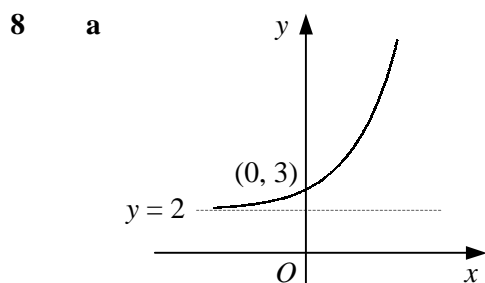
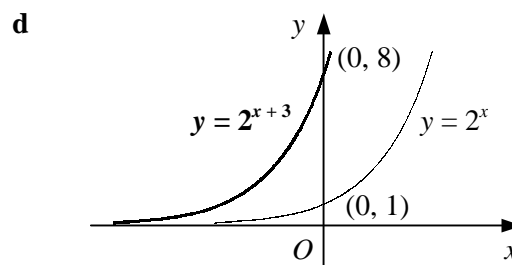
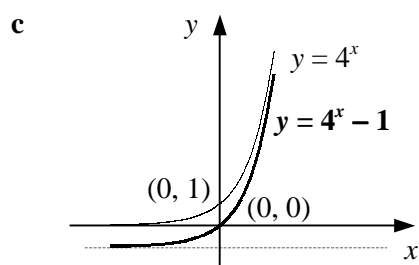
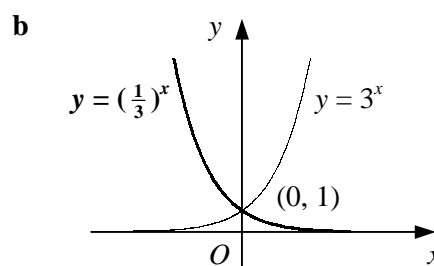
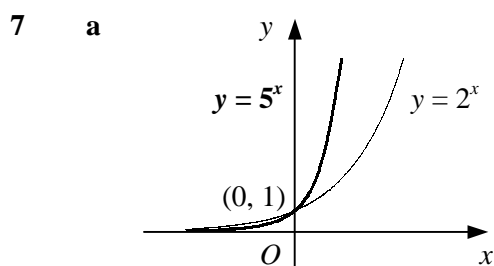


EXPONENTIALS AND LOGARITHMS

Answers

- 1** **a** 1.78 **b** 0.778 **c** 2.40 **d** -0.398
- 2** **a** $x = \lg 14 = 1.15$ **b** $10^x = 4$
 $x = \lg 4 = 0.60$ **c** $3x = \lg 49$
 $x = \frac{1}{3} \lg 49 = 0.56$
- d** $x - 4 = \lg 23$ **e** $2x + 1 = \lg 130$ **f** $(10^2)^x = 10^{2x} = 5$
 $x = 4 + \lg 23 = 5.36$ $x = \frac{1}{2}(\lg 130 - 1) = 0.56$ $2x = \lg 5$
 $x = \frac{1}{2} \lg 5 = 0.35$
- 3** let $y = \log_a b \Rightarrow a^y = b$
 $y \log_c a = \log_c b$
 $y = \frac{\log_c b}{\log_c a}$
 $\therefore \log_a b = \frac{\log_c b}{\log_c a}$
- 4** **a** $= \frac{\lg 7}{\lg 2} = 2.81$ **b** $= \frac{\lg 172}{\lg 20} = 1.72$ **c** $= \frac{\lg 49}{\lg 5} = 2.42$ **d** $= \frac{\lg 4}{\lg 9} = 0.631$
- 5** **a** $x \lg 3 = \lg 12$ **b** $x \lg 2 = \lg 0.7$ **c** $-y \lg 8 = \lg 3$ **d** $\frac{1}{2}x \lg 4 = \lg 0.3$
 $x = \frac{\lg 12}{\lg 3}$ $x = \frac{\lg 0.7}{\lg 2}$ $y = -\frac{\lg 3}{\lg 8}$ $x = \frac{2 \lg 0.3}{\lg 4}$
 $x = 2.26$ $x = -0.515$ $y = -0.528$ $x = -1.74$
- e** $(t + 3) \lg 5 = \lg 24$ **f** $(4 + x) \lg 3 = \lg 16$ **g** $(2x + 4) \lg 7 = \lg 12$ **h** $2^{3x+1} = 12.4$
 $t = \frac{\lg 24}{\lg 5} - 3$ $x = \frac{\lg 16}{\lg 3} - 4$ $x = \frac{1}{2} \left(\frac{\lg 12}{\lg 7} - 4 \right)$ $(3x + 1) \lg 2 = \lg 12.4$
 $t = -1.03$ $x = -1.48$ $x = -1.36$ $x = \frac{1}{3} \left(\frac{\lg 12.4}{\lg 2} - 1 \right)$
 $x = 0.877$
- i** $(2 - 3x) \lg 4 = \lg 32.7$ **j** $x \lg 5 = (x - 1) \lg 6$
 $x = \frac{1}{3} \left(2 - \frac{\lg 32.7}{\lg 4} \right)$ $x(\lg 6 - \lg 5) = \lg 6$
 $x = -0.172$ $x = \frac{\lg 6}{\lg 6 - \lg 5} = 9.83$
- k** $(y + 2) \lg 7 = (y + 1) \lg 9$ **l** $(5 - x) \lg 4 = (2x - 1) \lg 11$
 $y(\lg 9 - \lg 7) = 2 \lg 7 - \lg 9$ $x(2 \lg 11 + \lg 4) = 5 \lg 4 + \lg 11$
 $y = \frac{2 \lg 7 - \lg 9}{\lg 9 - \lg 7} = 6.74$ $x = \frac{5 \lg 4 + \lg 11}{2 \lg 11 + \lg 4} = 1.51$
- m** $(\frac{1}{2}x + 3) \lg 4 = (1 - 2x) \lg 5$ **n** $(3y - 2) \lg 2 = (2y + 5) \lg 3$
 $x(\frac{1}{2} \lg 4 + 2 \lg 5) = \lg 5 - 3 \lg 4$ $y(3 \lg 2 - 2 \lg 3) = 5 \lg 3 + 2 \lg 2$
 $x = \frac{\lg 5 - 3 \lg 4}{\frac{1}{2} \lg 4 + 2 \lg 5} = -0.652$ $y = \frac{5 \lg 3 + 2 \lg 2}{3 \lg 2 - 2 \lg 3} = -58.4$
- o** $7^{2x+4} = 11^{3x-4}$ **p** $3^{x+1} = 2^{4+x}$
 $(2x + 4) \lg 7 = (3x - 4) \lg 11$ $(x + 1) \lg 3 = (4 + x) \lg 2$
 $x(3 \lg 11 - 2 \lg 7) = 4 \lg 7 + 4 \lg 11$ $x(\lg 3 - \lg 2) = 4 \lg 2 - \lg 3$
 $x = \frac{4 \lg 7 + 4 \lg 11}{3 \lg 11 - 2 \lg 7} = 5.26$ $x = \frac{4 \lg 2 - \lg 3}{\lg 3 - \lg 2} = 4.13$

- 6**
- a** $(2^x + 3)(2^x - 2) = 0$
 $2^x = -3$ [no sols], 2
 $x = 1$
- b** $(3^x - 1)(3^x - 4) = 0$
 $3^x = 1, 4$
 $x = 0, \frac{\lg 4}{\lg 3} = 0, 1.26$
- c** $5^{2x} - 8(5^x) + 12 = 0$
 $(5^x - 2)(5^x - 6) = 0$
 $5^x = 2, 6$
 $x = \frac{\lg 2}{\lg 5}, \frac{\lg 6}{\lg 5} = 0.43, 1.11$
- d** $2(4^{2x}) - 7(4^x) + 3 = 0$
 $(2(4^x) - 1)(4^x - 3) = 0$
 $4^x = \frac{1}{2}, 3$
 $x = -\frac{1}{2}, \frac{\lg 3}{\lg 4} = -\frac{1}{2}, 0.79$
- e** $2(2^{2y}) + 7(2^y) - 15 = 0$
 $(2(2^y) - 3)(2^y + 5) = 0$
 $2^y = -5$ [no sols], $\frac{3}{2}$
 $y = \frac{\lg \frac{3}{2}}{\lg 2} = 0.58$
- f** $3(3^{2x}) - 17(3^x) + 10 = 0$
 $(3(3^x) - 2)(3^x - 5) = 0$
 $3^x = \frac{2}{3}, 5$
 $x = \frac{\lg \frac{2}{3}}{\lg 3}, \frac{\lg 5}{\lg 3} = -0.37, 1.46$
- g** $5^{2t} + 5(5^t) - 24 = 0$
 $(5^t + 8)(5^t - 3) = 0$
 $5^t = -8$ [no sols], 3
 $t = \frac{\lg 3}{\lg 5} = 0.68$
- h** $3(3^{2x}) - 18(3^x) + 15 = 0$
 $3(3^x - 1)(3^x - 5) = 0$
 $3^x = 1, 5$
 $x = 0, \frac{\lg 5}{\lg 3} = 0, 1.46$
- i** $3(4^{2x}) - 16(4^x) + 5 = 0$
 $(3(4^x) - 1)(4^x - 5) = 0$
 $4^x = \frac{1}{3}, 5$
 $x = \frac{\lg \frac{1}{3}}{\lg 4}, \frac{\lg 5}{\lg 4} = -0.79, 1.16$



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$$x = 0 \Rightarrow y = -4$$

$$y = 0 \Rightarrow 2^x = 5$$

$$x = \frac{\lg 5}{\lg 2}$$

$$AB^2 = 4^2 + \left(\frac{\lg 5}{\lg 2}\right)^2 = 21.391$$

$$AB = 4.63$$

b $(3, 29) \Rightarrow 29 = 2 + a^3$
 $a^3 = 27$
 $a = 3$