x + 5}$$



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14. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x^2 - \sqrt{x}}{\sqrt{x} - 1}$$



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15. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x^2 - x \log x + \log x - 1}{x - 1}$$



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16. Evaluate the following limits :

$$\lim_{x \rightarrow 3} (x^2 - 9) \left(\frac{1}{x + 3} + \frac{1}{x - 3} \right)$$



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17. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x^{1/4} - 1}{x^{1/3} - 1}$$



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18. Evaluate the following limits :

$$\lim_{h \rightarrow 0} \frac{[\sqrt{x+h} - \sqrt{x}]}{h}$$



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19. Evaluate the following limits :

$$\lim_{x \rightarrow a} \frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}}, a \neq 0$$



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20. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{(1+x^2)}}{x}$$



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21. Evaluate the following limits :

$$\lim_{h \rightarrow 0} \frac{1}{h} \left(\frac{1}{\sqrt{x+h}} - \frac{1}{\sqrt{x}} \right)$$





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22. Evaluate the following limits :

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



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23. Evaluate the following limits .

$$\lim_{x \rightarrow 0} \frac{(1+x)^6 - 1}{(1+x)^2 - 1}$$



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24. Evaluate the following limits .

$$\lim_{x \rightarrow 0} \frac{(1+x)^n - 1}{x}$$



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25. Evaluate

$$\lim_{x \rightarrow a} \frac{x^{\frac{3}{5}} - a^{\frac{3}{5}}}{x^{\frac{1}{3}} - a^{\frac{1}{3}}}$$



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26. Evaluate

$$\lim_{x \rightarrow 2} \frac{x^5 - 32}{x^2 - 4}$$



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27. Evaluate

$$\lim_{x \rightarrow a} \frac{(x + 2)^{\frac{5}{3}} - (a + 2)^{\frac{5}{3}}}{x - a}$$



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28. Evaluate

$$\lim_{x \rightarrow 0} \frac{(1 + x)^6 - 1}{(1 + x)^2 - 1}$$



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29. If $\lim_{x \rightarrow 2} \frac{x^n - 2^n}{x - 2} = 80$ and if n is a positive integer, find n .



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30. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{(x + 1)(2x + 3)}{(x + 2)(3x + 4)}$$



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31. Evaluate the following limits :

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



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32. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \left(\sqrt{x^2 + 5x + 4} - \sqrt{x^2 - 3x + 4} \right)$$



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33. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} 2x \left(\sqrt{x^2 + 1} - x \right)$$



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34. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{\sqrt{x^2 + 1} - \sqrt[3]{x^3 - 1}}{\sqrt[4]{x^4 + 1} - \sqrt[5]{x^4 + 1}}$$



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35. It is given that $f(x) = \frac{ax + b}{x + 1}$, $\lim_{x \rightarrow 0} f(x)$ and $\lim_{x \rightarrow \infty} f(x) = 1$ Prove that $f(-2) = 0$.



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36. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 3x}{5x}$$



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37. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin x \cos x}{3x}$$



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38. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x^3}{\sin x^2}$$



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39. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 5x - \sin 3x}{\sin x}$$



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40. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \left(\frac{\sin ax}{\sin bx} \right)^k$$



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41. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin x^\circ}{x}$$



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42. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3\sin x^\circ - \sin 3x^\circ}{x^3}$$



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43. Evaluate the following limits :

$$\lim_{x \rightarrow 0} x \sin\left(\frac{1}{x}\right)$$



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44. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x \sin 5x}{\sin^2 4x}$$



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45. Evaluate the following limits :

$$\lim_{x \rightarrow 0} 5^x \sin\left(\frac{a}{5^x}\right)$$



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46. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{1 - \cos 6x}{x^2}$$



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47. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 2x(1 - \cos 2x)}{x^3}$$



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48. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin(x + h) - \sin x}{h}$$



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49. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$$



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50. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\tan(x + a) - \tan a}{3x}$$



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51. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \left(\frac{\tan x - \sin x}{x^3} \right)$$



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52. Evaluate the following limits :

$$\lim_{h \rightarrow 0} \frac{\sin(x + h) - \sin x}{h}$$



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53. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\operatorname{cosec} x - \cot x}{x}$$



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54. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{1 - \cos ax}{x \sin 3x}$$



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55. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\tan 3x - 2x}{3x - \sin^2 x}$$



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56. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x^3 \cos x}{1 - \cos x}$$



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57. Evaluate the following limits :

$$\lim_{x \rightarrow \pi} \frac{\sin 2x}{\sin x}$$



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58. Evaluate the following limits :

$$\lim_{x \rightarrow \frac{\pi}{2}} \frac{\cos^2 x}{1 - \sin x}$$



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59. Evaluate the following limits :

$$\lim_{\theta \rightarrow \frac{\pi}{2}} (\sec \theta - \tan \theta)$$



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60. Evaluate the following limits :

$$\lim_{\theta \rightarrow \frac{\pi}{2}} \left(\frac{2\theta - \pi}{\cos \theta} \right)$$



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61. Evaluate the following limit :

$$\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 + \cos 2x}{(\pi - 2x)^2}$$



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62. Evaluate the following limit :

$$\lim_{\theta \rightarrow \frac{\pi}{4}} \frac{\sin \theta - \cos \theta}{\theta - \frac{1}{4}\pi}$$



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63. Evaluate the following limits :

$$\lim_{x \rightarrow \pi} \frac{\sin x}{x - \pi}$$



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64. Evaluate the following limits :

$$\lim_{x \rightarrow \frac{\pi}{4}} \frac{1 - \tan x}{x - \frac{\pi}{4}}$$



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65. Evaluate the following limits :

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



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66. Evaluate the following limits :

$$\lim_{\theta \rightarrow \frac{\pi}{2}} \frac{\cot \theta}{\frac{\pi}{2} - \theta}$$



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67. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{\sin x}{x}$$



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68. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{\cos x}{x}$$



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69. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} x \tan\left(\frac{1}{x}\right)$$



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70. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \sqrt{\left(\frac{x + \sin x}{x - \cos x}\right)} \text{ is equal to}$$

A. 0

B. 1

C. -1

D. None of these

Answer: A



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71. Evaluate the limits :

$$\lim_{\theta \rightarrow \frac{\pi}{6}} \frac{\cot^2 \theta - 3}{\operatorname{cosec} \theta - 2}$$



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72. If $\lim_{\theta \rightarrow 0} k\theta \cos e\theta = \lim_{\theta \rightarrow 0} \theta \cos eck\theta$, prove that

k must be ± 1 :



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73. Show that $\lim_{x \rightarrow 0} \frac{|\sin x|}{x}$ does not exist .



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74. Evaluate :

$$\lim_{x \rightarrow 0} (1 + ax)^{1/x}$$



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75. Evaluate :

$$\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$$



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76. Evaluate :

$$\lim_{x \rightarrow 0} \frac{e^x - e^{-x}}{x}$$



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77. Evaluate :

$$\lim_{x \rightarrow 0} \frac{a^x - b^x}{x}$$



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78. Evaluate :

$$\lim_{x \rightarrow 0} \frac{e^{\sin x} - 1}{x}$$



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79. Evaluate :

$$\lim_{x \rightarrow 0} \frac{e^x - e^{-x}}{x}$$



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80. Evaluate :

$$\lim_{x \rightarrow 0} \left(\frac{x+2}{x+1} \right)^{x+3}$$



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81. Evaluate :

$$\lim_{x \rightarrow \infty} \left(\frac{x-3}{x+3} \right)^{x+3}$$

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82. Evaluate :

$$\lim_{x \rightarrow 0} \left(\frac{1 + 6x^2}{1 + 4x^2} \right)^{\frac{1}{x^2}}$$

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83. Evaluate :

$$\lim_{x \rightarrow 0} \frac{3^x - 2^x}{\tan x}$$

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84. Evaluate :

$$\lim_{x \rightarrow 0} \frac{3^x - 2^x}{\tan x}$$



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85. Evaluate :

$$\lim_{x \rightarrow 0} \frac{e^{\cos x} - 1}{\cos x}$$



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86. Evaluate :

$$\lim_{x \rightarrow 0} \frac{10^x - 2^x - 5^x + 1}{\sin^2 x}$$



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87. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\log\left(1 - \frac{x}{2}\right)}{x}$$



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88. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^x + e^{-x} - 2}{x}$$



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89. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{\sin(e^{x-2} - 1)}{\log(x - 1)}$$



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90. Use the formula

$$\lim_{x \rightarrow 0} \frac{a^x - 1}{x} = \log_e a \quad \text{to find} \quad \lim_{x \rightarrow 0} \frac{2^x - 1}{(1 + x)^{1/2} - 1}$$



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91. Find the limit of the function $f(x)$ if it exists,

defined as follows : $f(x) = \frac{e^{1/x} - 1}{e^{1/x} + 1}$, $x \neq 0$ as x

tends to zero.



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92. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin x}{x}$$



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93. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\log x}{\cot x}$$



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94. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{1 - \cos mx}{1 - \cos nx}$$



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Exercise 18 A

1. Show that $\lim_{x \rightarrow 2} \frac{|x - 2|}{x - 2}$ does not exist .



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2. Show that $\lim_{x \rightarrow \frac{\pi}{2}} \tan x$ does not exist .



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3. If $f(x) \begin{cases} x^2 + 4 & \text{for } x < 2 \\ x^3 & \text{for } x > 2 \end{cases}$, find $\lim_{x \rightarrow 2} f(x)$

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4. If $f(x) = \begin{cases} \frac{x}{|x|} & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$, find $\lim_{x \rightarrow 0} f(x)$

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5. Does $\lim_{x \rightarrow 0} f(x)$ exist if $f(x) = \begin{cases} x & \text{when } x < 0 \\ 0 & \text{when } x = 0 \\ x^2 & \text{when } x > 0 \end{cases}$

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6. Show that $\lim_{x \rightarrow 0} \frac{1}{x}$ does not exist .



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7. Show that $\lim_{x \rightarrow 0} e^{-1/x}$ does not exist .



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8. Show that $\lim_{x \rightarrow 0} \sin\left(\frac{1}{x}\right)$ does not exist .



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9. If f is an even function , then prove that

$$\lim_{x \rightarrow 0^-} f(x) = \lim_{x \rightarrow 0^+} f(x) , \text{ whenever they exist .}$$



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10. For what values of p does the $\lim_{x \rightarrow 1} f(x)$ exist ,

where f is defined by the rule

$$f(x) = \begin{cases} 2px + 3 & \text{if } x < 1 \\ 1 - px^2 & \text{if } x > 1 \end{cases}$$



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Exercise 18 B

1. Evaluate the following limits :

$$\lim_{x \rightarrow 0} (7x^2 - 5x + 1)$$



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2. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x - 1}{x + 1}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{x^2 + 5x + 6}{2x^2 - 3x}$$



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4. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{ax + b}{cx + d}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow 5^+} \frac{x - 5}{|x - 5|}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow 5^-} \frac{x - 5}{|x - 5|}$$



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7. Evaluate the following limits :

$$\lim_{x \rightarrow 5^+} (x - [x])$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow 1^-} \frac{x^2 - 1}{|x - 1|}$$



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9. Show that $\lim_{x \rightarrow 2} \log_{10} \left\{ x^6 + \sqrt{(x^2 + 1292)} \right\} = 2$



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10.

Given

that

$$f(x) = \frac{4 - 7x}{(3x + 4)}, I = \lim_{x \rightarrow 2} f(x) \text{ and } m = \lim_{x \rightarrow 0} f(x)$$

, form the equation whose are $\frac{1}{l}, \frac{1}{m}$



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Exercise 18 C

1. Evaluate the following limits :

$$\lim_{x \rightarrow -1} \frac{x^2 - 1}{x + 1}$$



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2. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{(2x - 3)(x - 1)}{2x^2 + x - 3}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow -1} \frac{(x - 4)(x + 1)}{x^2 + 3x + 2}$$



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4. Evaluate the following limits :

$$\lim_{x \rightarrow \frac{1}{2}} \frac{4x^2 - 1}{2x - 1}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{7x^2 - 11x - 6}{3x^2 - x - 10}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{x^2(x^2 - 4)}{x - 2}$$



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7. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \left(\frac{x^8 - 16}{x^4 - 4} + \frac{x^2 - 9}{x - 3} \right)$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{x^3 - 8}{x - 2}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow \frac{1}{2}} \left(\frac{8x - 3}{2x - 1} - \frac{4x^2 + 1}{4x^2 - 1} \right)$$



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10. Evaluate the following limits :

$$\lim_{x \rightarrow 3} \frac{x^3 - 8x^2 + 45}{2x^2 - 3x - 9}$$



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11. Evaluate the following limits :

$$\lim_{x \rightarrow 3} \frac{x^3 - 6x - 9}{x^4 - 81}$$



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12. Evaluate the following limits :

$$\lim_{x \rightarrow \sqrt{2}} \frac{x^4 - 4}{x^2 + 3x\sqrt{2} - 8}$$



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13. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{1 - x^{-1/3}}{1 - x^{-2/3}}$$



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14. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{x - 2}{\sqrt{x} - \sqrt{2}}$$



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15. If $\lim_{x \rightarrow 1} \frac{x^4 - 1}{x - 1} = \lim_{x \rightarrow k} \frac{x^3 - k^3}{x^2 - k^2}$, find the value of k .

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Exercise 18 D

1. Evaluate the following limits :

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

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2. Evaluate the following limits :

$$\lim_{x \rightarrow a} \frac{\sqrt{x} - \sqrt{a}}{x - a}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow 4} \frac{3 - \sqrt{5 + x}}{x - 4}$$



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4. Evaluate the following limits : $\lim_{x \rightarrow 0} (\sqrt{x+2} - \sqrt{2})/x$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x}{\sqrt{(x+1)} - 1}$$



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6. Evaluate the following limits :

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



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7. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{\sqrt{(x^2-1)} + \sqrt{(x-1)}}{\sqrt{(x^2-1)}}$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sqrt{(1 + x + x^2)} - 1}{x}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sqrt{(1 + x^3)} - \sqrt{(1 - x^3)}}{x^2}$$



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Exercise 18 E

1. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x^n - 1}{x - 1}$$



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2. Evaluate the following limits :

$$\lim_{x \rightarrow 3} \frac{x^5 - 243}{x^2 - 9}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{(1 + x)^n - 1}{x}$$



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4. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x^m - 1}{x^n - 1}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow 5} \frac{x^4 - 625}{x^3 - 125}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{x^{10} - 1024}{x^5 - 32}$$





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7. Evaluate the following limits :

$$\lim_{x \rightarrow 9} \frac{x^{3/2} - 27}{x - 9}$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow a} \frac{x\sqrt{x} - a\sqrt{a}}{x - a}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow a} \frac{(x + 2)^{3/2} - (a + 2)^{3/2}}{x - a}$$



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10. If $\lim_{x \rightarrow -a} \frac{x^9 + a^9}{x + a} = 9$, find all possible values of a .



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11. If $\lim_{x \rightarrow a} \frac{x^5 - a^5}{x - a} = 405$, find all possible values of a .



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12. If $\lim_{x \rightarrow a} \frac{x^9 - a^9}{x - a} = 9$, find all possible values of a .



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13. Prove that $\lim_{x \rightarrow 0} \frac{\sqrt[3]{(1+x)} - \sqrt[3]{(1-x)}}{x} = \frac{2}{3}$



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Exercise 18 F

1. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{4x - 3}{2x + 7}$$



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2. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{3x^2 + 2x - 5}{x^2 + 5x + 1}$$



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3. Evaluate the following limits :

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



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4. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{3x^2 + x - 1}{x^2 - x + 7}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{5x - 6}{\sqrt{4x^2 + 9}}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{\sqrt{3x^2 - 1} - \sqrt{2x^2 - 1}}{4x + 3}$$



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7. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \sqrt{x} (\sqrt{x+c} - \sqrt{x})$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \sqrt{x^2 + x - 1} - x$$



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9. Evaluate the following limits :

$$\lim_{n \rightarrow \infty} \frac{1 + 2 + 3 + \dots + n}{n^2} \left(\text{or } \lim_{x \rightarrow \infty} \frac{\Sigma n}{n^2} \right)$$



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10. Evaluate the following limits :

$$\lim_{n \rightarrow \infty} \frac{\Sigma n^3}{n^4}$$



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Exercise 18 G

1. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$$



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2. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\tan 2x}{x}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\tan \frac{1}{2}x}{3x}$$



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4. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin^2 5x}{\sin 15x}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin ax}{\sin bx}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin^2 5x}{\sin^2 bx}$$



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7. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin^2 3x}{x^2}$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\tan ax}{\tan bx}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin^2 x}{2x}$$



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10. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin x^2}{x}$$



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11. Evaluate the following limits :

$$\lim_{\theta \rightarrow 0} \frac{\sin^3 a\theta}{\sin^2 b\theta}$$



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12. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 2x + \sin 6x}{\sin 5x - \sin 3x}$$



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13. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\cos mx - \cos nx}{x^2}$$



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14. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{2 \sin^2 3x}{x^2}$$



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15. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{1 - \cos 2x}{x^2}$$



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16. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{1 - \cos 4x}{x^2}$$



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17. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{1 - \cos mx}{1 - \cos nx}$$



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18. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\cos Ax - \cos Bx}{x^2}$$



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19. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3 \sin x - \sin 3x}{x^3}$$



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20. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 3x \cos 2x}{\sin 2x}$$



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21. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x^2}{1 - \cos x}$$



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22. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 3x - \sin x}{\sin x}$$

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Exercise 18 H

1. Evaluate the following limits :

$$\lim_{x \rightarrow \pi} \frac{\sin x}{x - \pi}$$

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2.
$$\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 + \cos 2x}{(\pi - 2x)^2}$$

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3. Evaluate the following limits: $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{\left(\frac{\pi}{2} - x\right)^2}$

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4. Evaluate the following limits: $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\cos x}{\frac{\pi}{2} - x}$

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5. $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{(\pi - 2x)^2}$

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6. Evaluate the following limits: $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{\left(\frac{\pi}{2} - x\right)^2}$

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7. $\lim_{x \rightarrow 1} \frac{1 - \frac{1}{x}}{\sin \pi(x - 1)}$

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8. $\lim_{x \rightarrow a} \frac{\sin x - \sin a}{\sqrt{x} - \sqrt{a}}$

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9. $\lim_{x \rightarrow \pi} \frac{1 + \sec^3 x}{\tan^2 x}$



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Exercise 18 I

1. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^{4x} - 1}{x}$$



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2. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3^x - 1}{x}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^x - x - 1}{x}$$



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4. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x(e^x - 1)}{1 - \cos 2x}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x(2^x - 1)}{1 - \cos x}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^{\sin x} - 1}{x}$$



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7. Evaluate the following limits :

$$\lim_{x \rightarrow 0} e^x$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^{ax} - e^{bx}}{x}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow \frac{\pi}{2}} \frac{e^{\sin x} - 1}{\sin x}$$



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10. Evaluate the following limits :

$$\lim_{x \rightarrow 2} \frac{e^x - e^2}{x - 2}$$



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11. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{e^x - e}{x - 1}$$



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12. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^{ax} - e^{bx}}{x}$$



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13. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3^x - 1}{\sqrt{1+x} - 1}$$



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14. Evaluate the following limits :

$$\lim_{x \rightarrow 1} x^{\frac{1}{x-1}}$$



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15. Evaluate the following limits :

$$\lim_{x \rightarrow 0} (1 + \sin x)^{\cot x}$$



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16. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{8^x - 2^x}{x}$$



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17. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{a^x - b^x}{\sin x}$$



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18. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{a^{\sin x} - 1}{\sin x}$$



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19. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3^{2x} - 2^{3x}}{x}$$



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20. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{x - 1}{\log_e x}$$



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21. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^x + e^{-x} - 2}{x^2}$$



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22. Evaluate the following limits :

$$\lim_{x \rightarrow 5} \frac{\log x - \log 5}{x - 5}$$



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23. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^x - 1}{\sqrt{1 - \cos x}}$$



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24. Evaluate the following limits :

$$\lim_{n \rightarrow \infty} \left(1 + \frac{2}{n}\right)^{2n}$$



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25. Evaluate the following limits :

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



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26. Evaluate the following limits :

$$\lim_{x \rightarrow 0} (1 + ax)^{\frac{b}{x}}$$



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27. Evaluate the following limits :

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



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28. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \left(\frac{x - 1}{x + 1} \right)^2$$



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29. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \left(\frac{1 + 5x^2}{1 + 3x^2} \right)^{\frac{1}{x^2}}$$



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30. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^{ax} - 1}{\sin x}$$



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31. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{e^{x^2} - 1}{\sin^2 x}$$



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32. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3^{2x} - 1}{2^{3x} - 1}$$



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33. Evaluate the following limits :

$$\lim_{x \rightarrow 1} \frac{\sin(e^x - 1)}{\log x}$$



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34. Evaluate $\lim_{x \rightarrow 0} \frac{\log(a + x) - \log(a - x)}{x}, a > 0$



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Exercise 18 J

1. Evaluate the following limits :

$$\text{Lim}_{x \rightarrow 0} \frac{(1+x)^m - 1}{(1+x)^n - 1}$$



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2. Evaluate the following limits :

$$\text{Lim}_{x \rightarrow a} \frac{\log x - \log a}{x - a}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow a} \frac{x^a - a^a}{a^x - a^a}$$



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4. Evaluate the following limits :

$$\lim_{x \rightarrow \pi/6} \frac{\sin\left(x - \frac{\pi}{6}\right)}{\frac{\sqrt{3}}{2} - \cos x}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow a} \frac{\tan x - \tan a}{\sin a - \sin x}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow 4} \frac{3 - \sqrt{5 + x}}{x - 4}$$



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7. Evaluate the following limits :

$$\lim_{x \rightarrow a} \frac{a^x - 1}{b^x - 1}$$



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8. Evaluate the following limits :

$$\lim_{\theta \rightarrow \frac{\pi}{2}} \frac{1 - \sin \theta}{\left(\frac{\pi}{2} - \theta\right) \cos \theta}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{x}{2^x}$$



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10. Evaluate the following limits :

$$\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{x \cos x}$$



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Chapter Test

1. Evaluate the following limits :

$$\lim_{x \rightarrow \frac{1}{2}} \frac{4x^2 - 1}{2x - 1}$$



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2. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 3x}{\sin 2x}$$



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3. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sin 2x + \sin 6x}{\sin 5x - \sin 3x}$$



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4. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\tan 3x - 2x}{3x - \sin^2 x}$$



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5. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{2x^2 + 7x + 5}{4x^2 + 3x - 1}$$



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6. Evaluate the following limits :

$$\lim_{x \rightarrow \infty} \frac{2 \sin x - \sin 2x}{x^3}$$



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7. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{\sqrt{1 + ax} - \sqrt{1 - ax}}{x}$$



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8. Evaluate the following limits :

$$\lim_{x \rightarrow \pi} \frac{\sin x}{\pi - x}$$



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9. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3^{2x} - 1}{2^{3x} - 1}$$



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10. Evaluate the following limits :

$$\lim_{x \rightarrow 0} \frac{3^{2x} - 2^{3x}}{x}$$



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