MATHS

BOOKS - A N EXCEL PUBLICATION

LIMITS AND DERIVATIVES

Question Bank

1. Evaluate $\lim_{x \to a} \frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}}$

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2. Fill in the blank

1° = --- radians

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3. (a)Evaluate $\underset{x \to 0}{L} t \frac{\sin x^0}{x}$

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4. Match the following

A: Limit	B: Value of the limit
$\lim_{x \to 0} \frac{\sin 3x}{x}$	4
$\lim_{x \to 1} \frac{x^4 - 1}{x - 1}$	5
$\lim_{x \to 0} \frac{e^{5x} - 1}{x}$	3
$\lim_{x \to 0} \frac{\log (1 + 7x)}{x}$	7 6

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5. Evaluate $\lim_{x \to 3} (x + 3)$

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6. Evaluate $\lim_{x \to \pi} \left(x - \frac{22}{7} \right)$

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7. Evaluate $\lim_{r \to l} \pi r^2$

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8. Evaluate $\lim_{x \to 4} \frac{4x + 3}{x - 2}$

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9. Evaluate $\lim_{x \to -1} \frac{x^{10} + x^5 + 1}{x - 1}$

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10. Evaluate $\lim_{x \to 0} \frac{(x + 1)^5 - 1}{x}$

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11. Evaluate $\lim_{x \to 2} \frac{3x^2 - x - 10}{x^2 - 4}$

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12. Evaluate $\lim_{x \to 3} \frac{x^4 - 81}{2x^2 - 5x - 3}$

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13. Evaluate $\lim_{x \to 0} \frac{ax + b}{cx + 1}$

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14. Evaluate $\lim_{z \to 1} \frac{\frac{z^1}{3} - 1}{\frac{z^1}{6} - 1}$

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15. Evaluate $\lim_{x \to 1} \frac{ax^2 + bx + c}{cx^2 + bx + a}, a + b + c \neq 0$

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16. Evaluate $\lim_{x \to -2} \frac{\frac{1}{x} + \frac{1}{2}}{x + 2}$

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17. Evaluate $\lim_{x \to 0} \frac{\sin ax}{b} x$

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

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19. Evaluate $\lim_{x \to \pi} \dfrac{\sin(\pi - x)}{\pi(\pi - x)}$

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20. Evaluate $\lim_{x \to 0} \dfrac{\cos x}{\pi - x}$

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21. Evaluate $\lim_{x \to 0} \dfrac{\cos 2x - 1}{\cos x - 1}$

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22. Evaluate $\lim_{x \to 0} \dfrac{ax + x \cos x}{b \sin x}$

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23. Evaluate $\lim_{x \to 0} x \sec x$

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24. Evaluate $\lim_{x \to 0} \frac{\sin ax + bx}{ax + \sin bx}$

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25. Evaluate $\lim_{x \to 0}$ (cosec x - cot x)

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26. Evaluate $\lim_{x \to \frac{\pi}{2}} \frac{\tan 2x}{x - \frac{\pi}{2}}$

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27. Evaluate $\lim_{x \to 0}$ f(x) and $\lim_{x \to 1}$ f(x), where f(x) = $\{(2x + 3, x \leq 0), (3(x + 1), x > 0)\}$

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28. Evaluate $\lim_{x \to 1}$ where f(x) = $\begin{cases} x^2 - 1 & x \leq 1 \\ -x^2 - 1 & x > 1 \end{cases}$

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29. Evaluate $\lim_{x \to 0}$ f(x), where f(x) = $\begin{cases} \frac{|x|}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$

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30. Evaluate $\lim_{x \to 0}$ where f(x) = $\begin{cases} \frac{x}{|x|} & x \neq 0 \\ 0 & x = 0 \end{cases}$

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31. Evaluate $\lim_{x \to 5} f(x)$, where f(x) = $|x| - 5$

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32. Suppose f(x) = $\begin{cases} a+bx & x<1 \\ 4 & x=1 \\ b-ax & x>1 \end{cases}$ and if $\lim_{x\to 1}$ f(x) = f(1) what are the possible values of a and b ?

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33. If f(x)= $\begin{cases} |x|+1 & x<0 \\ 0 & x=0 \\ |x|-1 & x>0 \end{cases}$, for what value(s) of a does $\lim_{x\to 0}$ f(x) exist ?

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34. If fthe function f(x) satisfies $\lim_{x\to 1}\frac{f(x)-2}{x^2-1}=\pi$, evaluate $\lim_{x\to 1}$ f(x).

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35. If f(x)= $\begin{cases} mx^2+n & x<0 \\ nx+m & 0\le x\le 1 \\ nx^3+m & x>1 \end{cases}$, for what integers m and n does $\lim_{x\to 0}$ and $\lim_{x\to 1}$ f(x) exist ?

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36. Factorise $x^3 - 6x^2 + 11x - 6$ into two factors so that one factor is x - 2.

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37. Factorise $x^2 - 6x + 8$ into linear factors.

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38. What is the rationalising factor of $\sqrt{1+x} - \sqrt{1-x}$?

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39. Evaluate $\lim_{x \to 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{2x}$

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40. Evaluate $\lim_{x \to 0} \frac{x^{10} - 1024}{x - 2}$

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41. $\lim_{x \to 2} \frac{x^5 - 32}{x - 2}$

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42. Evaluate $\lim_{x \to 2} \frac{x^{10} - 1024}{x^5 - 32}$

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43. Factorise x^2 - 4

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44. Rationalise $\sqrt{3x-2}-\sqrt{x+2}$

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45. Evaluate $\lim_{x \to 2} \frac{x^3-4}{\sqrt{3x-2}-\sqrt{x+2}}$

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46. Evaluate $\lim_{x \to -a} \frac{x^9+a^9}{x+a}$

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47. Find the value of a if $\lim_{x \to -a} \frac{x^9+a^9}{x+a} = 9$

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48. What is the value of $\left(\lim_{x \to 1} \frac{x^n - 1}{x - 1} \right.$ for any integer n ?

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49. Evaluate $\lim_{x \to 1} \frac{\left(x + x^2 + \ldots\ldots\ldots + x^n\right) - n}{x - 1}$

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50. Given that $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$ and $\lim_{\theta \to 0} \cos \theta = 1$

Evaluate $\lim_{\theta \to 0} \frac{\tan \theta}{\theta}$

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51. Given that $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$ and $\lim_{\theta \to 0} \cos \theta = 1$

Evaluate $\lim_{\theta \to \frac{\pi}{2}} \frac{\cot \theta}{\frac{\pi}{2} - \theta}$

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52. Prove that $\frac{1-\cos 4\theta}{1-\cos 5\theta} = \left[\frac{\sin(2\theta)}{\sin\left(\frac{5}{2}\theta\right)}\right]^2$

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53. Evaluate $\lim_{\theta \to 0} \frac{1-\cos 4\theta}{1-\cos 5\theta}$

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54. Evaluate $\lim_{x \to a} \frac{\cos x - \cos a}{x - a}$

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55. Evaluate $\lim_{x \to a} \frac{\sqrt{x} - \sqrt{a}}{x - a}$

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56. Evaluate $\lim_{x \to a} \frac{\cos x - \cos a}{\sqrt{x} - \sqrt{a}}$

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57. If we assume u $=\tan^{-1} 2x$, prove that $\lim_{x \to 0} \frac{x}{\tan^{-1} 2x} = \frac{1}{2} \lim_{u \to 0} \frac{\tan u}{u}$

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58. Evaluate $\lim_{x \to 0} \frac{x}{\tan^{-1} 2x}$

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59. Evaluate $\lim_{x \to \frac{\pi}{3}} \frac{\sqrt{3} - \tan x}{\pi - 3x}$

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60. $\lim_{x \to 0} \frac{\tan x - \sin x}{x^3}$

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61. Evaluate $\lim_{x \to 0} \frac{e^{bx} - 1}{x}$ and $\lim_{x \to 0} \frac{e^{ax} - 1}{x}$

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62. Evaluate $\lim_{x \to 0} \frac{e^{bx} - e^{ax}}{x}$

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63. What is the value of $\lim_{x \to \frac{\pi}{2}}$ cos x ?

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64. Evaluate $\lim_{x \to 0} \frac{\tan x}{x}$

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65. Evaluate $\lim_{x \to 0} \frac{3^x - 2^x}{\tan x}$

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66. Evaluate $\lim_{x \to 0} \frac{\log\left(1 + \frac{x}{5}\right)}{x}$

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67. Evaluate $\lim_{x \to 0} \frac{\log\left(1 - \frac{x}{5}\right)}{x}$

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68. Evaluate $\lim_{x \to 0} \frac{\log(5 + x) - \log(5 - x)}{x}$

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69. Evaluate $\lim_{x \to 0} \frac{\sqrt{1+x}-1}{x}$

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70. Evaluate $\lim_{x \to 0} \frac{\sqrt{1+x}-1}{\log(1+x)}$

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71. Consider the function f (x) $= \frac{x^2-9}{x-3}, x \neq 3$

complete the following table

x	2.5	2.75	2.99	2.999	3.001	3.01	3.25	3.5
$f(x)$	5.5	---	5.99	---	6.001	---	6.25	---

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72. Consider the function f (x) = $\frac{x^2-9}{x-3}, x \neq 3$

On the basis of the table does $\lim_{x \to 3}$ f(x) exist? If so, find the limt.

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73. Consider the function f (x) = $\frac{x^2-9}{x-3}, x \neq 3$

Find the possible integer n so that $\lim_{x \to 3} \frac{x^n - 3^n}{x-3} = 108$

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74. Consider the function f(x) = $\frac{x^2-4}{x-2}$

Evaluate $\lim_{x \to 2} \frac{x^2-4}{x-2}$. choose the correct answer from the bracket given below

A. 6

B. 7

C. 4

D. 5

Answer: B

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75. Consider the function f(x) = $\frac{x^2 - 4}{x - 2}$

Find the domain and range of f .

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76. Consider the function f(x) = $\frac{x^2 - 4}{x - 2}$

If $\lim_{x \to a} \frac{x^4 - a^4}{x - a} = \lim_{x \to 0} \frac{e^{4x} - 1}{x}$, find all possible values of a.

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77. Given that $\lim_{x \to 0} \frac{a^x - 1}{x} = \log a$ and $\lim_{x \to 0} \frac{\tan x}{x} = 1$

Evaluate $\lim_{x \to 0} \frac{5^x - 1}{x}$

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78. Given that $\lim_{x \to 0} \frac{a^x - 1}{x} = \log a$ and $\lim_{x \to 0} \frac{\tan x}{x} = 1$

Evaluate $\lim_{x \to 0} \frac{2^x - 1}{x}$

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79. Evaluate $\lim_{x \to 0} \left[\frac{10^x - 2^x - 5^x + 1}{x \tan x} \right]$

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80. Find the derivative of the function f(x) = $2x^2 + 3x + 5$ at x = 1

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81. (a)Find the derivative of $\sin x + \cos x$ from first principle

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82. Derivative of $x^2 - 2$ at $x = 10$ is .....a)10 b)20 c)-10 d)-20

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83. (a)Find the derivative of $99x at x = 100$.

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84. Find the derivative of x at x = 1

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85. Find the derivative of the following functions from first principle

$x^3 - 27$

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86. Find the derivative of the following functions from first principle (x - 1) (x - 2)

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87. Find the derivative of the following functions from first principle $\frac{1}{x^2}$

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

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89. If $f(x) = \frac{x^{100}}{100} + \frac{x^{99}}{99} + \ldots\ldots + \frac{x^2}{2} + x + 1$ prove that $f'(1) = 100f'(0)$

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90. Find the derivative of $x^n + ax^{n-1} + a^2x^{n-2} + \ldots + a^{n-1}x + a^n$ for some fixed real number a.

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91. Find the derivative of

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

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92. Find the derivative of

$y = \left(ax^2 + b\right)^2$

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93. Find the derivative of

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

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94. Find the derivative of $\frac{x^n - a^n}{x - a}$ for some constant a .

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95. Find the derivative of the following 2x-3/4

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96. Find the derivative of the following $\left(5x^3 + 3x - 1\right)$(x-1)

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97. Find the derivative of the following x^{-3}(5 + 3x)

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98. Find the derivative of the following $x^5\left(3-6x^{-9}\right)$

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99. Find the derivative of the following $x^{-4}\left(3-4x^{-5}\right)$

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100. Differentiate $\frac{2}{x+1}-\frac{x^2}{3x-1}$

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101. Find the derivative of cos x from first principle.

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102. Find the derivative of the following functions sin x cos x

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103. Find the derivative of the following function sec x

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104. Find the derivative of the following functions 5 sec x + 4 cos x

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105. Find the derivative of the function cosec x

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106. Find the derivative of the following functions 3 cot x + 5 cosec x

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107. Find the derivative of the following functions 5 sin x - 6 cos x + 7

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108. Find the derivative of the following functions 2 tan x - 7 sec x

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109. Consider the function f(x) = $\begin{cases} \frac{x^2-4}{|x-2|} : x \neq 2 \\ 2 : x = 2 \end{cases}$

complete the following table

Column : A	Column B
$f(2)$	-------
$f(2+)$	-------
$f(2-)$	-------
$f(3)$	-------

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110. Consider the function f(x) = $\begin{cases} \frac{x^2-4}{|x-2|} : x \neq 2 \\ 2 : x = 2 \end{cases}$

Does the $\lim_{x \to 2}$ f (x) exist ? explain.

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111. Given that $\frac{d}{dx}(c_1u_1 \pm c_2u_2 \pm \ldots\ldots\ldots \pm c_\nu \_ n) = c_1\frac{d}{dx}(u_1) \pm c_2\frac{d}{dx}(u_2) \pm \ldots\ldots \pm c$ and $\frac{d}{dx}(c) = 0$ if $c, c_1, c_2, \ldots\ldots\ldots . , c_n$ are constants and $u_1, u_2, \ldots . . , u_n$ are functions of x.

Using the given results, evaluate $\frac{d}{dx}\left(\frac{3x^2 + 12x - 11}{x}\right)$

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112. Given that $\frac{d}{dx}(c_1u_1 \pm c_2u_2 \pm \ldots\ldots\ldots \pm c_\nu \_ n) = c_1\frac{d}{dx}(u_1) \pm c_2\frac{d}{dx}(u_2) \pm \ldots\ldots \pm c$ and $\frac{d}{dx}(c) = 0$ if $c, c_1, c_2, \ldots\ldots\ldots . , c_n$ are constants and $u_1, u_2, \ldots . . , u_n$ are functions of x.

After expanding the square, differentiate $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$ w.r.t. x

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113. Fill in the blanks $\frac{d}{dx}(2x + 3)$ = ...

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114. Fill in the blanks $\frac{d}{dx}\left(5x^2-7x+1\right)$=.....

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115. Using product rule differentiate $(2x+3)\left(5x^2-7x+1\right)$ w.r.t. x

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116. Expand $(2x+3)\left(5x^2-7x+1\right)$ as a single polynomial and differentiate w.r.t.x

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117. Sajan finds the derivate of two functions f(x) =x^2 + cos x and g(x) = x^2 cos x as follows f(x) =x^2 + cos x , f'(x) = 2x - sin x, g (x) = x^2 cos x , g'(x) = 2x (

- sin x)

Sajan makes a mistake in finding derivative of one of the functions. Identify that function and find out correct derivate of that function

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118. Fill in the blanks $\frac{d}{dx}(\cos x) = ...$

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

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120. Express $\frac{8\cos^2 x + 11\sin x}{\cos x}$ as the sum of function and hence differentiate it w.r.t.x

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121. If $\sin(x+y)=\frac{1}{2}$, prove that $y=\sin^{-1}\left(\frac{1}{2}\right)-x$

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122. Prove that $\frac{dy}{dx}$= -1

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123. What are the values of $\frac{d}{dx}$ (cos x) and $\frac{d}{dx}$ (tan x)

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124. Using the product rule and the relation tan x cos x = sin x , find $\frac{d}{dx}$ (sin x)

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125. Writing cos x = $\frac{\sin x}{\tan x}$ and apply quotient rule find $\frac{d}{dx}$ (cos x)

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126. Differentiate 1-2 tan x w.r.t.x

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127. Differentiate 5 + 4 sin x w.r.t.x

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128. Using product rule differentiate (1-2tan x) (5 + 4 sin x) w.r.t.x

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129. Find $\frac{d}{dx}(1 + \tan x)$

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130. Find $\frac{d}{dx}\left(\frac{x}{1+\tan x}\right)$

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131. What is the value of $\frac{d}{dx}(\sec x)$?

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132. Differentiate $\frac{\sec x+1}{\sec x-1}$ w.r.t.x

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133. Using product rule differentiate x tan x w.r.t. x

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134. Differentiate sec x + tan x w.r.t. x

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135. Using quotient rule find $\frac{d}{dx}\left(\frac{x\tan x}{\sec x+\tan x}\right)$

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136. Express tan x as quotient of two trigonometric functions

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137. Using quotient rule differentiate tan x w.r.t.x

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138. Find the derivative of the following functions from first principle

(-x)

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139. Find the derivative of the following functions from first principle

$(-x)^{-1}$

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140. Find the derivative of the following functions from first principle

sin (x + 1)

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141. Find the derivative of the following functions from first principle

$\cos\left(x - \frac{\pi}{8}\right)$

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142. Differentiate x + a w.r.t.x

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143. Find the derivative of $(px+q)\left(\frac{r}{x}+s\right)$

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144. Find the derivate of (ax + b) $(cx+d)^2$

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145. Differentiate $\frac{ax+b}{cx+d}$ w.r.t.x

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146. Find the derivate of $\frac{1+\frac{1}{x}}{1-\frac{1}{x}}$

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147. Find the derivative of $\frac{1}{ax^2+bx+c}$

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148. Find the derivative of $\frac{ax+b}{px^2+qx+r}$

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149. Find the derivative of $\frac{px^2+qx+r}{ax+b}$

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150. Find the derivative of $\frac{a}{x^4}-\frac{b}{x^2}+\cos x$

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151. Find the derivative of $4\sqrt{x} - 2$

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152. Find the derivative of $(ax + b)^n$

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153. Find the derivative of

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

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154. Find the derivative of sin (x + a)

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155. Find the derivative of $\cos ecx \cot x$

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156. Find the derivative of $\frac{\cos x}{1+\sin x}$

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

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158. Find the derivative of $\frac{\sec x-1}{\sec x+1}$

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159. Find the derivative of $\sin^n x$, n is integer

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160. Find the derivative of $\frac{a - b\sin x}{c + d\cos x}$

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161. Find the derivative of $\frac{\sin(x + a)}{\cos x}$

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162. Find the derivative of $x^4(5\sin x - 3\cos x)$

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163. Find the derivative of $\left(x^2 + 1\right)\cos x$

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164. Find the derivative of $\left(ax^2 + \sin x\right)(p + q\cos x)$

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165. Find the derivative of (x + cos x)(x - tan x)

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166. Find the derivative of $\frac{4x + 5\sin x}{3x + 7\cos x}$

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167. Find the derivative of $\frac{x^2 \cos\left(\frac{\pi}{4}\right)}{\sin x}$

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168. Find the derivative of $\frac{x}{1+\tan x}$

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169. Find the derivative of (x + sec x) (x - tan x)

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170. Find the derivative of $\frac{x}{\sin^n x}$, n is an integer.

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