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 $x - 4 = \lg 23$
$x = 4 + \lg 23 = 5.36$

e $2x + 1 = \lg 130$
$x = \frac{1}{2}(\lg 130 - 1) = 0.56$

f $(10^2)^x = 10^{2x} = 5$
$2x = \lg 5$
$x = \frac{1}{2}\lg 5 = 0.35$

3 let $y = \log_a b \Rightarrow a^y = b$
$y \log_c a = \log_c b$
$y = \dfrac{\log_c b}{\log_c a}$

$\therefore \log_a b = \dfrac{\log_c b}{\log_c a}$

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** $x \lg 3 = \lg 12$
$x = \frac{\lg 12}{\lg 3}$
$x = 2.26$

b $x \lg 2 = \lg 0.7$
$x = \frac{\lg 0.7}{\lg 2}$
$x = -0.515$

c $-y \lg 8 = \lg 3$
$y = -\frac{\lg 3}{\lg 8}$
$y = -0.528$

d $\frac{1}{2}x \lg 4 = \lg 0.3$
$x = \frac{2\lg 0.3}{\lg 4}$
$x = -1.74$

e $(t + 3)\lg 5 = \lg 24$
$t = \frac{\lg 24}{\lg 5} - 3$
$t = -1.03$

f $(4 + x)\lg 3 = \lg 16$
$x = \frac{\lg 16}{\lg 3} - 4$
$x = -1.48$

g $(2x + 4)\lg 7 = \lg 12$
$x = \frac{1}{2}(\frac{\lg 12}{\lg 7} - 4)$
$x = -1.36$

h $2^{3x+1} = 12.4$
$(3x + 1)\lg 2 = \lg 12.4$
$x = \frac{1}{3}(\frac{\lg 12.4}{\lg 2} - 1)$
$x = 0.877$

i $(2 - 3x)\lg 4 = \lg 32.7$
$x = \frac{1}{3}(2 - \frac{\lg 32.7}{\lg 4})$
$x = -0.172$

j $x \lg 5 = (x - 1)\lg 6$
$x(\lg 6 - \lg 5) = \lg 6$
$x = \frac{\lg 6}{\lg 6 - \lg 5} = 9.83$

k $(y + 2)\lg 7 = (y + 1)\lg 9$
$y(\lg 9 - \lg 7) = 2\lg 7 - \lg 9$
$y = \frac{2\lg 7 - \lg 9}{\lg 9 - \lg 7} = 6.74$

l $(5 - x)\lg 4 = (2x - 1)\lg 11$
$x(2\lg 11 + \lg 4) = 5\lg 4 + \lg 11$
$x = \frac{5\lg 4 + \lg 11}{2\lg 11 + \lg 4} = 1.51$

m $(\frac{1}{2}x + 3)\lg 4 = (1 - 2x)\lg 5$
$x(\frac{1}{2}\lg 4 + 2\lg 5) = \lg 5 - 3\lg 4$
$x = \frac{\lg 5 - 3\lg 4}{\frac{1}{2}\lg 4 + 2\lg 5} = -0.652$

n $(3y - 2)\lg 2 = (2y + 5)\lg 3$
$y(3\lg 2 - 2\lg 3) = 5\lg 3 + 2\lg 2$
$y = \frac{5\lg 3 + 2\lg 2}{3\lg 2 - 2\lg 3} = -58.4$

o $7^{2x+4} = 11^{3x-4}$
$(2x + 4)\lg 7 = (3x - 4)\lg 11$
$x(3\lg 11 - 2\lg 7) = 4\lg 7 + 4\lg 11$
$x = \frac{4\lg 7 + 4\lg 11}{3\lg 11 - 2\lg 7} = 5.26$

p $3^{x+1} = 2^{4+x}$
$(x + 1)\lg 3 = (4 + x)\lg 2$
$x(\lg 3 - \lg 2) = 4\lg 2 - \lg 3$
$x = \frac{4\lg 2 - \lg 3}{\lg 3 - \lg 2} = 4.13$

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], $\frac{3}{2}$
$y = \frac{\lg \frac{3}{2}}{\lg 2} = 0.58$

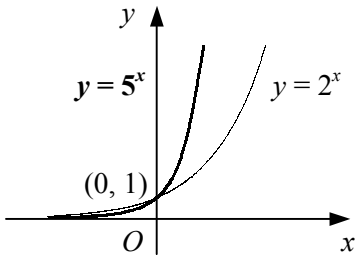
f $3(3^{2x}) - 17(3^x) + 10 = 0$
$(3(3^x) - 2)(3^x - 5) = 0$
$3^x = \frac{2}{3}, 5$
$x = \frac{\lg \frac{2}{3}}{\lg 3}, \frac{\lg 5}{\lg 3} = -0.37, 1.46$

g $5^{2t} + 5(5^t) - 24 = 0$
$(5^t + 8)(5^t - 3) = 0$
$5^t = -8$ [no sols], 3
$t = \frac{\lg 3}{\lg 5} = 0.68$

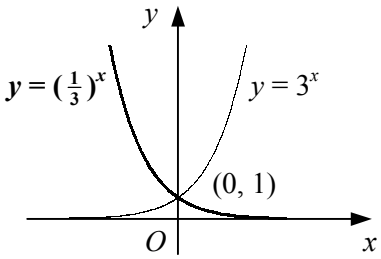
h $3(3^{2x}) - 18(3^x) + 15 = 0$
$3(3^x - 1)(3^x - 5) = 0$
$3^x = 1, 5$
$x = 0, \frac{\lg 5}{\lg 3} = 0, 1.46$

i $3(4^{2x}) - 16(4^x) + 5 = 0$
$(3(4^x) - 1)(4^x - 5) = 0$
$4^x = \frac{1}{3}, 5$
$x = \frac{\lg \frac{1}{3}}{\lg 4}, \frac{\lg 5}{\lg 4} = -0.79, 1.16$

7 **a**



b



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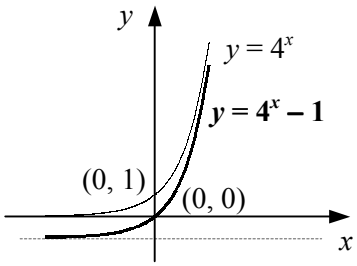
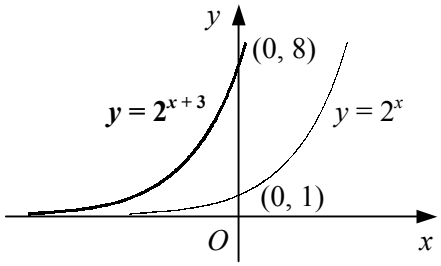
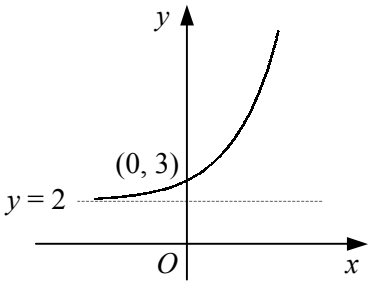


d



8 **a**



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

9 $x = 0 \Rightarrow y = -4$
$y = 0 \Rightarrow 2^x = 5$
$x = \frac{\lg 5}{\lg 2}$
$AB^2 = 4^2 + (\frac{\lg 5}{\lg 2})^2 = 21.391$
$AB = 4.63$