Disequazioni logaritmiche intere

indice

Gli esercizi sono proposti in ordine di difficoltà crescente.

nota: in un file così lungo e complesso può accadere che sia presente un errore di diversa natura nonostante gli esercizi siano stati controllati più volte. Saremo grati di ricevere segnalazioni di eventuali refusi o suggerimenti di qualsiasi natura.

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1. risolvere le seguenti disequazioni utilizzando la definizione ed i teoremi sui logaritmi

1	$log\, x > 0$	$x > 1$
2	$log\, x \leq 0$	$0 < x \leq 1$
3	$log\, x > 1$	$x > 10$
4	$log\, x \leq 1$	$0 < x \leq 10$
5	$ln\, x > 0$	$x > 1$
6	$ln\, x > 1$	$x > e$
7	$log_3 x < 2$	$0 < x < 9$
8	$log_{\frac{1}{3}} x > 0$	$0 < x < 1$
9	$log_2 x < 0$	$0 < x \leq 1$
10	$log_{\frac{1}{3}} x > 2$	$0 < x < \frac{1}{9}$
11	$log_9 x \leq 10$	$0 < x \leq 9^{10}$
12	$log_{\frac{1}{2}} x > -1$	$0 < x < 2$
13	$log_3 x \leq 1$	$0 < x \leq 3$
14	$log_5 x > 2$	$x > 25$

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15	$log_1 x \geq 9$	$\emptyset$
16	$log_0 x > 4$	$\emptyset$
17	$log_{-6} x < 6$	$\emptyset$
18	$log_{\frac{1}{2}} x \leq 3$	$x \geq \frac{1}{8}$
19	$log_{\frac{1}{3}} x > 4$	$0 < x < \frac{1}{81}$
20	$log_{\frac{1}{10}} x < -3$	$x > 10^3$
21	$log_5 x < \frac{1}{2}$	$0 < x < \sqrt{5}$
22	$log_{\frac{1}{3}} x > \frac{1}{2}$	$0 < x < \frac{\sqrt{3}}{3}$
23	$log_{\frac{1}{5}} x \leq -\frac{1}{3}$	$x \geq \sqrt[3]{5}$
24	$log_{\frac{1}{4}} x \geq -4$	$0 < x \leq 4^4$
25	$log_{100} x > -\frac{1}{2}$	$x > \frac{1}{10}$
26	$log_{0,09} x \leq \frac{1}{2}$	$x \geq \frac{3}{10}$
27	$log_{\frac{27}{125}} x < -\frac{1}{3}$	$x > \frac{5}{3}$
28	$log_{\frac{32}{3}} x \geq -\frac{1}{5}$	$x \geq \frac{\sqrt[5]{3}}{2}$

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29	$log_{0,0016}\, x \geq \frac{1}{4}$	$0 < x \leq \frac{1}{5}$
30	$log_{\frac{3}{4}}\, x < -\frac{2}{3}$	$x > \frac{2\sqrt[3]{6}}{3}$
31	$log_{\frac{7}{6}}\, x \leq -\frac{3}{2}$	$0 < x \leq \frac{6\sqrt{42}}{49}$
32	$ln\, 2x \leq 3$	$0 < x \leq \frac{e^3}{2}$
33	$2\, log\, x \geq 1$	$x \geq \sqrt{10}$
34	$log_2\, 2x > \frac{1}{2}$	$x > \frac{\sqrt{2}}{2}$
35	$ln\, x^2 < 1$	$-\sqrt{e} < x < \sqrt{e}$
36	$log_{\frac{2}{3}}\, 2x^2 \leq 2$	$x \leq -\frac{\sqrt{2}}{3} \vee x \geq \frac{\sqrt{2}}{3}$
37	$log_{\frac{1}{3}}\, x + 3 > 0$	$0 < x < 27$
38	$log_{\frac{1}{3}}(x + 3) > 0$	$-3 < x < -2$
39	$ln(x - 1) \geq 2$	$x \geq 1 + e^2$
40	$log_3(1 - 2x) \leq 2$	$-4 \leq x < \frac{1}{2}$
41	$log_{\frac{4}{3}}(1 - 7x) > -2$	$x < \frac{1}{16}$
42	$ln(x + 1) < 0$	$-1 < x < 0$

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43	$log_2(3x+1)-1>0$	$x>\frac{1}{3}$
44	$ln(x+2)<0$	$-2<x<-1$
45	$ln(x+1)\geq -2$	$x\geq \frac{1}{e^2}-1$
46	$log_3(2x-1)<-1$	$\frac{1}{2}<x<\frac{2}{3}$
47	$log_{\frac{1}{2}}(x-2)\geq 0$	$2<x\leq 3$
48	$log_4(3x-4)>-\frac{3}{2}$	$x>\frac{11}{8}$
49	$log_2(x-1)\leq 3$	$1<x\leq 9$
50	$2-log_3(3x-7)>0$	$\frac{7}{3}<x<\frac{16}{3}$
51	$2\,log_2(x+1)-1\leq 0$	$-1<x\leq \sqrt{2}-1$
52	$log_{\frac{3}{2}}\frac{x-2}{3}>-2$	$x>\frac{10}{3}$
53	$log_5(x^2+x+1)\geq 1$	$x<\frac{-1-\sqrt{17}}{2}\ \vee x>\frac{-1+\pm\sqrt{17}}{2}$
54	$\sqrt{1+log_{\sqrt{2}}x}\leq= 3$	$\frac{\sqrt{2}}{2}\leq x\leq 16$
55	$log_{0,01}\left(\sqrt{x+1}+2\right)\leq -\frac{1}{2}$	$x\geq 63$
56	$log_6(x^2-x)\leq 1$	$-2\leq x<0\ \vee\ 1<x\leq 3$

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57	$log\frac{x-5}{x+7}>0$	$x<-7$
58	$log_{\frac{1}{3}}\sqrt{x^2-1}<0$	$x<-\sqrt{2}\ \vee\ x>\sqrt{2}$
59	$log_5(x^2-11)-2<0$	$-6<x<-\sqrt{11}\ \vee\ \sqrt{11}<x<6$
60	$log_3(1-x^2)\leq -1$	$-1<x\leq-\sqrt{\frac{2}{3}}\ \vee\ \sqrt{\frac{2}{3}}\leq x<1$
61	$ln(x^2-x)>1$	$x<\frac{1-\sqrt{1+4e}}{2}\vee x>\frac{1+\sqrt{1+4e}}{2}$
62	$log_{\frac{1}{3}}(x^2-x)>log_{\frac{1}{3}}6$	$-2<x<0\ \vee\ 1<x<3$
63	$log_4(2x-1)<log_4 x$	$\frac{1}{2}<x<1$
64	$log_2(x-1)+log_2 x<0$	$1<x<\frac{1+\sqrt{5}}{2}$
65	$log(x-3)-log(2x+1)>0$	$\emptyset$
66	$2\,ln\,2-ln(x+1)<0$	$x>3$
67	$log_2\frac{x-1}{x+1}>1$	$-3<x<-1$
68	$log_{\frac{1}{5}}(2x+2)<log_{\frac{1}{5}}x$	$x>0$
69	$log\frac{x+3}{x-1}>1$	$1<x<\frac{13}{9}$
70	$ln(x-2)>ln(x+3)$	$\emptyset$

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71	$log_{\frac{1}{4}}(3-x) > log_{\frac{1}{4}}(2x+6)$	$-1 < x < 3$
72	$2\,ln\,x - 2\,ln(x+2) > 0$	$\emptyset$
73	$log_{\frac{1}{3}}(2-x) > log_{\frac{1}{3}}(1-2x)$	$x < -1$
74	$log_3(x+4) > log_3(2-x)$	$-1 < x < 2$
75	$log_3(x-1) \leq \frac{1}{2} log_3\, x$	$1 < x \leq \frac{3+\sqrt{5}}{2}$
76	$lnx < 2ln2x$	$x > \frac{1}{4}$
77	$log_2(x^2+4x+3) - log_2(x+1) \geq 0$	$x > -1$
78	$2log_{\frac{1}{2}}(x-1) - log_{\frac{1}{2}}x^2 \geq 0$	$x > 1$
79	$ln(3x+3) \leq ln(x^2-4x-5)$	$x \geq 8$
80	$log_2(2x^2+3) < log_2(x+4)$	$\frac{1-\sqrt{5}}{4} < x < \frac{1+\sqrt{5}}{4}$
81	$log_5(x^2-5x+6) < log_5(x+4)$	$3-\sqrt{7} < x < 2 \vee 3 < x < 3+\sqrt{7}$
82	$log_3\sqrt{x^2-x} > log_3\sqrt{2}$	$x < -1 \vee x > 2$
83	$log_5\sqrt{x-3} \geq \frac{1}{2} log_5(3x-4)$	$\emptyset$
84	$log\frac{x^2-1}{x} \geq log\,2$	$x < 1-\sqrt{2} \vee x > 1+\sqrt{2}$

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85	$log(3x-5)+log(x-2)\geq log\,2$	$x\geq\frac{8}{3}$
86	$log(x-2)-log(x-1)<log\,5$	$x>2$
87	$2log_2\,x\leq 2+log_2(x+3)$	$0<x\leq 6$
88	$log(x-2)+log\,5<log\,x$	$2<x<\frac{5}{2}$
89	$ln2x+ln\frac{x}{2}<ln4$	$0<x<2$
90	$ln\,2+ln\,x<2\,ln(4x-15)$	$x>\frac{9}{2}$
91	$log\,5-log(2x-3)\geq 1$	$\frac{3}{2}<x\leq\frac{7}{4}$
92	$ln\,x+ln\,3>ln(x^2+2)$	$1<x<2$
93	$log\,x+log\left(\frac{1}{x}-x\right)<0$	$0<x<1$
94	$log_3(3x+1)-log_3\,x>2$	$0<x<\frac{1}{6}$
95	$1+log_3\,x-\frac{1}{2}log_3(10x-1)\geq 0$	$\frac{1}{10}<x\leq\frac{1}{9}\ \vee\ x>1$
96	$log_2(3x-1)+log_2\,2>1$	$x>\frac{2}{3}$
97	$ln(x^2-4)\leq ln(x+2)+1$	$2<x\leq 2+e$
98	$log_3(x^2+3x-16)-log_3(x+3)>1$	$x>5$

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99	$log\,4 + log\,x - log\,7 \leq 0$	$0 < x \leq \frac{7}{4}$
100	$ln\,x + ln\,3 < ln\,x^2$	$x > 3$
101	$\frac{1}{2}log(3x-1) + log\,3 > -log\,0{,}1$	$x > \frac{109}{27}$
102	$ln\,7 - ln\,4x + 2\,ln\,x < 1 - ln\,x + ln\,2$	$0 < x < 2\sqrt{\frac{2e}{7}}$
103	$ln(x^2 + 12x + 5) > ln\,2 + ln(x-10)$	$x > 10$
104	$log_{\frac{1}{3}}x - log_{\frac{1}{3}}(x-2) - 2\,log_{\frac{1}{3}}3 \geq 0$	$x \geq \frac{9}{4}$
105	$ln\frac{x}{x+7} + ln(x+7) > ln\,x$	$\emptyset$
106	$log_{\sqrt{2}}(1+x^2) - log_{\sqrt{2}}(x+2) - 2 \geq 0$	$-2 < x \leq -1 \vee x \geq 3$
107	$ln(28-x^3) - ln(7-x) < 2ln(4-x)$	$x < 2 \vee \frac{14}{5} < x < \sqrt[3]{28}$
108	$log(x-1) - 2\,log(x+1) - log\,8 < -2$	$1 < x < \frac{3}{2} \vee x > 9$
109	$ln(x-2) - ln\,3 \leq ln(5-x) - ln\,2$	$2 < x \leq \frac{19}{5}$
110	$log_2(x^2+x+1) > log_2\,7 - log_2(x-1)$	$x > 2$
111	$ln(4x+5) + ln(x-2) < ln3 + ln(5-x)$	$2 < x < \frac{5}{2}$
112	$ln\,10 - ln(x-1) > ln\,8 - ln(x+3)$	$x < 1$

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113	$log(10-x^2)-log\,8 \geq 2\,log\frac{x}{5}-2\,log\frac{\sqrt{2}}{5}$	$0 < x \leq \sqrt{2}$
114	$log(x-1)-2\cdot log(x+1)-log\,8 \geq -2$	$\frac{3}{2} \leq x \leq 9$
115	$log_2(x+1)+log_2\,3 > log_2(x-1)$	$x > 1$
116	$\frac{1}{2}log\left(x+\sqrt{2}\right) < log(2-x^2)-\frac{1}{2}log\left(\sqrt{2}-x\right)$	$-1 < x < 1$
117	$log_4(x^2+2)-log_4(x^2-1) > log_4\,5-log_4(x+1)$	$x > 1$
118	$log_3(3x-1)+log_3(4-x)-1 \leq log_3(x+2)+log_3(2-x)$	$\frac{1}{3} < x \leq \frac{16}{13}$
119	$log\sqrt{x-3}+log\sqrt{x+3} > log\,4$	$x > 5$
120	$log_3\,4+log_3\,2+2\,log_3\,x > log_3(x^2-3)+log_3(x^2+3)$	$\sqrt{3} < x < 3$
121	$3\,log_2(x+2)-3\,log_2(2x-1)+log_2 4-log_3 9 \geq 0$	$\frac{1}{2} < x \leq 3$
122	$log(2x+2)-log(x-1) < 1-[log(3x-2)-log\,x]$	$\emptyset$
123	$\frac{1}{2}ln(x-1)+ln\sqrt{3} < \frac{1}{2}[ln(5x^2-20)-ln(x-2)]$	$x > 2$
124	$log_2\lvert x^2-x\rvert < 1$	$-1 < x < 2 \ \wedge \ x \neq (0;1)$
125	$log\left(log(x^2-6)\right) < 0$	$-4 < x \leq -\sqrt{7} \ \vee \ \sqrt{7} < x < 4$
126	$log_{\frac{1}{3}}\,log_{\frac{1}{3}}(5x+9) > 0$	$-\frac{26}{15} < x < -\frac{8}{5}$

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127	$log_2 log_3 \frac{3x-1}{x} \geq 2$	$-\frac{1}{78} \leq x < 0$
128	$log_{\frac{1}{3}} log_2(3x-1) < 0$	$x > 1$
129	$log_{2x}(x^2+1) \geq 1$	$x > \frac{1}{2}$
130	$log_x 2 \geq \frac{1}{\sqrt{2}}$	$1 < x \leq 2^{\sqrt{2}}$
131	$log_x 4 > 1$	$1 < x < 4$
132	$log_{x+1} 1 < 0$	$\emptyset$
133	$log_{x-2} 9 \leq 2$	$2 < x < 3 \vee x \geq 5$
134	$log_{\frac{1}{x}} -2 > 2$	$\emptyset$
135	$log_{3-2x} \frac{1}{3} < -2$	$\frac{3-\sqrt{3}}{2} < x < 1$
136	$log_x x \geq 0$	$0 < x < 1 \vee x > 1$
137	$log_x(2x+3) < 2$	$0 < x < 1 \vee x > 3$
138	$2\, log_{3x-1} 4 > 1$	$\frac{2}{3} < x < \frac{17}{3}$
139	$log_x \lvert x-3 \rvert \geq 1$	$1 < x \leq \frac{3}{2}$

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140	$log_{x+1}\|x^2+x\| \leq log_{x+1}\|x^2-3x+2\|$	$0 < x \leq \frac{1}{2}$

2. risolvere le seguenti disequazioni utilizzando anche una variabile ausiliaria

141	$log_2^2 x + log_2 x - 2 > 0$	$0 < x < \frac{1}{4} \vee x > 2$
142	$log^2 x + 3\,log\,x + 2 < 0$	$10^{-2} < x < 10^{-1}$
143	$log_3^2 x - 3log_3 x + 2 \leq 0$	$3 \leq x \leq 9$
144	$log_2^2 x - 4log_2 x + 4 > 0$	$x > 0 \wedge x \neq 4$
145	$log_2^2 x - log_2 x^3 + 2 \geq 0$	$0 < x \leq 2 \vee x \geq 4$
146	$log_2^2\, x + log_2\, x - 12 \leq 0$	$\frac{1}{16} \leq x \leq 8$
147	$log_3^2 x + log_3 x - 12 \leq 0$	$\frac{1}{81} \leq x \leq 27$
148	$ln^2 x - 3lnx - 4 \geq 0$	$0 < x \leq \frac{1}{e} \vee x \geq e^4$
149	$ln^2\, x - 2\,ln\, x + 1 > 0$	$x > 0 \wedge x \neq e$
150	$2\,log^2\, x - 3\,log\, x + 1 > 0$	$0 < x < \sqrt{10} \vee x > 10$
151	$2\,log^2\, x + 9\,log\, x + 4 < 0$	$10^{-4} < x < 10^{-\frac{1}{2}}$
152	$2\,log^2\, x - 5\,log\, x > 7$	$0 < x < \frac{1}{10} \vee x > 10^{\frac{7}{2}}$

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153	$4\,log^2 x + 3\,log\,x > 1$	$0 < x < 10^{-1} \vee x > 10^{\frac{1}{4}}$
154	$4\,log_2^2 x + 3\,log_2 x < 1$	$\frac{1}{2} < x < \sqrt[4]{2}$
155	$2\,log^2 x + 3 \leq 7\,log\,x$	$\sqrt{10} \leq x \leq 10^3$
156	$3\,log^2 x + log\,x \geq -4$	$x > 0$
157	$4log_{\frac{1}{2}}^2 x - 5\,log_{\frac{1}{2}} x + 1 < 0$	$\frac{1}{2} < x < \frac{\sqrt[4]{8}}{2}$
158	$3log_2^2 x - 7\,log_2 x + 2 > 0$	$0 < x < \sqrt[3]{2} \vee x > 4$
159	$3ln^2 x + 5\,ln\,x - 2 \geq 0$	$0 < x \leq e^{-2} \vee x \geq \sqrt[3]{e}$
160	$3log_2^2 x + 5\,log_2 x < 8$	$2^{-\frac{8}{3}} < x < 2$
161	$log^2 x - 4\,log\,x > 0$	$0 < x < 1 \vee x > 10^4$
162	$2 - 4\,log^2 x \geq 0$	$10^{-\frac{\sqrt{2}}{2}} \leq x \leq 10^{\frac{\sqrt{2}}{2}}$
163	$log_{\frac{4}{3}}^2 2x - 2log_{\frac{4}{3}} 2x - 8 < 0$	$\frac{9}{32} < x < \frac{128}{81}$
164	$log_{\frac{1}{2}}^2 (x+1) > 1$	$-1 < x < -\frac{1}{2} \vee x > 1$
165	$-2ln^2 x + lnx + 1 > 0$	$\frac{\sqrt{e}}{e} < x < e$
166	$3(logx + 1) > 5\,log^2 x$	$10^{\frac{3-\sqrt{69}}{10}} < x < 10^{\frac{3+\sqrt{69}}{10}}$

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167	$(2\log x - 5)\log x < 3 - \log x$	$10^{\frac{2-\sqrt{10}}{2}};\ 10^{\frac{2+\sqrt{2}}{2}}$
168	$\log_2^2 x - \log_2 x^3 + 2 \geq 0$	$0 < x \leq 2 \ \vee \ x \geq 4$
169	$\log x\,(\log x + 1) + 5\log x \geq \log^2 x + 4\log x - 7$	$x \geq 10^{-\frac{7}{2}}$
170	$\log_3 2x^2\,(\log_3 2x^2 - 1) < \log_3 2x^2 + 3$	$-\frac{3\sqrt{6}}{2} < x < -\frac{\sqrt{6}}{6} \ \vee \frac{\sqrt{6}}{6} < x < \frac{3\sqrt{6}}{2}$
171	$\log_3^2(x-1) - 2\log_3(x-1) \geq 3$	$1 < x \leq \frac{4}{3} \ \vee \ x \geq 28$
172	$2\ln^2(x-1) - 5\ln(x-1) + 2 \leq 0$	$\sqrt{e} + 1 \leq x \leq e^2 + 1$
173	$2\log_2^2(2x+1) + \log_2(2x+1) - 1 < 0$	$-\frac{1}{4} < x < \frac{1}{2}(\sqrt{2} - 1)$
174	$2\log_{\frac{1}{2}}^2(1-x) - 5\log_{\frac{1}{2}}(1-x) + 3 \geq 0$	$x \leq \frac{1}{2} \ \vee \ \frac{1}{4}(4 - \sqrt{2}) \leq x < 1$
175	$2\log_3^2(x^2) - 3\log_3(x^2) - 2 \leq 0$	$-3 \leq x \leq -\frac{1}{\sqrt[4]{3}} \ \vee \ \frac{1}{\sqrt[4]{3}} \leq x \leq 3$
176	$4\log_{\frac{1}{3}}^2(x^2+1) - 4\log_{\frac{1}{3}}(x^2+1) + 1 > 0$	R
177	$\log_3^2(x+2) - \log_3(x+2) - 2 \leq 0$	$-\frac{5}{3} \leq x \leq 7$
178	$(\log_2 x^2)^2 + 9\log_2 x + 2 > 0$	$0 < x < \frac{1}{4} \ \vee \ x > \frac{\sqrt[4]{8}}{2}$
179	$\log_3^2(4-x) - 2\log_3(4-x) \leq 0$	$-5 \leq x \leq 3$
180	$3\log_{\frac{1}{2}}^2 x - \left(\log_{\frac{1}{2}} x - 1\right)^2 < 3$	$\frac{1}{2} < x < 4$

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181	$(log_2(3x+4)-1)^2 > log_2 2$	$-\frac{4}{3} < x < -1 \vee x > 0$
182	$log_2 x^3 \left(log_2 x + \frac{7}{3}\right) - 6 \geq 0$	$0 < x \leq \frac{1}{8} \vee x \geq \sqrt[3]{4}$
183	$5\, ln^3 \sqrt{x} + 6\, ln^2 \sqrt{x} - 9 ln \sqrt{x} \leq 2$	$0 < x \leq e^{-4} \vee \frac{\sqrt[5]{e^3}}{e} \leq x \leq e^2$
184	$ln^3 x - 9 ln x > 0$	$e^{-3} < x < 1 \vee x > e^3$
185	$log^3 x - log^2 x < 0$	$0 < x < 10 \wedge x \neq 1$
186	$log^3 x + 2\, log^2 x - 3 log\, x \leq 0$	$0 < x \leq \frac{1}{1000} \vee 1 \leq x \leq 10$
187	$log_3^3 x - log_3^2 x - 2\, log_3 x \leq 0$	$0 < x \leq \frac{1}{3} \vee 1 \leq x \leq 9$
188	$3 log_3^2 \frac{x+1}{x-1} + 7 log_3 \frac{x-1}{x+1} + 2 < 0$	$\frac{5}{4} < x < \frac{1+\sqrt[3]{3}}{\sqrt[3]{3}-1}$
189	$2\, ln^3 x - 4\, ln^2 x + ln\, x - 2 < 0$	$0 < x < e^2$
190	$log_2^4(2x-3) - 5 log_2^2(2x-3) + 4 \leq 0$	$\frac{13}{8} \leq x \leq \frac{7}{4} \vee \frac{5}{2} \leq x \leq \frac{7}{2}$
191	$log_2 x \leq \sqrt{log_2 x + 1}$	$\frac{1}{2} \leq x \leq 2^{\frac{1+\sqrt{5}}{2}}$
192	$2 - log \sqrt{x} \leq \frac{1 - log \sqrt{x}}{2}$	$x \geq 10^6$
193	$\sqrt{ln x} \leq 1 - ln x$	$1 \leq x \leq e^{\frac{3-\sqrt{5}}{2}}$

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194	$log_4^2\|x\| - log_{\|x\|}4 \leq 0$	$-4 \leq x < -1 \vee 1 < x \leq 4$
195	$log_{x-1}^2 3 - log_{x-1}3 - 2 \geq 0$	$\frac{4}{3} \leq x \leq 1+\sqrt{3} \ \wedge \ x \neq 2$
196	$log_{2x+1}^2 27 + log_{2x+1}\frac{1}{27} - 6 \geq 0$	$\frac{\sqrt{3}-9}{18} \leq x \leq 1 \ \wedge \ x \neq 0$

3. risolvere le seguenti equazioni con logaritmi di basi diverse

197	$log_2 x \geq log_3 9$	$x \geq 4$
198	$log_3 x \leq log_4 64$	$0 < x \leq 27$
199	$log_{\frac{1}{2}} x + 8log_{49}7 > 0$	$0 < x < 16$
200	$2\,log_2 x > log_{\frac{1}{4}} 3x$	$x > \frac{\sqrt[5]{81}}{3}$
201	$2\,log_2 x < log_5 25$	$0 < x < 2$
202	$log_5 x - log_{25} x < 1$	$0 < x < 25$
203	$3\,log_9 x + log_3 x < 10$	$0 < x < 81$
204	$log_2 \frac{x}{2} - log_4 3x < 1$	$0 < x < 48$
205	$3log_9 x - log_{\frac{1}{3}} x > 2 - 2log_3 x$	$x > \sqrt[9]{81}$

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206	$log_2(3-2x)-2\,log_{\frac{1}{2}}x \geq 0$	$x=1$
207	$log_2(x-2)-log_4(3x-1) \geq 1$	$x \geq 8+2\sqrt{14}$
208	$log_3^2(3x-1)-log_{\frac{1}{3}}(3x-1)<0$	$\frac{4}{9}<x<\frac{2}{3}$
209	$log_{\frac{1}{2}}(x-1)-log_2(x+1)>3$	$1<x<\frac{3\sqrt{2}}{4}$
210	$log_3(2x-1)+log_{\frac{1}{3}}(x-4)>-1$	$x>4$
211	$(2x-1)\,log_7 2>1+x\,log_{\frac{1}{7}}4$	$x>\frac{ln\,14}{ln\,16}$
212	$log_2(x-1)>log_{\frac{1}{2}}(3-x)-1$	$2-\frac{\sqrt{2}}{2}<x<2+\frac{\sqrt{2}}{2}$
213	$2\,log_3(2x+1)+log_{\frac{1}{3}}x<3-2\,log_9 x$	$0<x<\frac{1}{2}(3\sqrt{3}-1)$
214	$log_{\frac{1}{9}}x-log_{\frac{1}{3}}x+log_4 16 \geq 0$	$x \geq \frac{1}{81}$
215	$log_4(1-x^2)-log_4(5x^2+3)<log_2 x$	$\frac{\sqrt{5}}{5}<x<1$
216	$log_2(x-2)-log_2(3-2x) \geq log_{\frac{1}{2}}4x$	$\emptyset$
217	$log_2 x-log_{\frac{1}{2}}x \geq log_4 9+log_2(x+2)$	$x \geq \frac{1}{2}(3+\sqrt{33})$

Logaritmi: disequazioni intere

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218	$2log_4^2\,(x-1)+log_{\frac{1}{4}}(x-1)>0$	$1<x<2 \ \vee \ x>3$
219	$\frac{1}{2}log_3\,x^2+2\leq -log_{\frac{1}{3}}2$	$-\frac{2}{9}\leq x\leq\frac{2}{9} \ \wedge \ x\neq 0$
220	$log_3^2(x-2)+log_{\frac{1}{3}}(x-2)\leq 6$	$\frac{19}{9}\leq x\leq 29$
221	$log_2^2 x+5log_{\frac{1}{2}}x+6\geq 0$	$0<x\leq 4 \ \vee \ x\geq 8$
222	$log_3^2(2x-1)+2log_{\frac{1}{3}}(2x-1)-3<0$	$\frac{2}{3}<x<14$
223	$2log_4^2 3x+log_{\frac{1}{4}}3x-log_3 3>0$	$0<x<\frac{1}{6} \ \vee \ x>\frac{4}{3}$
224	$log_3^2(x-1)+log_{\frac{1}{3}}(x^2-2x+1)-8>0$	$1<x<\frac{10}{9} \ \vee \ x>82$
225	$log_{\frac{1}{3}}^2 x-log_3\frac{1}{x}-6\leq 0$	$\frac{1}{27}\leq x\leq 9$
226	$log_2^2(x-1)+log_{\sqrt{2}}(x-1)-8>0$	$1<x<\frac{17}{16} \ \vee \ x>5$
227	$log_2(x^2-1)\geq -log_{\frac{1}{2}}4+2\,log_4 x$	$x\geq 2+\sqrt{5}$
228	$log_{\frac{1}{3}}^2(3x+1)+log_3(3x+1)^6\geq -9$	$x>-\frac{1}{3}$
229	$2\,log_{\frac{1}{3}}\left(\frac{1}{3}x-1\right)>2-log_9 x^4$	$x>3$

230	$log_2^4(3x+1)+5log_{\frac{1}{2}}^2(3x+1)-36<0$	$-\frac{1}{4}<x<1$
231	$log_2\sqrt{x-2}-\frac{1}{2}log_{\frac{1}{2}}(2+x)\leq log_4 x$	$2<x\leq\frac{1+\sqrt{17}}{2}$
232	$log_4^2\lvert x\rvert+log_2\lvert x\rvert-3\leq 0$	$-4\leq x\leq-\frac{1}{64}\vee\frac{1}{64}\leq x\leq 4$
233	$log_2\sqrt{x-2}+\frac{1}{2}log_{\frac{1}{2}}(2+x)\leq log_4 x$	$x>2$
234	$log_2^2\lvert x\rvert-log_{\frac{1}{2}}\lvert x\rvert^3-4<0$	$-2<x<-\frac{1}{16}\vee\frac{1}{16}<x<2$
235	$log_2\frac{\sqrt{x^2-1}}{x+4}\geq log_4\frac{(x+4)^2}{(x^2-1)}$	$-4<x\leq-\frac{17}{8}$
236	$log_2\sqrt[3]{x}-log_4 x+log_2 x^2<2$	$0<x<2\sqrt[11]{2}$
237	$log_5\sqrt[16]{5}+2log_{25}x-3log_5 x\geq 0$	$0<x\leq\sqrt[32]{5}$
238	$log_2 x\sqrt{x}+4log_4\sqrt{x}-log_{16}x^{12}-1<0$	$x>\frac{1}{4}$
239	$log_2 ln(x+1)>1-log_4 3$	$x>e^{\frac{2}{\sqrt{3}}}-1$
240	$-log_{\frac{1}{3}}(2x+5)\,(log_3(2x+5)-1)\geq 2$	$-\frac{5}{2}<x\leq-\frac{7}{3}\vee x\geq 2$
241	$log_2\left(1+\sqrt{x+1}\right)+log_2\left(1-\sqrt{x+1}\right)\geq log_4(2-x)$	$\emptyset$

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242	$\frac{1}{5}log_3(x+1) - log_{x+1} 3 > \frac{4}{5}$	$-\frac{2}{3} < x < 0 \vee x > 242$
243	$log_3 x - 2\, log_x 9 \geq 3$	$\frac{1}{3} \leq x < 1 \vee x \geq 81$
244	$log_x 3 \leq 2\, log_{\frac{1}{x}+1} \sqrt{3}$	$0 < x < 1 \vee x \geq \frac{1+\sqrt{5}}{2}$
245	$log_{x+2} 4 + log_4(x+2) \geq 2$	$x > -1$
246	$log_3(3x-1) + log_{3x-1} 9 < 3$	$\frac{1}{3} < x < \frac{2}{3} \vee \frac{4}{3} < x < \frac{10}{3}$

4. risolvere le seguenti equazioni logaritmiche/esponenziali

247	$ln\, 3^x < 0$	$x < 0$
248	$ln\, 2^x > 0$	$x > 0$
249	$log_5 7^x < 1$	$x < log_7 5$
250	$log_2 3^x - 2 \leq 0$	$x \leq \frac{ln\, 4}{ln\, 3}$
251	$log_5 2^{x-1} > \frac{1}{4}$	$x > 1 + \frac{1}{4\, log_5 2}$
252	$ln(1 - e^x) \leq 0$	$x < 0$
253	$ln\, 4^{x^2-6} - ln\, 64 \leq 0$	$-3 \leq x \leq 3$

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254	$ln\,5^x + ln\,5^{-2x} < 0$	$x > 0$
255	$log_2(3^x - 1) \leq 1$	$0 < x \leq 1$
256	$ln(e^x + 1) > 0$	R
257	$log(25^x + 5) < log\,6$	$x < 0$
258	$log_3\left(5^{x^2-4x}\right) \geq 0$	$x \leq 0 \vee x \geq 4$
259	$log_2\,3^x < log_2\,1$	$x < 0$
260	$log_2\,3^{x+1} - log_2\,3^{2x} \geq 0$	$x \leq 1$
261	$ln\,2^{3x-1} + ln\,4^x \leq 0$	$x \leq \frac{1}{5}$
262	$2\,log_4\,3^x > -log_2\,9$	$x > -2$
263	$log\,5^{x+1} - log\,3^{2x} \leq 0$	$x \geq \frac{log\,5}{log\,9 - log\,5}$
264	$log(e^x + 1) > log(e^{2x} - 1)$	$0 < x < \ln 2$
265	$ln(e^{2x} - 1) < ln(1 - e^x)$	$\emptyset$
266	$log\left(5^{1+\sqrt{x}} + 5^{1-\sqrt{x}}\right) \leq 1$	$x = 0$

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PASSED

267	$log_2(4^x + 2^x) - log_2 2 < 0$	$x < 0$
268	$log(2^{x+1} + 3) > log\, 4^x$	$x < log_2 3$
269	$log_{\frac{1}{6}}\left(2\left(\frac{1}{2}\right)^x - 2^x\right) \leq 0$	$x \leq 0$
270	$log_4 7^{-x} > log_4 7 + log_4 1$	$x < -1$
271	$log\, 5^{1-x} - log\, 4 > 1$	$x < -log_5 8$
272	$log(e^x + e) \geq 2$	$x \geq \ln(100 - e)$
273	$ln\, 2^{\frac{x-1}{2}} - 1 \geq 0$	$x \geq 1 + \frac{2}{ln\, 2}$
274	$2\, ln\, 3^{\frac{x-1}{3x+1}} > ln\, 9$	$-1 < x < -\frac{1}{3}$
275	$ln(2^{2x} - 9 \cdot 2^x + 21) \leq 0$	$2 \leq x \leq \frac{ln\, 5}{ln\, 2}$
276	$log_2(2^x + 1) + log_2^2\,(2^x + 1) - 2 \geq 0$	$x \geq 0$
277	$log\, 5 + (x - 2)\, log\, 4 < log(4^x - 11)$	$x > 2$
278	$ln(9^x - 3^x) \geq 0$	$x \geq \frac{ln(\sqrt{5}+1) - ln\, 2}{ln\, 3}$
279	$ln\left(2^{\frac{x^2-x}{x+1}}\right) \leq 0$	$x < -1 \vee 0 \leq x \leq 1$
280	$log\, 2^{3x^2-2x} > \frac{1}{3} log\, 2$	$x < \frac{1}{3}(1-\sqrt{2}) \vee x > \frac{1}{3}(1+\sqrt{2})$

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281	$log_3 2^{x-2} + log_3 4 > 3$	$x > \frac{3\,ln\,3}{ln\,2}$
282	$ln\,3^{\frac{x-2}{x+1}} - ln\,9 \leq 0$	$x \leq -4 \vee x > -1$
283	$log_3\left(9^{x+\frac{3}{2}} - 2\right) \geq x + 1$	$x \geq -1$
284	$1 - log\,3^x \leq log\,2^x$	$x \geq \frac{ln\,10}{ln\,6}$
285	$\frac{3}{2} ln\,2^{x+1} - 2\,ln\frac{1}{2} \geq 1$	$x \geq \frac{1}{3}\left(\frac{2}{ln\,2} - 7\right)$
286	$-2\,log\,4^{2-x} + 5\,log\,2^{x+1} \geq 1$	$x \geq log_{512}80$
287	$-\,ln\,2^x + 2\,ln\,3 < 1 - ln\,4^{-x}$	$x > \frac{ln\,9 - 1}{ln\,8}$
288	$(x+1)\,ln\,3 - ln\frac{1}{9} > 2\,ln\left(\frac{1}{3}\right)^x$	$x > -1$
289	$ln(e^x - 1) + ln(2e^{2x} - 5e^x + 3) \leq ln\,1$	$ln\frac{3}{2} < x \leq ln2$
290	$log_8\left(4^{\frac{1}{x}} + 3 \cdot 2^{\frac{1}{x}}\right) \leq 0$	$\frac{ln\,2}{ln(\sqrt{13} - 3) - ln\,2} \leq x < 0$
291	$3 - x + log_2 3^{2x+1} < 0$	$x < -\frac{ln\,24}{ln\,9 - ln\,2}$
292	$2 - 3x\,log_4 3^x + 2(log_4 9 - log_4 4) \geq 0$	$-\frac{2\sqrt{3}}{3} \leq x \leq \frac{2\sqrt{3}}{3}$
293	$2\,log\,\sqrt[4]{2^x} < 3x\,log\,2 - log\,2 - log\,2^{1-x} + log(4 \cdot 2^x)$	$x > 0$
294	$x\,log_2 3 + log_2 5^x < (2x-1)\,log_2 5 - x\,log_2 5$	$x < -\frac{ln\,5}{ln\,3}$

Logaritmi: disequazioni intere

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295	$log(2^{4x}-1)+2\,log\,3 \geq (1-2x)\,log\,4$	$x \geq log_{16}\left(\frac{4}{3}\right)$
296	$log(4^x-1)+log\,2 \geq log(2^{2x}+3\cdot 2^{x+1}-10)$	$\log_2(-3+\sqrt{19}) < x \leq 1 \vee x \geq 2$
297	$ln\lvert 3^x-1\rvert > x ln\,9$	$x < log_3\left(\frac{\sqrt{5}-1}{2}\right)$
298	$2\,log_3\,4^x < log_{\frac{1}{3}}\,2^{-x}$	$x < 0$
299	$x^2\,log_3\,2^{\frac{1}{x}} - 3\,log_{\frac{1}{3}}\,2 \geq 0$	$-3 \leq x < 0 \vee x > 0$
300	$\frac{2\,log_3\,e^{2x}}{5} - 1 > log_9\,4$	$x > \frac{5}{4} ln\,6$
301	$\frac{2}{3}x\,log_3\,2^x + \frac{3}{2}log_9\,3^x < 0$	$-\frac{9\,ln\,3}{8\,ln\,2} < x < 0$
302	$log(3^{2x}+2)+log_{\frac{1}{10}}(3^x-2) < 1$	$\log_3 5-\sqrt{3} < x < \log_3 5+\sqrt{3}$
303	$ln\,3^x + 2\,log_{3^x}\,e - 3 \leq 0$	$x < 0 \vee \frac{1}{ln\,3} \leq x \leq \frac{2}{ln\,3}$
304	$x log\,2 - 3\,log_{2^x}\,10 - 2 < 0$	$x < -\frac{ln\,10}{ln\,2} \vee 0 < x < 3\frac{ln\,10}{ln\,2}$
305	$3\,log_2\,2^x + 4\,log_4\sqrt{2^x} < 1+\frac{1}{2}log_2\,2^{6x}$	$x > 1$

5. risolvere le seguenti disequazioni di riepilogo

306	$log_{\frac{1}{4}}(x+1) > log_{\frac{1}{4}}(2-x)$	$-1 < x < \frac{1}{2}$
307	$2\,log_2\,x - 3 < 0$	$0 < x < 2^{\frac{3}{2}}$
308	$ln\,5 - ln(x-1) > 2\,ln\,4$	$1 < x < \frac{21}{16}$

Logaritmi: disequazioni intere

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309	$4\,log^2 x \geq 1$	$0 < x < 10^{-\frac{1}{2}} \vee x \geq 10^{\frac{1}{2}}$
310	$log_2^2 x - 4\,log_2 x + 3 < 0$	$2 < x < 8$
311	$log\dfrac{4-x}{x+8} > 0$	$-8 < x < -2$
312	$2\,log_2(x+2) + log_{\frac{1}{2}} x + 1 \geq 0$	$x > 0$
313	$2x\,log\,5 - log\,5 > 1 + x\,log\,25$	$\emptyset$
314	$xln\,3 < ln\,1 - xln\,9$	$x < 0$
315	$ln(x^2 - x) < ln\,6$	$-2 < x < 0 \vee 1 < x < 3$
316	$log\dfrac{6x-4}{5x+8} > 1$	$-\dfrac{21}{11} < x < -\dfrac{8}{5}$
317	$log_2^2 x - 6log_2 x + 8 > 0$	$0 < x < 4 \vee x > 16$
318	$3\,log^2 x + 5\,log\,x < 0$	$10^{-\frac{5}{3}} < x < 1$
319	$log_{\frac{1}{2}} x + log_2 3 - log_2 x \geq 0$	$0 < x \leq \sqrt{3}$
320	$ln(3 \cdot 2^x) > 0$	$x > log_2 \dfrac{1}{3}$

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321	$ln(7-2^x) > ln(4^x+5) - ln\,7$	$x < 2$
322	$log_2^2(2x+1) - log_{\frac{1}{2}}(2x+1) \geq 0$	$-\frac{1}{4} < x \leq -\frac{1}{4} \vee x \geq 0$
323	$3log_{\frac{1}{2}}^2 x - 11log_{\frac{1}{2}} x - 4 < 0$	$\frac{1}{16} < x < \sqrt[3]{2}$
324	$log_2 \frac{5x+4}{2-x} > 1$	$0 < x < 2$
325	$7\,ln\sqrt[3]{x} + ln\,x^2 \leq 5$	$0 < x \leq e^{\frac{15}{13}}$
326	$log_3 \sqrt{x} \geq \frac{1}{2} log_3 x$	$x > 0$
327	$x\,ln\,4 + ln\,3 < 2x\,ln\,3$	$x > \frac{ln\,3}{2(ln\,3 - ln\,2)}$
328	$log_{\frac{1}{2}} 3^{2x-1} > log_2 1 - log_2 3$	$x < 1$
329	$log_{\frac{1}{4}}(x+1) + log_{\sqrt{2}} x - log_2 4x^2 \leq 0$	$x > 0$
330	$ln^2 x^2 - ln\,x^2 + 3 < 0$	$\emptyset$
331	$log_{\frac{3}{4}}^2(x-2) - 2log_{\frac{3}{4}}(x-2) - 3 \geq 0$	$2 < x \leq \frac{155}{64} \vee x \geq \frac{10}{3}$
332	$log_x \frac{x+3}{x-1} > 1$	$1 < x < 3$

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333	$(x-2)\,ln\,4 - ln\,8 > ln\,2 - ln\,7$	$x > \frac{ln\,256 - ln\,7}{ln\,4}$
334	$log\big(log(x^2+2)\big) \geq 0$	$x \leq -2\sqrt{2} \ \vee \ x \geq 2\sqrt{2}$
335	$log(x+5) > log(2-x^2) - log(5-x)$	$-\sqrt{2} < x < \sqrt{2}$
336	$2\,log^2 x + 5\,log\,x - 3 \leq 0$	$10^{-3} \leq x \leq \sqrt{10}$
337	$log^3 x - log\,x > 0$	$\frac{1}{10} < x < 1 \ \vee \ x > 10$
338	$log_2(2^x - 1)\,log_2(2^{x+1} - 2) < 0$	$\log_2 \frac{3}{2} < x < 1$
339	$log_{\frac{1}{2}} x > log_2(x-1)$	$1 < x < \frac{1+\sqrt{5}}{2}$
340	$log(3^x + 1) + log(3^x - 1) \leq 2$	$0 < x \leq \frac{1}{2} log_3 101$
341	$log_2(x-3)^2\,(log_2(x-3) - 2) - log_{\frac{1}{2}}(x-3) < 2$	$\frac{\sqrt{2}}{2} + 3 < x < 7$
342	$3log_3^2 x - log_3 x^2 - log_3 3 \geq 0$	$0 < x < \frac{\sqrt[3]{9}}{3} \ \vee \ x > 3$
343	$log_{\frac{1}{3}}(2x^2 + 6) > log_{\frac{1}{3}}(x^2 + 5x)$	$2 < x < 3$
344	$log\,x + log\left(\frac{1}{x} + x\right) \geq 0$	$x > 0$
345	$log\,\frac{x}{x+2} + log(x+2) > 2$	$x > 100$

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346	$log_x \frac{4x+5}{6-5x} < -1$	$\frac{1}{2} < x < 1$
347	$log \frac{x^2+5x+4}{x^2+5x+6} < 0$	$x < -4 \vee x > -1$
348	$log \frac{x^2+14x+16}{x-1} > 1$	$x > 1$
349	$ln(x+1) \geq 1 + 2\, ln\, x$	$0 < x \leq \frac{1+\sqrt{1+4e}}{2e}$
350	$log_{\frac{1}{2}} \sqrt{4x-4} > log_{\frac{1}{2}} 4 - log_{\frac{1}{2}} \sqrt{5x+4}$	$x \leq -\frac{4}{5} \vee 1 \leq x < \frac{1+\sqrt{161}}{10}$
351	$\frac{1}{2} log\, 4 - log\, 3 + log(x-1) \leq 2 + log\, 3x$	$x > 1$
352	$ln\, 2x + 2\, ln\, x \geq 6 - ln\, x$	$x \geq \frac{e\sqrt[4]{8e^2}}{2}$
353	$\frac{\frac{1}{3} + 2\, log_{\frac{1}{8}} x}{3} - \frac{3\left(\frac{1}{3} + log_{\frac{1}{8}} x\right)}{2} \geq -\frac{2}{3}$	$x \geq \frac{1}{2}$
354	$log_2^2 x + 95 \geq 8\sqrt{6}\, log_2 x$	$0 < x \leq 2^{4\sqrt{6}-1} \vee x \geq 2^{4\sqrt{6}+1}$
355	$log_2 \frac{x+1}{x-1} < log_{\frac{1}{2}} \frac{x^2-3x+2}{x^2+1}$	$-3 < x < -1 \vee x > 2$
356	$log_{\frac{1}{4}}(e^{2x}+1) > log_{\frac{1}{4}} e^x$	$\emptyset$
357	$log_2 e^{3x-1} > log_{\frac{1}{2}} 3$	$x > \frac{1}{3}(1 - ln\, 3)$

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358	$\big((x+1)\,log\,3-1\big)(1+log\,3^{x+1})<0$	$-1-\frac{1}{log\,3}<x<-1+\frac{1}{log\,3}$
359	$ln^2\,x+2\lvert ln\,x\rvert>15$	$0<x<e^{-3}\ \vee\ x>e^3$
360	$log_3\lvert x\rvert\geq -1$	$x\leq-\frac{1}{3}\ \vee\ x\geq\frac{1}{3}$
361	$log_5\frac{1+\lvert x\rvert}{1-\lvert x\rvert}>log_5\,2$	$-1<x<-\frac{1}{3}\ \vee\ \frac{1}{3}<x<1$
362	$log_2\lvert x^2+2\rvert\geq 2-\sqrt{2}$	$x\leq-\sqrt{2}\ \vee\ x\geq\sqrt{2}$
363	$\sqrt{1-x^2}-log_3\lvert x\rvert>0$	$-1<x<1\ \wedge\ x\neq 0$
364	$log(x^2+4\lvert x\rvert)-2log(x+1)\geq 0$	$-1<x\leq-\frac{1}{6}\ \vee\ x\geq\frac{1}{2}$
365	$log\frac{(\lvert x\rvert-1)}{x}<0$	$-1<x<-\frac{1}{2}\ \vee\ x>1$
366	$log_{\frac{1}{2}}\lvert x+2\rvert<3$	$x<-\frac{17}{8}\ \vee\ x>-\frac{15}{8}$
367	$log_x\frac{x}{x-2}<2$	$x>1+\sqrt{2}$
368	$ln^2(x^2-1)+3ln(x^2-1)<0$	$-\sqrt{2}<x<-\sqrt{1+\frac{1}{e^3}}\ \vee\ \sqrt{1+\frac{1}{e^3}}<x<\sqrt{2}$

369	$log_3^2(2x^2 - x) < 1$	$-1 < x < \frac{3-\sqrt{33}}{12} \vee \frac{3+\sqrt{33}}{12} < x < \frac{3}{2}$
370	$log_{\frac{1}{3}}^2(x^2-1) + log_3(x^2-1) - log_3 9 \geq 0$	$x \leq -2 \vee -\frac{\sqrt{10}}{3} \leq x < -1 \vee 1 < x \leq \frac{\sqrt{10}}{3} \vee x \geq 2$
371	$3log_8^2[x(x-2)] < 1 - 2log_{\frac{1}{16}}[x(x-2)]$	$1-\sqrt{1+2^{\frac{3+\sqrt{57}}{4}}} < x < 1-\sqrt{1+2^{\frac{3-\sqrt{57}}{4}}} \vee 1+\sqrt{1+2^{\frac{3-\sqrt{57}}{4}}} < x < 1+\sqrt{1+2^{\frac{3+\sqrt{57}}{4}}}$
372	$log_2(x + 2x^2) - log_3 9 < 1$	$\frac{-1-\sqrt{65}}{4} < x < -\frac{1}{2} \vee 0 < x < \frac{-1+\sqrt{65}}{4}$
373	$log_3 2x^2 - log_3 9 > 1 - 2\,log_{2x^2} 3$	$x < -\frac{3}{\sqrt{2}} \vee -\sqrt{\frac{3}{2}} < x < -\frac{1}{\sqrt{2}} \vee \frac{1}{\sqrt{2}} < x < \sqrt{\frac{3}{2}} \vee x > \frac{3}{\sqrt{2}}$
374	$log_{\frac{1}{2}}^2[x(x+4)] \leq log_{\frac{1}{2}}[x(x+4)]$	$-2-\sqrt{5} \leq x \leq \frac{-4-3\sqrt{2}}{2} \vee \frac{-4+3\sqrt{2}}{2} \leq x \leq -2+\sqrt{5}$