



MATHS

BOOKS - MAXIMUM PUBLICATION

LIMITS AND DERIVATIVES

Example

1. Evaluate

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



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2. Evaluate

$$\lim_{x \rightarrow 2} \frac{3x^2 - x - 10}{x^2 - 4}$$



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3. Evaluate

$$\lim_{x \rightarrow 3} \frac{x^4 - 81}{2x^2 - 5x - 3}$$



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4. Evaluate

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



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5. Evaluate

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



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6. Evaluate

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



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7. Evaluate

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



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8. Find the derivative of

$$y = (x - a)(x - b)$$



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9. Find the derivative of

$$y = (ax^2 + b)^2$$



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10. Find the derivative of

$$y = \frac{x - a}{x - b}$$



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11. Find the derivative of

$$y = x^{-3}(5 + 3x)$$



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12. Find the derivative of

$$y = \frac{-2}{(x+1)^2} - \frac{x^2}{3x-1}$$



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13. Find the derivative of

$$y = \frac{\sin x}{x}$$



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14. Find the derivative of

$$y = \frac{ax + b}{cx + d}$$



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15. Find the derivative of

$$y = \frac{1 + \tan x}{1 - \tan x}$$



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16. If $xy = c^2$, prove that $x^2 \frac{dy}{dx} + c^2 = 0$



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17. Evaluate : $\lim_{x \rightarrow 0} \frac{(x + 5)^2 - 25}{x}$



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18. Find the derivative of $f(x) = x \sin x$



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19. Find the derivative of $f(x) = \frac{\sin x}{x}$



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



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21. Evaluate

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



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22. Evaluate

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



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23. Evaluate

$$\lim_{x \rightarrow 0} \frac{x^{10} - 1024}{x^5 - 32}$$



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24. Evaluate

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



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25. Evaluate

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



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26. Evaluate

$$\lim_{x \rightarrow 1} \frac{z^{\frac{1}{3}} - 1}{z^{\frac{1}{6}} - 1}$$



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27. Evaluate

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



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28. Evaluate

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



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29. Evaluate

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



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30. Evaluate

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



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31. Evaluate

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



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32. Evaluate

$$\lim_{x \rightarrow 0} \frac{ax + x \cos x}{b \sin x}$$



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33. Evaluate

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



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34. Evaluate

$$\lim_{x \rightarrow \frac{\pi}{2}} \frac{\tan 2x}{x - \frac{\pi}{2}}$$



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35. Evaluate

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



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36. Evaluate

$$\lim_{x \rightarrow 0} \frac{\log(1 + x)}{\sin x}$$



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37. Evaluate

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



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38. Evaluate

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



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39. Evaluate

$$\lim_{x \rightarrow 0} \frac{e^{\sin x} - 1}{\log(1 + x)}$$



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40. Find $\lim_{x \rightarrow 0} f(x)$ and

$$\lim_{x \rightarrow 1} f(x) \text{ where } f(x) = \begin{cases} 2x + 3 & x \leq 0 \\ 3(x + 1) & x > 0 \end{cases}$$



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41. Find $\lim_{x \rightarrow 1} f(x)$ where

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



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42. Evaluate

$$\lim_{x \rightarrow 0} f(x), \text{ where } f(x) = \begin{cases} \frac{|x|}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$$



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43. Find the derivative of $y = \tan x$ from first principles.



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44. Choose the most appropriate answer from those given in bracket

If $\lim_{x \rightarrow 2} \frac{x^p - 2^p}{x - 2} = 192$ then $p = \dots\dots\dots$

A. 2

B. 4

C. 6

D. 10

Answer: C



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

A. 0

B. 1

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

D. not defined

Answer: C



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46. Choose the most appropriate answer from those given in bracket

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

A. 0

B. a

C. b

D. not defined

Answer: B



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47. $\lim_{z \rightarrow 1} \frac{\sqrt{z} - 1}{1 - z} = \dots\dots\dots$

A. 0

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

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

D. 1

Answer: B



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48. $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\tan\left(\frac{\pi}{4} - x\right)}{\left(\frac{\pi}{4} - x\right)}$

A. 0

B. 1

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

D. not defined

Answer: B



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49. If $\lim_{x \rightarrow 0} \frac{f(x)}{x^2} = k \neq 0$ then $\lim_{x \rightarrow 1} f(x)$
=.....

A. 0

B. 1

C. k

D. not defined

Answer: D



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50. Using the first principal of derivatives , find the derivative of $\frac{1}{x}$.



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51. Using the quotient rule find the derivative of $f(x) = \cot x$



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52. Find the derivative of

$$f(x) = \frac{2x + 3}{x - 1}$$



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53. Find the derivative of

$$f(x) = \cos(x - 5)$$



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54. Prove that $\frac{d}{dx} \left(\frac{\cos x}{1 + \sin x} \right) = \frac{-1}{1 + \sin x}$



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55. Find the derivative of $y = \cot x$ from first principles.



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56. The value of $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ is



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57. Evaluate $\lim_{x \rightarrow 0} \frac{\sin 4x}{3x}$



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58. The value of $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ is



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59. Evaluate $\lim_{x \rightarrow 1} \frac{x^{15} - 1}{x^{10} - 1}$



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60. Find the derivative of $f(x) = \sin x$ from the first principle.



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61. Find the derivative of $\frac{x + \cos x}{\tan x}$



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62. Find the derivatives of $f(x) = \sin x$ using the first principle.



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63. Find the derivative of $\frac{x^5 - \cos x}{\sin x}$ using the quotient rule.



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64. Using the first principle, find the derivative of $\cos x$.



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65. Find the derivative of $\frac{\cos x}{2x + 3}$



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66. Evaluate

$$\lim_{x \rightarrow 1} \frac{x^7 - 1}{x^4 - 1}$$



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67. Evaluate

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



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68. Evaluate $\lim_{x \rightarrow \pi} \frac{\sin(\pi - x)}{\pi(\pi - x)}$



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69. Compute the derivative of $\sec x$ with respect to x from first principle.



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70. Find $\lim_{x \rightarrow 2} \frac{x^4 - 4x^2}{x^2 - 4}$



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71. If $y = \sin 2x$, Prove that $\frac{dy}{dx} = 2 \cos 2x$



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72. If $f(x) = \begin{cases} a + bx & x < 1 \\ 4 & x = 1 \\ b - ax & x > 1 \end{cases}$ and

$\lim_{x \rightarrow 1} f(x) = f(1)$, then find the value of a and b .



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73. Find the derivative of $y = \cos ecx$ from first principle.



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74. Find the derivative of $\frac{x + 1}{x - 1}$ from first principle.



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75. The value of $\lim_{x \rightarrow 0} \frac{\sin 5x}{5x}$ is



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76. Evaluate $\lim_{x \rightarrow 0} \frac{\sin ax}{\sin bx}$, $a, b \neq 0$



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77. Find the derivative of $\frac{1}{x}$ from first principle.



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78. Find the derivative of

$$(ax + b)^n(ax + c)^m$$



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



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80. Find $f'(x)$ given $f(x) = \frac{x^2 + 5x + 6}{x^2 + 3x + 2}$



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81. Evaluate $\lim_{x \rightarrow 3} \left(\frac{x^3 - 27}{x^2 - 9} \right)$



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82. Evaluate $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{\sin^3 x}$



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



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84. Find the derivative of $y = \cos x$ from the first principle.



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85. Find the derivative of $\frac{\sin x}{x + \cos x}$



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86. Match the following :

A	B
$\frac{d}{dx}(\tan x)$	$\sec x \tan x$
$\frac{d}{dx}(\operatorname{cosec} x)$	$-\operatorname{cosec}^2 x$
$\frac{d}{dx}(\cot x)$	$\sec^2 x$
	$-\operatorname{cosec} x \cot x$

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87. $\frac{d}{dx}(\tan x) = \dots\dots$

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88. Find the derivative of $3 \tan x + 5 \sec x$



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89. find the derivative of

$$f(x) = (x^2 + 1)\sin x$$



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90. Match the following :

(a) $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{x}$	1
(b) $\lim_{x \rightarrow 0} \cos 5x$	0
(c) $\lim_{x \rightarrow 0} \frac{\sin 8x}{x}$	2
	8



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91. Find the derivative of $\tan x$ using first principle.



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92. Match the following:

(i) $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x - 2}$	0
(ii) $\lim_{x \rightarrow 0} \frac{\sin \pi x}{\cos 2x}$	32
(iii) $\lim_{r \rightarrow 1} \pi r^2$	3.0
	π



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93.

if

$$f(x) = \frac{x^{100}}{100} + \frac{x^{99}}{99} + \dots + \frac{x^2}{2} + x + 1$$

prove that $f'(1) = 100f'(0)$



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94. $\lim_{x \rightarrow 0} \frac{\tan x}{x} = \dots\dots\dots$



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95. Find $\lim_{x \rightarrow 0} \frac{\sin 4x}{\sin 2x}$



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96. Using the first principle , find the derivative of $\cos x$.



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97. Derivative of $x^2 - 2$ at $x = 10$ isa)10

b)20 c)-10 d)-20

A. 10

B. 20

C. -10

D. -20

Answer: B



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98. $f(x) = \begin{cases} 2x + 3 & x \leq 0 \\ 3(x + 1) & x > 0 \end{cases}$ find

$\lim_{x \rightarrow 0} f(x)$ and $\lim_{x \rightarrow 1} f(x)$.





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99. If $xy = c^2$, prove that $x^2 \frac{dy}{dx} + c^2 = 0$



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100. $\frac{d}{dx} \left(\frac{x^n}{n} \right) = \dots\dots\dots$



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101. Differentiate $y = \frac{\sin x}{x + 1}$ with respect to x .





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102. Using the first principle , find the derivative of $\cos x$.



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103. $\frac{d}{dx}(-\sin x) = \dots\dots\dots$



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104. Find $\frac{dy}{dx}$ if $y = \frac{a}{x^4} - \frac{b}{x^2} + \cos x$, where a, b are constants.



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105. Using first principle, find the derivative of $\sin x$.



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106. $\frac{d}{dx}(\tan x) = \dots\dots\dots$



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107. Compute: $\lim_{x \rightarrow 0} \frac{e^{3x} - 1}{x}$



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108. Using the first principle, find the derivative of $\cos x$.



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109. $\frac{d}{dx}(9 + \sin x)$



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110. Find $\frac{dy}{dx}$ if $y = \frac{4 + 5 \sin x}{3 + 7 \cos x}$



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

A. 0

B. 1

C. 2

D. 3

Answer: B



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



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113. Find the derivative of $f(x) = \sin x$ from the first principle.



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