

C_21 More Solving Practice with Solutions

Practice Solving Logarithmic & Exponential Equations

1. Solve each equation for x.

a)
$$6^{3x-6} = 1$$

b)
$$4^{8x} = \frac{1}{16}$$

c)
$$x^{4/5} = 23$$

d)
$$3^x = 125$$

e)
$$65 = e^{7x}$$
 (e is a number, just like π is a number)

f)
$$7(2^x) = 5^{x-2}$$

g)
$$17^{x+4} = 196^{3x-2}$$

2. Solve these logarithmic equations for x.

a)
$$\log_3(4x-1)=2$$

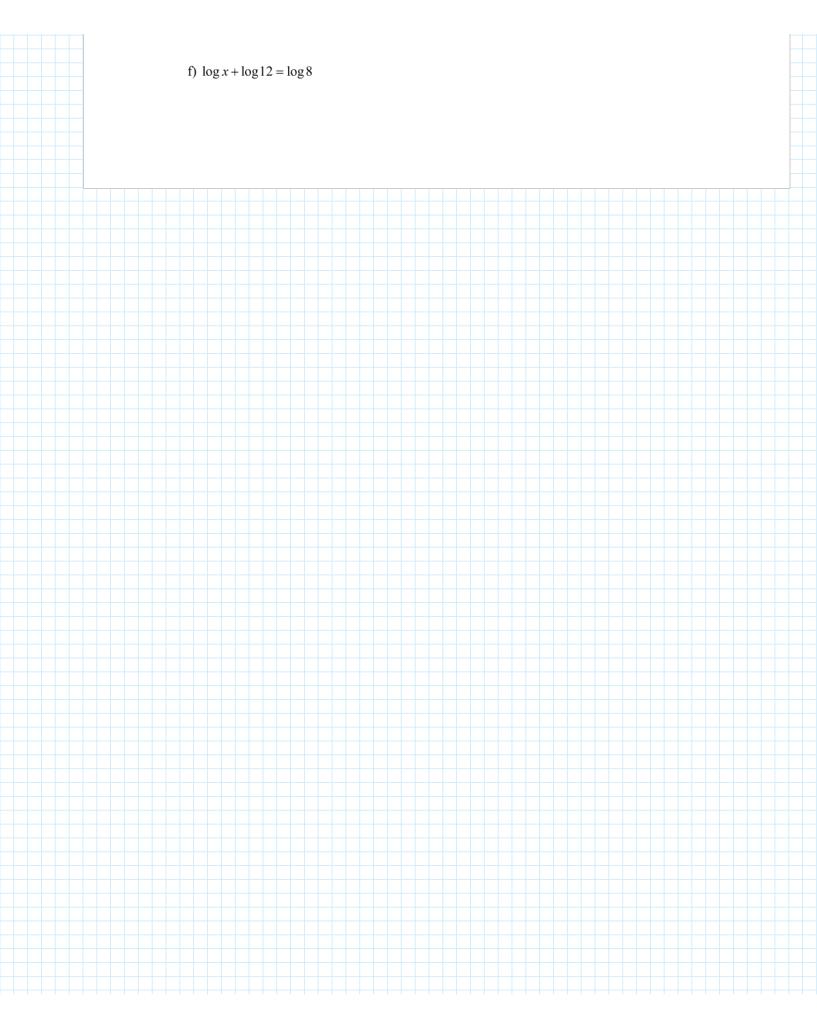
b)
$$\log_5 24 - \log_5 2 = \log_5 3x$$

c)
$$\log(8+2x) = \log(7x-2)$$

d)
$$\log_{2x} 64 = 2$$

e)
$$\log_{x} 125 = 3$$

f)
$$\log x + \log 12 = \log 8$$



3. Solve these logarithmic equations for x.

a)
$$x \log 26 = \log 13$$

b)
$$\log(5x+4) = 3$$

c)
$$\log_4 188 = x$$

d)
$$\log 42 = \log 14 - \log x$$

e)
$$\ln x - \ln 4 = \ln 5$$
 ("ln" means \log_e)

f)
$$\ln x - \ln 4 = 5$$
 (This is NOT the same question as part e)

g)
$$\log_2(x^2+8) - \log_2 6 = \log_2 x$$

h)
$$\log_5 (3x+1) + \log_5 (x-3) = 3$$

i)
$$\log_2(x-2) + \log_2 x = \log_2 3$$

j)
$$\log_5(x-6) = 1 - \log_5(x-2)$$

k)
$$2\log_3 x - \log_3 (x+3) - 3 = 0$$

1)
$$\log_5(x+1) + \log_5(x-3) = 1$$

Solutions

1. Solve each equation for x.

a)
$$6^{3x-6} = 1$$

$$3x = 6 = 0$$

$$3x = 6$$

$$X = 2$$

b)
$$4^{8x} = \frac{1}{16}$$

$$H^{8X} = \frac{1}{4^2}$$

$$H^{8X} = H^{-2}$$

$$\Rightarrow 8x = -2$$

$$x = -\frac{2}{8}$$

$$x = -\frac{1}{4}$$

c)
$$x^{4/5} = 23$$

$$(X^{4/5})^{5/4} = (23)^{5/4}$$

$$\sqrt{X = 50.37}$$

d)
$$3^{x} = 125$$

$$| \log 3^{x} | = \log 125$$

$$| \times \log 3 | = \log 125$$

$$| \times = \frac{\log 125}{\log 3}$$

$$| \times = 4.39$$

$$|\log 6^{3x-6}| = |\log 1|$$

$$(3x-6) \log 6 = |\log 1|$$

$$3x \log 6 - 6 \log 6 = |\log 1|$$

$$3x \log 6 = |\log 1 + 6 \log 6|$$

$$\times (3 \log 6) = |\log 1 + 6 \log 6|$$

$$\times (3 \log 6) = |\log 1 + 6 \log 6|$$

$$X = |\log 1 + 6 \log 6|$$

$$(3 \log 6)$$

(log17 - 3 log 196)



- 2. Solve these logarithmic equations for x.
- a) $\log_3(4x-1)=2$

$$3^{2} = 4x - 1$$

$$9 = 4x - 1$$

$$10 = 4x$$

$$4 = 5$$

b) $\log_5 24 - \log_5 2 = \log_5 3x$

$$\log_{5} \left(\frac{27}{2}\right) = \log_{5} 3x$$

$$\log_{5} (12) = \log_{5}^{3x}$$

$$\Rightarrow |2 = 3x \qquad x = 4$$

c)
$$\log(8+2x) = \log(7x-2)$$

$$\Rightarrow 8+2x = 7x-2$$

$$-\frac{5}{5}x = -\frac{10}{-5}$$

$$x = 2$$

$$d)\log_{2x}64 = 2$$

$$\left(2x\right)^{2} = 64$$

$$\frac{4x^{2}}{x^{2}} = \frac{64}{4}$$

$$x^{2} = 16$$

$$x = \pm 4$$

$$x =$$

e)
$$\log_{x} 125 = 3$$

$$\sqrt[3]{\chi} = \sqrt[3]{12.5}$$

f) $\log x + \log 12 = \log 8$

$$|\log(12x)| = \log 8$$

$$\Rightarrow \frac{12}{12}x = \frac{8}{12}$$

$$X = \frac{8}{12}, \quad X = \frac{2}{3}$$

- 3. Solve these logarithmic equations for x.
- a) $x \log 26 = \log 13$

$$X = \frac{\log 13}{\log 26}$$

$$X = 0.79$$

b)
$$\log(5x+4)=3$$

$$|0|^3 = 5x+4$$

$$|0|0| = 5x+4$$

$$10^{3} = 5x + 4$$
 $1000 = 5x + 4$
 $996 = 5x$

$$X = \frac{996}{5}$$
 $X = 199.2$

c) $\log_4 188 = x$

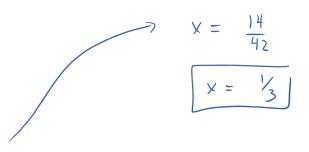
$$X = \frac{\log 188}{\log 4}$$
 (Change of base law)
$$X = \frac{3.78}{\log 4}$$

d)
$$\log 42 = \log 14 - \log x$$

$$\log 42 = \log \left(\frac{14}{x}\right)$$

$$\Rightarrow 42 = \frac{14}{x}$$

$$\frac{42}{42}x = \frac{14}{42}$$



e) $\ln x - \ln 4 = \ln 5$ ("ln" means \log_e)

$$\ln\left(\frac{x}{4}\right) = \ln 5$$

$$\Rightarrow \quad \frac{x}{4} = 5$$

$$x = 20$$

f) $\ln x - \ln 4 = 5$ (This is NOT the same question as part e)

$$\ln \left(\frac{x}{4}\right) = S$$

$$e^{S} = \frac{x}{4}$$

$$x = 4e^{S}$$

g)
$$\log_2(x^2+8) - \log_2 6 = \log_2 x$$

$$\log_{2} \left(\frac{x^{2} + 8}{6} \right) = \log_{2} x$$

$$\Rightarrow \frac{x^{2} + 8}{6} = x$$

$$x^{2} + 8 = 6x$$

$$x^{2} - 6x + 8 = 0$$

$$(x - 2)(x - 4) = 0$$

h)
$$\log_{3}(3x+1) + \log_{3}(x-3) = 3$$

$$\log_{5} \left[(3x+1)(x-3) \right] = 3$$

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$$\log_{5} \left((3x^{2} - 9x + x - 3) \right) = 3$$

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k)
$$2\log_3 x - \log_3 (x+3) - 3 = 0$$

$$|\log_3 x^2 - \log_3 (x+3)| = 3$$

$$|\log_3 (\frac{x^2}{x+3})| = 3$$

$$|\log_3 (x+3)| = |x^2|$$

$$|\log_3 ($$

1)
$$\log_{5}(x+1) + \log_{5}(x-3) = 1$$

 $\log_{5}\left[(x+1)(x-3)\right] = 1$
 $\log_{5}\left[(x+1)(x-3)\right] = 1$