

$$\begin{aligned} \text{NPV: } 10 - 3x &\leq 0 \\ 10 &\leq 3x \\ \frac{10}{3} &\leq x \\ x &\geq 3.\bar{3} \end{aligned}$$

Logarithmic Equations

Solve each equation.

1) $\log 5x = \log (2x + 9)$ NPV: $x \leq 0$
 $5x = 2x + 9$ $x \leq -4.5$
 $3x = 9$
 $x = 3$

2) $\log (10 - 4x) = \log (10 - 3x)$ NPV: $10 = 4x \leq 0$
 $10 - 4x = 10 - 3x$
 $0 = x$ ✓
 $\frac{10}{4} \leq x$
 $2.5 \leq x$

3) $\log (4p - 2) = \log (-5p + 5)$ NPV: $4p - 2 \leq 0$
 $4p - 2 = -5p + 5$ $4p \leq 2$
 $9p = 7$ $p \leq \frac{1}{2}$
 $p = \frac{7}{9}$ NPV: $-5p + 5 \leq 0$
 $-5p \leq -5$
 $p \geq 1$

4) $\log (4k - 5) = \log (2k - 1)$ NPV: $4k - 5 \leq 0$
 $4k - 5 = 2k - 1$ $4k \leq 5$
 $2k = 4$ $k \leq \frac{5}{4}$
 $k = 2$

5) $\log (-2a + 9) = \log (7 - 4a)$
 $-2a + 9 = 7 - 4a$ NPV: $-2a + 9 \leq 0$
 $2a = -2$ NPV: $7 - 4a \leq 0$ $-2a \leq -9$
 $a = -1$ $-4a \leq -7$ $2a \geq 9$
 $a \geq \frac{7}{4}$ $a \geq 4.5$

6) $2 \log_7 (-2r) = 0$
 $\log_7 (-2r) = 0 = \log_7 1$
 $-2r = 1$ NPV: $-2r \leq 0$
 $r = -\frac{1}{2}$ $2r \geq 0$

7) $-10 + \log_3 (n + 3) = -10$
 $\log_3 (n + 3) = 0$ NPV: $n + 3 \leq 0$
 $\log_3 (n + 3) = \log_3 1$ $n \leq -3$
 $n + 3 = 1$
 $n = -2$

8) $-2 \log_5 7x = 2$
 $\log_5 (7x) = 2$
 $\log_5 \frac{1}{49x} = \log_5 25$
 $\frac{1}{49x^2} = 25$
 $1 = 25(49)x^2$
 $x = \sqrt{\frac{1}{1225}}$
 $x = \frac{1}{35}$ NPV: $7x \leq 0$
 $x \leq 0$

9) $\log -m + 2 = 4$ NPV: $-m \leq 0$
 $\log(-m) = 2$ $m \geq 0$
 $\log(-m) = \log 100$
 $-m = 100$
 $m = -100$

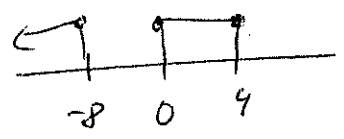
10) $-6 \log_3 (x - 3) = -24$
 $\log_3 (x - 3) = 4$ NPV: $x - 3 \leq 0$
 $\log_3 (x - 3) = \log_3 81$ $x \leq 3$
 $x - 3 = 81$
 $x = 84$

11) $\log_{12} (v^2 + 35) = \log_{12} (-12v - 1)$
 $v^2 + 35 = -12v - 1$ NPV: $v^2 + 35 \leq 0$
 $v^2 + 12v + 36 = 0$ $v^2 \leq -35$
 $(v + 6)(v + 6) = 0$ ND!
 $-12v - 1 \leq 0$

12) $\log_9 (-11x + 2) = \log_9 (x^2 + 30)$ NPV: $x^2 + 30 \leq 0$
 $-11x + 2 = x^2 + 30$ $x^2 \leq -30$
 $0 = x^2 + 11x + 28$ ND
 $0 = (x + 7)(x + 4)$ NPV: $-11x + 2 \leq 0$
 $x = -7$ $-11x \leq -2$

NPV: $16 + 2b \leq 0$
 $2b \leq -16$
 $b \leq -8$

$b^2 - 4b \leq 0$
 $b(b-4) \leq 0$
 $b \geq 0, b-4 \leq 0$
 $b \leq 4$



NPV: $n^2 + 12 \leq 0$
 $n^2 \leq -12$
 never

13) $\log(16 + 2b) = \log(b^2 - 4b)$
 $16 + 2b = b^2 - 4b$
 $0 = b^2 - 6b - 16$
 $0 = (b - 8)(b + 2)$
 $b = 8$
 $b = -2$

14) $\ln(n^2 + 12) = \ln(-9n - 2)$ NPV: $-9n - 2 \leq 0$
 $n^2 + 12 = -9n - 2$
 $n^2 + 9n + 14 = 0$
 $(n + 2)(n + 7) = 0$
 $n = -2, n = -7$

$-9n \leq 2$
 $n \geq -\frac{2}{9}$

15) $\log x + \log 8 = 2$
 $\log 8x = \log 100$ NPV: $x \leq 0$
 $8x = 100$
 $x = \frac{100}{8}$
 $x = 12.5$

16) $\log x - \log 2 = 1$ NPV: $x \leq 0$
 $\log \frac{x}{2} = \log 10$
 $\frac{x}{2} = 10$
 $x = 20$

17) $\log 2 + \log x = 1$ NPV: $x \leq 0$
 $\log 2x = \log 10$
 $2x = 10$
 $x = 5$

18) $\log x + \log 7 = \log 37$ $x \leq 0$
 $\log 7x = \log 37$
 $7x = 37$
 $x = \frac{37}{7}$

19) $\log_8 2 + \log_8 4x^2 = 1$ NPV: $x^2 \leq 0$
 $\log_8 8x^2 = \log_8 8$ never
 $8x^2 = 8 \Rightarrow$ No NPV
 $x^2 = 1$
 $x = \pm 1$

20) $\log_9 (x + 6) - \log_9 x = \log_9 2$ NPV: $x \leq 0$
 $\log_9 \frac{(x+6)}{x} = \log_9 2$ $x+6 \leq 0$
 $\frac{x+6}{x} = 2$ $x \leq -6$
 $x(x+6) = 2x$
 $x = -6$

21) $\log_6 (x + 1) - \log_6 x = \log_6 29$
 $\log_6 \frac{(x+1)}{x} = \log_6 29$ $x = \frac{1}{28}$
 $\frac{x+1}{x} = 29$ NPV: $x \leq 0$
 $x+1 = 29x$ $x \leq -1$

22) $\log_5 6 + \log_5 2x^2 = \log_5 48$ No NPV
 $\log_5 12x^2 = \log_5 48$
 $12x^2 = 48$
 $x^2 = 4$
 $x = \pm 2$

23) $\ln 2 - \ln(3x + 2) = 1$ NPV: $3x \leq -2$
 $\ln \frac{2}{3x+2} = \ln e$ $\frac{2}{e-2} = 3x$
 $2 = (3x+2)e$ $x = \frac{2-2e}{3e}$
 $\frac{2}{e} = 3x+2$ $x = -3.1$

Nicht
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24) $\ln(-3x - 1) - \ln 7 = 2$ NPV: $-3x - 1 \leq$
 $\ln \frac{-3x-1}{7} = \ln e^2$ $-3x \leq$
 $-3x - 1 = 7e^2$ $x \geq$
 $-3x = 7e^2 + 1$
 $x = -\frac{7e^2 + 1}{3}$ ok

25) $\ln(x - 3) - \ln(x - 5) = \ln 5$
 $\frac{x-3}{x-5} = 5$ NPV: $x \leq 3$
 $x - 3 = 5x - 25$ $x \leq 5$
 $+22 = 4x$

26) $\ln(4x + 1) - \ln 3 = 5$ NPV: $4x \leq -1$
 $\frac{4x+1}{3} = e^5$ $x \leq -\frac{1}{4}$
 $4x + 1 = 3e^5$
 $4x = 3e^5 - 1$