MATHS

BOOKS - KALYANI PUBLICATION

LOGARITHMS

Example

1. Determine logarithm of 1728 to the base $2\sqrt{3}$

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2. Prove that $\log_2 \log_3 \log_2 512 = 1$.

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3. Show that $7\log\left(\frac{10}{9}\right) - 2\log\left(\frac{25}{24}\right) + 3\log\left(\frac{81}{80}\right) = \log 2$

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4. If $a^2 + b^2 - 7ab = 0$,prove that $(\log a + \log b) = 2\log\left(\frac{a+b}{3}\right)$

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5. Show that $2\log(a+b) = 2\log a + \log\left\{1 + \frac{2b}{a} + \frac{b^2}{a^2}\right\}$

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6. Prove that $\log_a x + \log_{\frac{1}{a^2}} x = \log_a \sqrt{x}$

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7. Prove that $\frac{2}{3} < \log_{10} 5 < \frac{3}{4}$

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8. Solve the equation $\log_3 x + \log_9 x + \log_{27} x = 5.5$

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9. If $\frac{xy\log(xy)}{x+y} = \frac{yz\log(yz)}{y+z} = \frac{zx\log(zx)}{z+x}$ then show that $x^x = y^y = z^z$

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Exercise

1. Express the following in the form of $x = \log_a y$:

$3^4 = 81$

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2. Express the following in the form of $x = \log_a y$:

$2^5 = 32$

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3. Express the following in the form of $x = \log_a y$:

$5^3 = 125$

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4. Express the following in the form of $x = \log_a y$:

$\sqrt{8} = 2^{\frac{3}{2}}$

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5. Express the following in the form of $x = \log_a y$:

$3^{-3} = \frac{1}{27}$

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6. Express the following in the form of $x = \log_a y$:

$$\left(\frac{3}{2}\right)^5 = \frac{243}{32}$$

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7. Express the following in the form of $x = \log_a y$:

$$10^{-4} = .0001$$

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8. Express the following in index form :

$$\log_{10} 1000 = 3$$

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9. Express the following in index form :

$\log_5 125 = 3$

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10. Express the following in index form :

$\log_{2\sqrt{2}} 64 = 4$

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11. Express the following in index form :

$\log_{25}(.04) = -1$

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12. Express the following in index form :

$\log_{11}\left(\frac{1}{121}\right) = -2$

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13. Express the following in index form :

$\log_4\left(\frac{1}{8}\right) = -\frac{3}{2}$

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14. Evaluate the following :

$\log_6 216$

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15. Evaluate the following :

$\log_{5\sqrt{5}} 125$

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16. Evaluate the following :

$\log_{2\sqrt{3}} 144$

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17. Evaluate the following :

$\log_{\sqrt{5}} .008$

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18. Evaluate the following :

$\log_{\sqrt{5}} 3125$

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19. Evaluate the following :

$\log_{3\sqrt{2}} 324$

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20. Evaluate the following :

$\log_{.001} 100$

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21. Evaluate the following :

$\log_{7\sqrt{7}} 2401$

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22. Evaluate the following :

$\log_{3\sqrt{2}} 5832$

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23. Evaluate the following :

$\log_{3\sqrt{9}} 81$

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24. Prove that

$\log_2 \log_3 9 = 1$

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25. Prove that

$\log_3 \log_2 8 = 1$

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26. Prove that

$\log_4 \log_{\sqrt{2}} 256 = 2$

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27. Prove that

$\log_2 \log_{\sqrt{2}} \log_3 81 = 2$

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28. Prove that

$\log_2 \log_{\sqrt{2}} \log_3^9 = 1$

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29. Prove that

$\log_4 \log_4 \log_4 256 = 0$

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30. Prove that

$\log_2 \log_2 \log_2 16 = 1$

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31. Evaluate

$\log_4 \log_{\sqrt{3}} \log_4 64 =$

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32. Prove that

$\log_8 \log_4 \log_{\sqrt{2}} 256 = \frac{1}{3}$

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33. Prove that

$\log_5 \log_2 \log_3 \log_2 512 = 0$

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34. Prove that

$\log_2 \log_2 \log_3 \log_3 19683 = 0$

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35. Determine x if

$\log_{10}(\log_{10} x) = 1$

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36. Determine x if

$\log_2(\log_2 x) = 1$

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37. Determine x if

$\log_2(\log_9 x) = -1$

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38. Determine x if

$\log_2\left(\log_{\sqrt{3}} x\right) = 2$

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39. Determine x if

$\log_{36}(\log_2)x = \frac{1}{2}$

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40. Determine x if

$\log_{25}(\log_3 x) = \frac{1}{2}$

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41. Determine x if

$\log_5\{\log_3(\log_2 x)\} = 0$

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42. Determine x if

$\log_3\{\log_2(\log_2 x)\} = 1$

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43. Prove that

$\log_a \frac{51}{16} + \log_a \frac{44}{85} - \log_a \frac{33}{40} = \log_a 2$

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44. Prove that

$$\log_x \frac{9}{14} + \log_x \frac{35}{24} - \log_x \frac{15}{48} = \log_x 3$$

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45. Prove that

$$\log_a \frac{p^2}{qr} + \log_a \frac{q^2}{rp} + \log_a \frac{r^2}{pq} = 0$$

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46. Prove that

$$\log\left(x^2\right) + \log\left(y^2\right) + \log\left(z^2\right) = \log xy + \log yz + \log zx$$

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47. Prove that

$$(\log a)^2 - (\log b)^2 = \log(ab)\log\left(\frac{a}{b}\right)$$

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48. Prove that

$$\log_a \frac{25}{21} + \log_a \frac{9}{35} + \log_a \frac{49}{15} = 0$$

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49. Prove that

$$\log \frac{75}{16} - 2\log \frac{5}{9} + \log \frac{32}{243} = \log 2$$

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50. Show that $7\log\left(\frac{10}{9}\right) - 2\log\left(\frac{25}{24}\right) + 3\log\left(\frac{81}{80}\right) = \log 2$

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51. Prove that

$$7\log\frac{16}{15}+5\log\frac{25}{24}+3\log\frac{81}{80}=\log 2$$

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52. Prove that

$$16\log\frac{16}{15}+12\log\frac{25}{24}+7\log\frac{81}{80}=\log 5$$

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53. Prove that

$$7\log\frac{15}{16}+6\log\frac{8}{3}+5\log\frac{2}{5}+\log\frac{32}{25}=\log 3$$

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54. Prove that

$$\log\frac{384}{5}+\log\frac{513}{32}+\log\frac{5}{27}-\log\frac{57}{25}=2$$

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55. Prove that

$$\log\left\{a+\sqrt{a^2+1}\right\} = -\log\left\{\sqrt{a^2+1}-a\right\}$$

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56. Assuming the base as 10,prove that

$$\log\frac{81}{8} - 2\log\frac{3}{2} + 3\log\frac{2}{3} + \log\frac{3}{4} = 0$$

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57. Assuming the base as 10,prove that

$$\log 2 + 16\log\frac{16}{15} + 12\log\frac{25}{24} + 7\log\frac{80}{81} = 1$$

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58. Assuming the base as 10,prove that

$$\log 20 + 7\log\frac{15}{16} + 5\log\frac{24}{25} + 3\log\frac{80}{81} = 1$$

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59. Assuming the base as 10,prove that

$$24\log\frac{9}{10} - 8\log\frac{24}{25} + 10\log\frac{160}{81} = 2$$

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60. Assuming the base as 10,prove that

$$\log 768 + \log\frac{81}{32} + 3\log\frac{5}{3} + \log\frac{1}{9} = 3$$

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61. Assuming the base as 10,prove that

$$23\log\frac{16}{15} + 17\log\frac{25}{24} + 10\log\frac{81}{80} = 1$$

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62. Assuming the base as 10,prove that

$20\log 8 + 45\log 16 - 18\log 32 = 30(5 - 5\log 5)$

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63. Assuming the base as 10,prove that

$\log 12.5 = 2 - 3\log 2$

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64. Assuming the base as 10,prove that

$\log 800 = 2 + 3\log 2$

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65. Assuming the base as 10,prove that

$$\log\left(1+\frac{1}{2}\right)+\log\left(1+\frac{1}{3}\right)+\log\left(1+\frac{1}{4}\right)+\ldots.+\log\left(1+\frac{1}{19}\right)=1$$

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66. Assuming the base as 10,prove that

$$\frac{\log 3\sqrt{3}+\log 2\sqrt{2}-\log 5\sqrt{5}}{\log 1.2}=\frac{3}{2}$$

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67. If $\frac{\log p}{b-c}=\frac{\log q}{c-a}=\frac{\log r}{a-b}$,then prove that

$p^a.\,q^b.\,r^c=1$

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68. If $\frac{\log x}{a+b-2c}=\frac{\log y}{b+c-2a}=\frac{\log z}{a+c-2b}$, then prove that xyz=1`

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69. If $\frac{xy\log(xy)}{x+y} = \frac{yz\log(yz)}{y+z} = \frac{zx\log(zx)}{z+x}$ then show that $x^x = y^y = z^z$

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70. If $\frac{\log x}{y-z} = \frac{\log y}{z-x} = \frac{\log z}{x-y}$ prove that $xyz = 1$

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71. If $(3.7)^x = (.37)^y = 1000$,then prove that $\frac{1}{x} - \frac{1}{y} = \frac{1}{3}$

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72. If $a^2 + b^2 = 23ab$,then prove that $\log\left(\frac{a+b}{5}\right) = \frac{1}{2}(\log a + \log b)$

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73. If $x^2 + y^2 = 7xy$,then prove that $\log(x + y) = \log 3 + \frac{1}{2}(\log x + \log y)$

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74. If $x^2 + y^2 = 11xy$,then prove that $\log\left(\frac{x + y}{13}\right) = \frac{1}{2}(\log x + \log y)$

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75. If $a^2 + b^2 = 18ab$,then prove that $\log\left(\frac{a - b}{4}\right) = \frac{1}{2}(\log a + \log b)$

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76. If $4a^4 + 9b^4 = 37a^2b^2$,then prove that $\log(2a^2 + 3b^2) = \log a + \log b + \log 7$

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77. If $2\log(a + b) = \log a + \log b + \log 8$,then prove that $(a + b)^2 = 8ab$

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78. If $\log\left(\frac{x + y}{3}\right) = \frac{1}{2}(\log x + \log y)$,then prove that $\frac{x}{y} + \frac{y}{x} = 7$

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79. If $\log\left(\frac{a + 2b}{4}\right) = \frac{1}{2}(\log a + \log b)$,then prove that $a^2 + 4b^2 = 12ab$

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80. If $\log\left(\frac{x+y}{2}\right) = \frac{1}{2}(\log x + \log y)$,then prove that $x = y$

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81. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 5 - .6990, \log_{10} 10 = .7782$,then prove that

$\log_2 6 = 2.5854$

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82. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771$,find the value of $\log_{10} 12$

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83. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 5 - .6990, \log_{10} 10 = .7782$, then prove that

$\log_6 5 = .8982$

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84. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 5 - .6990, \log_{10} 10 = .7782$, then prove that

$\log_4 9 = 1.5848$

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85. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771$, then find the value of $\log_{10}\left((24)^{\frac{1}{2}}\right)$

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86. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 5 - .6990, \log_{10} 10 = .7782$, then prove that

$\log_6 30 = 1.898$

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87. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 7 = .8450, \log_{10} 10 = 1$, then prove that

$\log_3 70 = 3.8673$

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88. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 7 = .8450, \log_{10} 10 = 1$, then prove that

$\log_7 90 = 2.3124$

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89. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 5 - .6990, \log_{10} 10 = .7782,$ then prove that $\log_6 45 = 2.1244$

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90. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 5 - .6990, \log_{10} 10 = .7782,$ then prove that $\log_9 24 = 1.4465$

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91. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 7 = .8450, \log_{10} 10 = 1,$ then prove that $\log_3 56 = 3.6642$

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92. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771$, then find the value of $\log_{10} 3.6$

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93. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021, \log_{10} 7 = .8450, \log_{10} 10 = 1$, then prove that $\log_3 56 = 3.6642$

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94. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021, \log_{10} 5 - .6990, \log_{10} 10 = .7782$, then prove that $\log_5 72 = 2.6572$

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95. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 5 - .6990, \log_{10} 10 = .7782$, then prove that

$\log_9 96 = 2.0774$

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96. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 7 = .8450, \log_{10} 10 = 1$, then prove that

$\log_7 120 = 2.4606$

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97. Given that $\log_{10} 2 = .3010, \log_{10} 3 = .4771, \log_{10} 4 = .6021,$ $\log_{10} 7 = .8450, \log_{10} 10 = 1$, then prove that

$\log_8 140 = 2.3764$

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98. Prove that

$\log_a x + \log_{\frac{1}{a}} x = 0$

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99. Prove that

$\log_3 2 = \log_9 4 = \log_{27} 8$

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100. Prove that

$\log_{a^2} x = \left(\frac{1}{2}\right)\log_a x$

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101. Prove that

$\log_a x = \log_{a^2} x^2 = \log_{a^n} x^n$

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102. Prove that

$$\frac{1}{\log_6 24}+\frac{1}{\log_{12} 24}+\frac{1}{\log_8 24}=2$$

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103. Prove that

$$\frac{1}{\log_{\frac{a}{b}} x}+\frac{1}{\log_{\frac{b}{c}} x}+\frac{1}{\log_{\frac{c}{a}} x}=0$$

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104. Prove that

$$\frac{1}{\log_a P}+\frac{1}{\log_b P}+\frac{1}{\log_c P}=\frac{1}{\log_x P} \text{ where, } abc=x$$

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105. Prove that

$$\log_a m + \log_{a^2} m^2 + \log_{a^3} m^3 + \ldots\ldots + \log_{a^p} m^p = p \log_a m$$

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106. Prove that

$$\log_a x . \log_b a . \log_c b . \log_x c = 1$$

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107. Prove that

$$\log_a x . \log_b y = \log_b x . \log_a y$$

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108. Prove that

$$\frac{\log_a bx}{\log_a x} = 1 + \log_x b$$

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109. Prove that

$$\log_a(ab) + \log_b(ab) = \log_a(ab).\log_b(ab)$$

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110. Prove that

$$\frac{1}{4} < \log_{10} 2 < \frac{1}{3}$$

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111. Prove that

$$\frac{3}{10} < \log_{10} 2 < \frac{1}{3}$$

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112. Prove that

$$\frac{1}{3} < \log_{10} 3 < \frac{1}{2}$$

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113. Prove that $\frac{5}{6} < \log_{10} 7 < \frac{6}{7}$.

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114. Solve the following equation :

$$\log x + \log 3 + 3 \log 2 = 2 \log 4$$

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115. Solve the following equation :

$$\frac{\log x}{\log 4} = \frac{\log 64}{\log 16}$$

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116. Solve the following equation :

$\log_x 2 + \log_x 4 + \log_x 8 + \log_x 16 = 10$

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117. Solve the following equation :

$\log_2 x + \log_4 x + \log_{16} x = \frac{21}{24}$

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118. Solve the following equation :

$\log_2 x + \log_{16} x = 15$

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119. Solve the following equation :

$\log_3 x + \log_9 (x^2) + \log_{27} (x^3) = 3$

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120. Solve the following equation :

$\log_8 x + \log_4 x + \log_2 x = 11$

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121. Solve the following equation :

$\log_4 x + \log_2 x = 6$

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122. Solve the following equation :

$\log_x 3 + \log_x 9 + \log_x 729 = 9$

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