Disequazioni esponenziali intere

Indice

I problemi 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.disequazioni esponenziali risolubili mediante applicazioni delle proprietà delle potenze

1	$2^x > 0$	R
2	$5^x \geq 0$	R
3	$3^x < 0$	$\emptyset$
4	$4^x \leq 0$	$\emptyset$
5	$2^x > 2$	$x > 1$
6	$3^x < 9$	$x < 2$
7	$5^x > 1$	$x > 0$
8	$7^x \geq 1$	$x \geq 0$
9	$2^x \geq 8$	$x \geq 3$
10	$7^x \leq 49$	$x \leq 2$
11	$3^x \leq 81$	$x \leq 4$
12	$3^x > 81$	$x > 4$
13	$5^x > 25$	$x > 2$
14	$1 - 5^{2+x} \geq 0$	$x \leq -2$

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15	$2^{9x+5} > 2^{x-7}$	$x > -\frac{3}{2}$
16	$3^{2x} - 1 < 0$	$x < 0$
17	$2^{3x} - 4 > 0$	$x > \frac{2}{3}$
18	$5^{3x} + 1 > 0$	R
19	$9^x - 3^x \leq 0$	$x \leq 0$
20	$5^x \leq \frac{1}{5}$	$x \leq -1$
21	$\left(\frac{1}{2}\right)^x > 2$	$x < -1$
22	$\left(\frac{1}{3}\right)^x \leq \frac{1}{3}$	$x \geq 1$
23	$\left(\frac{1}{5}\right)^x \geq \frac{1}{5}$	$x \geq \frac{1}{25}$
24	$\left(\frac{1}{4}\right)^x \leq \frac{1}{64}$	$x \geq 3$
25	$5^x \geq \frac{1}{25}$	$x \geq -2$
26	$2^x > \frac{1}{64}$	$x > -6$
27	$\left(\frac{1}{2}\right)^x \leq -1$	$\emptyset$
28	$\left(\frac{1}{25}\right)^x > 625$	$x < -2$

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29	$\left(\frac{1}{49}\right)^{x} < 343$	$x > -\frac{3}{2}$
30	$\left(\frac{1}{7}\right)^{3x+2} < 49$	$x > -\frac{4}{3}$
31	$\left(\frac{1}{4}\right)^{x} < 0$	$\emptyset$
32	$\left(\frac{2}{3}\right)^{\frac{x}{2}} - \frac{9}{4} > 0$	$x < -4$
33	$\left(\frac{1}{2}\right)^{2x} - 8 < 0$	$x > -\frac{3}{2}$
34	$\left(\frac{1}{5}\right)^{\sqrt{x}} > 25$	$\emptyset$
35	$3^{2x} - 3^{x-1} \geq 0$	$x \geq -1$
36	$5^{-2x^2+x+2} < 5^{(2-x)^2}$	$x < \frac{2}{3} \quad \vee \quad x > 1$
37	$4^{2x^2+1} - 16 > 0$	$x < -\frac{\sqrt{2}}{2} \quad \vee \quad x > \frac{\sqrt{2}}{2}$
38	$\left(\frac{2}{3}\right)^{x^2+2} - \left(\frac{27}{8}\right)^{x} < 0$	$x < -2 \quad \vee \quad x > -1$
39	$16^{x^2+x} < 4$	$-\frac{\sqrt{3}+1}{2} < x < \frac{\sqrt{3}-1}{2}$
40	$3^{\sqrt{x^2-9}} \geq 1$	$x \leq -3 \quad \vee \quad x \geq 3$

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41	$3^{3-x} - \left(\frac{1}{3}\right)^{\frac{x-2}{2}} < 0$	$x > 4$
42	$\left(\frac{1}{2}\right)^{\sqrt{3x-2}} > 4^{1-x}$	$x > 2$
43	$2^{\sqrt{6x-x^2}} < 2^{3-2x}$	$0 \leq x < \frac{3}{5}$
44	$5^{\frac{2x-1}{2}} - \left(\frac{1}{25}\right)^{\frac{x+4}{x}} > 0$	$x > 0$
45	$\left(\frac{1}{4}\right)^{-\frac{x}{x+1}} - 16^{\frac{x}{x-1}} < 0$	$x < -3 \ \vee \ -1 < x < 0 \ \vee \ x > 1$
46	$3^{\frac{2x^2-3}{2x-1}} - \frac{1}{3} < 0$	$x < -2 \quad \vee \quad \frac{1}{2} < x < 1$
47	$\frac{2^{3x}}{4^{x+1}} - \left(\frac{1}{2}\right)^{x} > 0$	$x > 1$
48	$\frac{5^{2-x}}{125^{\frac{1}{x}}} < \left(\frac{1}{25}\right)^{x}$	$x < -3 \quad \vee \quad 0 < x < 1$
49	$\sqrt[3]{2^{6x}} < \frac{1}{4} 16^{x^2-1}$	$x < -1 \quad \vee \quad x > \frac{3}{2}$
50	$54 \cdot 3^{2x} \leq 36 \cdot 4^{x}$	$x \leq -\frac{1}{2}$
51	$1 \leq 3^{2x-1} \leq 9$	$\frac{1}{2} \leq x \leq \frac{3}{2}$
52	$-\frac{1}{2} \leq 4^{x} \leq 16^{\frac{1}{x}}$	$x \leq -\sqrt{2} \quad \vee \quad 0 < x \leq \sqrt{2}$

53	$\sqrt{3^x} \leq \left(\frac{1}{9}\right)^{\frac{1}{x^2}} \leq \frac{1}{3}$	$\emptyset$
	2.disequazioni esponenziali risolubili mediante una variabile ausiliaria	
54	$3^{2x} - 10 \cdot 3^x + 9 < 0$	$0 < x < 2$
55	$2^{2x} - 10 \cdot 2^x + 16 < 0$	$1 < x < 3$
56	$5^{2x} - 26 \cdot 5^x + 25 < 0$	$0 < x < 2$
57	$2^{2x} - 3 \cdot 2^x + 2 > 0$	$x < 0 \vee x > 1$
58	$4^x - 5 \cdot 2^x + 4 < 0$	$0 < x < 2$
59	$25^x + 5^x - 30 < 0$	$x < 1$
60	$4^x - 2^{x+1} + 1 > 0$	$x \neq 0$
61	$9^{x+1} + 3^{x+2} \leq 108$	$x \leq 1$
62	$32 \cdot \left(\frac{1}{2}\right)^{2x} < 1 + 4 \cdot \left(\frac{1}{2}\right)^x$	$x > 2$
63	$\left(\frac{1}{2}\right)^{2x} - 3\left(\frac{1}{2}\right)^x - 4 > 0$	$x < -2$
64	$5^{x+2} + 25^{x+1} > 750$	$x > 1$
65	$3^x + 3^{x+2} - 3^{x-1} < 87$	$x < 2$
66	$4^{x+1} - 17 \cdot 2^x + 4 > 0$	$x < -2 \vee x > 2$

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67	$\left(\frac{1}{3}\right)^{2x-3} - 4 \cdot \left(\frac{1}{3}\right)^{x-1} + 1 \leq 0$	$1 \leq x \leq 2$
68	$4^{-x} + \left(\frac{1}{2}\right)^{x} - 2 > 0$	$x < 0$
69	$\left(\frac{1}{49}\right)^{x} - 6 \cdot 7^{-x} - 7 \leq 0$	$x \geq -1$
70	$3^{x} - 2\left(\sqrt{3}\right)^{x} - 3 > 0$	$x > 2$
71	$4^{2x} - 15\left(\frac{1}{2}\right)^{-2x} - 16 \leq 0$	$x \leq 2$
72	$4^{-x^2} - 7\left(\frac{1}{2}\right)^{x^2} - 8 \geq 0$	$\emptyset$
73	$2^{3x-1} - (2^{x-1})^3 \geq 3 \cdot 2^{x}$	$x \geq \frac{3}{2}$
74	$4^{\frac{2}{x}} - 4^{\frac{1}{x}} + 1 > 0$	R
75	$\left(\frac{1}{3}\right)^{\frac{x+1}{2}} - 7\left(\frac{1}{3}\right)^{\frac{x+1}{4}} - 18 < 0$	$x > -9$

3.disequazioni esponenziali risolubili mediante l'uso di logaritmi

76	$2^{x} \geq 6$	$x \geq log_2 6$
77	$5^{2x} > 7^{x}$	$x > 0$
78	$3^{x} > 2$	$x > \frac{ln\,2}{ln\,3}$
79	$2^{3x} \leq 5$	$x \leq \frac{ln\,5}{3\,ln\,2}$

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80	$2^{2+x} > 3^x$	$x < \frac{2}{log_2 3 - 1}$
81	$3^{2x} > 3 \cdot 7^x$	$x > \frac{ln\, 3}{ln\, 9 - ln\, 7}$
82	$\left(\frac{1}{9}\right)^x > 5^x$	$x < 0$
83	$\left(\frac{1}{2}\right)^x \leq 7$	$x \geq log_2 \frac{1}{7}$
84	$\left(\frac{1}{3}\right)^{x+1} > 4$	$x < -\left(1 + \frac{ln\, 4}{ln\, 3}\right)$
85	$\left(\frac{1}{2}\right)^x - 3 < 0$	$x > -\frac{ln\, 3}{ln\, 2}$
86	$\left(\frac{1}{9}\right)^x \leq 5$	$x \geq log_9 \frac{1}{5}$
87	$\frac{1}{7^x} > 100^{1-2x}$	$x > \frac{2}{4 + log\, 7}$
88	$\sqrt{3}\left(\frac{1}{5}\right)^{2x} \leq \sqrt{21}$	$x \geq -\frac{1}{4}\frac{ln\, 7}{ln\, 5}$
89	$10^{x+1} < 5^{2x}$	$x > \frac{1}{log 25 - 1}$
90	$6^{\frac{x}{2}} > 4^x$	$x < 0$
91	$3^{\frac{x-1}{2}} + 2 < 0$	$\emptyset$
92	$27^x \cdot 5^{3x-2} < 9^{x+1}$	$x < \frac{2\, ln\, 15}{ln\, 375}$
93	$3^{x+2} - 5^x \geq 3^x$	$x \leq \frac{ln\, 8}{ln\, 5 - ln\, 3}$

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94	$3^{2x} - 3^{x+1} + 2 < 0$	$0 < x < \frac{ln\,2}{ln\,3}$
95	$7 \cdot 2^{2x} + 20 \cdot 2^{x} - 3 > 0$	$x > -\frac{ln\,9}{ln\,2}$
96	$9^{x} - 3^{x+1} + 2 < 0$	$0 < x < log_3\,2$
97	$3^{2x} - 5 \cdot 3^{x} + 6 \geq 0$	$x \leq log_3 2 \quad \vee \quad x \geq 1$
98	$3^{x+1} \geq 2^{1-x}$	$x \geq log_6\left(\frac{2}{3}\right)$
99	$2^{x+2} < 3^{2x+1}$	$x > \frac{ln4 - ln3}{ln9 - ln2}$
100	$5^{x} - 3 \cdot 5^{1-x} \leq 2$	$x \leq 1$
101	$3^{x+1} + 3^{x-1} < 3$	$x < 2 - \frac{ln10}{ln3}$
102	$5^{x+1} + 5^{x-1} + 5^{x} < 5$	$x < 2 - \frac{ln31}{ln5}$
103	$25^{x} - 6 \cdot 5^{x} + 9 \geq 0$	R
104	$49^{x} - 2 \cdot 7^{x} + 1 < 0$	$\emptyset$
105	$1 + \frac{1}{4} \cdot 25^{x} \leq 5^{x}$	$x = \frac{ln2}{ln5}$
106	$2 - 2^{x+1} < 3^{x} - 6^{x}$	$0 < x < \frac{ln2}{ln3}$
107	$2^{x} + 3 \cdot 2^{1-x} \geq 5$	$x \leq 1 \quad \vee \quad x \geq \frac{log3}{log2}$

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108	$3^{2x} - 6 \cdot 3^{x} - 6 \cdot 3^{-x} + 11 > 0$	$0 < x < \frac{\ln 2}{\ln 3} \quad \vee \quad x > 1$
109	$3 \cdot 5^{x} + 5 \cdot 3^{2x} < 2 \cdot 9^{x+1}$	$x > \frac{\ln 13 - \ln 3}{\ln 5 - \ln 9}$
110	$3(e^{2x} - 3^{x}) > e^{2x} + 5 \cdot 3^{x}$	$x > \frac{\ln 4}{2 - \ln 3}$
111	$20 \cdot 3^{x} - 2^{x} > 2 \cdot 3^{x} + 2^{x+1}$	$x > \frac{\ln 6}{\ln 2 - \ln 3}$
112	$10^{\sqrt{2x+4}} > 4^{x}$	$-2 \le x < \frac{1 + \sqrt{1 + 4\,log^2 4}}{log^2 4}$
113	$7 - 4^{\frac{x}{2}-1} \le 0$	$x \ge 2\left(\frac{\ln 7}{\ln 4} + 1\right)$
114	$2^{x-1} > \frac{1}{2\sqrt[5]{3}}$	$x > -\frac{\ln 3}{5 \ln 2}$
115	$\left(\frac{2}{3}\right)^{2x-1} > \frac{10}{\sqrt{2}}$	$x < \frac{1}{2}\left(1 + \frac{1}{2}\frac{2 \ln 10 - \ln 2}{\ln 2 - \ln 3}\right)$
116	$2^{x} > \frac{7}{3^{2x+1}}$	$x > \frac{\ln 7 - \ln 3}{\ln 18}$
117	$\sqrt{3^{\,2x+4}} > 2^{x}$	$x > -\frac{\ln 9}{\ln 3 - \ln 2}$
118	$\left(\frac{1}{\sqrt{2}}\right)^{x-4} \ge 3^{x+1}$	$x \le \frac{\ln 16 - \ln 9}{\ln 18}$
119	$2^{3x-1} - \sqrt{7} \cdot 7^{x} > 0$	$x > \frac{\ln 28}{\ln 64 - \ln 49}$
120	$\frac{2^{x-1} \cdot \sqrt{3}^{x+1}}{3} < \left(\frac{1}{2}\right)^{x}$	$x < \frac{\ln 12}{\ln 48}$
121	$9 \cdot 2^{x} + 4 \cdot 2^{-x} > 12$	$x \ne 1 - \frac{\ln 3}{\ln 2}$

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122	$9^x - 4 \cdot 15^x + 4 \cdot 25^x > 0$	$x \neq \frac{ln3}{ln2 - ln5}$

4.disequazioni esponenziali di riepilogo

123	$1 - 3^{x+1} \geq 0$	$x \leq -1$
124	$\left(\frac{2}{7}\right)^{5x} - \left(\frac{49}{4}\right)^{3-2x} \geq 0$	$x \leq -6$
125	$(0{,}5)^{x-2} - 2^{-2x} \leq 0$	$x \leq -2$
126	$\frac{1}{3^{x^2}} < \frac{1}{9}$	$x < -\sqrt{2} \ \vee \ x > \sqrt{2}$
127	$4^{\frac{x^2-x}{x+1}} \leq 1$	$x < -1 \ \vee \ 0 \leq x \leq 1$
128	$3^{\frac{2}{x}} - 3^{\frac{1}{x}} + 1 > 0$	$x \neq 0$
129	$\left(\frac{1}{3}\right)^{(x-2)^2} < \left(\frac{1}{3}\right)^{4(x-3)}$	$x \neq 4$
130	$3^x - 2\left(\frac{1}{3}\right)^x \geq -1$	$x \geq 0$
131	$\left(\frac{1}{7}\right)^{\sqrt{x^2-x}} \geq \left(\frac{1}{7}\right)^{\sqrt{2}}$	$-1 \leq x \leq 0 \ \vee \ 1 \leq x \leq 2$
132	$3^{\sqrt{x^2-9}} \geq 0$	$x \leq -3 \ \vee \ x \geq 3$

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133	$2^{4(x+1)} - 25 \cdot 2^{2x} + 9 \geq 0$	$x \leq log_2 3 - 2 \quad \vee \quad x \geq 0$
134	$49^x + \frac{1}{7^{2x}} \leq 2$	$\emptyset$
135	$3^{-2x+1} - 4\left(\frac{1}{3}\right)^x + 1 \leq 0$	$0 \leq x \leq 1$
136	$2^{\sqrt{x+1}} \leq 4$	$-1 \leq x \leq 3$
137	$3^{\sqrt{x-2+x^2}} < 3^{2-x}$	$x \leq -2 \vee 1 \leq x < \frac{6}{5}$
138	$\sqrt{2^{x^2} - \frac{1}{2}} \geq \frac{2}{3}$	R
139	$3^{2-x} > \sqrt{\left(\frac{1}{3}\right)^{x-4} \cdot 9^{-x}}$	$x > 0$
140	$\left(\frac{1}{2}\right)^{x^2-2} \cdot 4 < 8^{3-x}$	R
141	$\frac{4 \cdot 2^x}{\frac{1}{2} - 1} + 8^x < 0$	$x < \frac{3}{2}$
142	$3^{2x+1} \geq 5^{1-x}$	$x \geq \frac{ln5 - ln3}{ln5 + ln9}$
143	$7^{1+x} - 1 \geq 7^{x-1}$	$x \geq \frac{ln7 - ln48}{ln7}$
144	$3^{2-x} + 45 < 64 - 2 \cdot 3^x$	$-\frac{ln2}{ln3} < x < 2$

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145	$15 \cdot 3^x > -6^{1-x}$	R
146	$2^{x+1} - 3^{x-1} > 2^x$	$x < \frac{ln3}{ln3 - ln2}$
147	$25^x + 30 \geq 13 \cdot 5^x$	$x \leq \frac{ln3}{ln5} \vee x \geq \frac{ln5 + ln2}{ln5}$
148	$2 \cdot (2 - 3^x)^2 - 3 \cdot (2 - 3^x) + 1 < 0$	$0 < x < 1 - \frac{ln2}{ln3}$
149	$3^{2x-1} - 5^x \geq 2 \cdot 5^{x+1}$	$x \geq \frac{ln33}{ln9 - ln5}$
150	$3 \cdot 4^x \geq 2^{x+2} - 10$	R
151	$3^x - 4^{x+1} > 0$	$x < -\frac{ln\,4}{ln\,4 - ln\,3}$
152	$5 \cdot 3^{x-1} > 4^{x+1}$	$x < \frac{ln12 - ln5}{ln3 - ln4}$
153	$\sqrt{4^x + 2} < 2^x + 1$	$x > -1$
154	$5 \cdot \left(\frac{2}{5}\right)^{3x} + 3\left(\frac{4}{25}\right)^x - 12 \cdot \left(\frac{2}{5}\right)^x + 4 > 0$	$x < 0 \vee x > 1$
155	$a^{\sqrt{4-x}} > a^{3x-2} \quad a > 0$	$x < \frac{11}{9}$
156	$\sqrt[4]{3^{3x-2}} > \sqrt[3]{3^{x-2}}$	$x > -\frac{2}{5}$
157	$\left(\frac{e}{2}\right)^{2x-1} - 2\left(\frac{e}{2}\right)^{\frac{2x-1}{2}} + 1 > 0$	$x \neq \frac{1}{2}$

158	$\frac{3^{2x-1}\cdot 2^x}{5} > \left(\frac{1}{3}\right)^{-x}$	$x > \frac{ln\,15}{ln\,6}$
159	$\left(\frac{1}{10}\right)^{\frac{2}{x-1}} > 3^{2(x+1)}$	$x < 1$
160	$\left(\frac{1}{2}\right)^{\sqrt{2x^2+7x-4}} - 8^{\,2x+1} > 0$	$x \leq -4$
161	$e^x - 5 \geq \sqrt{7 - e^x}$	$ln6 \leq x \leq ln7$
162	$3^{2x} - \sqrt{3}\cdot 2^x > 0$	$x > \frac{ln\,3}{ln\,81 - ln\,4}$
163	$3^{x+1} + 2^{x+1} \leq 3^x + 5\cdot 2^x$	$x \leq 1$
164	$3\cdot 5^x - 13\cdot 3^{2x} < 0$	$x > \frac{ln\,13 - ln\,3}{ln\,5 - ln\,9}$
165	$2^{x-2} - 7^{2x+1} < 0$	$x > \frac{ln\,28}{ln\,2 - log\,49}$
166	$3^{\frac{x+1}{x}}\cdot 6 > 2^{\frac{2x+1}{x}}$	$x < -\frac{ln\,3 - ln\,2}{ln\,9 - ln\,2} \quad \vee \quad x > 0$
167	$5^{\frac{3x-2}{3}}\cdot\left(\frac{1}{2}\right)^x > 2^{1+x}$	$x > \frac{ln\,200}{ln\,125 - ln\,64}$
168	$3\cdot\left(\frac{2}{3}\right)^x - 2 < \sqrt{9\cdot\left(\frac{4}{9}\right)^x + 4}$	R

5.disequazioni esponenziali di riepilogo più impegnative

169	$\lvert 3^{2x} + 3^x\rvert < 2$	$x < 0$
170	$3^{4x} - 3^{3x} - 7\cdot 3^{2x} + 3^x + 6 \geq 0$	$x \leq 0 \vee x \geq 1$

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171	$4^{2x+1} - 7 \cdot 3^{2x} > \frac{7}{3} \cdot 9^x + 16^{x-1}$	$x > \frac{3}{2}$
172	$3 \cdot 3^{\sqrt{x}} - 9^{\sqrt{x}} + 4 \geq 0$	$0 \leq x \leq 4log_3 4$
173	$\lvert 3^x - 1 \rvert + 3 \cdot 3^x - 3 < 0$	$x < 0$
174	$x^{\sqrt{x+1}} > 0$	$x > 0$
175	$\left(\frac{1}{2}\right)^{\frac{\lvert x+1 \rvert}{1-x}} - 4 > 0$	$1 < x < 3$
176	$5^{\left\lvert \frac{2x+1}{3-x} \right\rvert} < 5$	$-4 < x < \frac{2}{3}$
177	$5 \cdot \left(\frac{1}{2}\right)^{2x-1} < 9^{x+\frac{1}{2}} < 4^{-x-1}$	$\emptyset$
178	$2^{x+1} \leq 3^{-x} \leq 2 \cdot 5^{\frac{x+2}{3}}$	$-\frac{3\,ln\,2 + 2\,ln\,5}{3\,ln\,3 + ln\,5} \leq x \leq -\frac{ln\,2}{ln\,2 + ln\,3}$
179	$7^{\left(\frac{1}{25^x} - \frac{2}{5^x - 25^x}\right)} > 7^{\frac{1}{(5^x-1)^2}}$	$x < \frac{ln(1+\sqrt{2}/2)}{ln\,5} \quad \vee \quad x > \frac{ln(1+\sqrt{2}/2)}{ln\,5}$
180	$\sqrt{2^{3x+1}} + 3^{2x+1} \geq 3^{2x} + \sqrt{2^{3x+2}}$	$x \geq \frac{ln\,2 - ln(2-\sqrt{2})}{\frac{3}{2}ln\,2 - 2\,ln\,3}$
181	$2\lceil 4^x - 2 \rceil + \lceil 4^x + 2 \rceil + \lceil 4^x + 1 \rceil > 7$	$x > \frac{1}{2}$
182	$\lceil 4^x - 3 \rceil + \lceil 4^x - 2 \rceil + \lceil 4^x - 1 \rceil > 6$	$x < 1$