

Equazioni esponenziali

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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.


1. equazioni esponenziali risolubili mediante applicazioni delle proprietà delle potenze ↑

1	$2^x = 4$	2
2	$3^x = 1$	0
3	$5^x = 25$	2
4	$2^x = 8$	3
5	$3^x = -3$	<i>impossibile</i>
6	$4^x = 16$	2
7	$7^x = 7$	1
8	$2^x = 0$	<i>impossibile</i>
9	$5^{2x} = 1$	0
10	$2^{2x} = 8$	$\frac{3}{2}$
11	$6^x = 36$	2
12	$3^x = 81$	4
13	$5^x = 125$	3
14	$2^{5x} = 32$	1
15	$4^x = 8$	$\frac{3}{2}$


16	$49^x = 7$	2
17	$10^x = 0,01$	-2
18	$2^{2x} = 8$	$\frac{3}{2}$
19	$3^x - 3 = 0$	1
20	$\left(\frac{1}{3}\right)^x = 3$	-1
21	$5^x = \frac{1}{25}$	-2
22	$\left(\frac{1}{8}\right)^x = \frac{1}{256}$	$\frac{8}{3}$
23	$49^x = \frac{1}{7}$	$-\frac{1}{2}$
24	$5^{x^2} = \frac{1}{25}$	<i>impossibile</i>
25	$\left(\frac{1}{3}\right)^{x+1} = 9$	-3
26	$\left(\frac{2}{3}\right)^{-3x} = \frac{27}{8}$	1
27	$3^{x+2} = 81$	2
28	$5^x = \left(\frac{1}{5}\right)^5$	-5
29	$7^{x+1} = \left(\frac{1}{7}\right)^{5+x}$	-3

30	$3^{2x+3} = \frac{1}{3}$	-2
31	$3^{3x} = \frac{1}{27}$	-1
32	$\left(\frac{7}{3}\right)^{-2x} = \frac{9}{49}$	1
33	$a^x = -2 \quad a > 0 \wedge a \neq 1$	<i>impossibile</i>
34	$a^{6x} = a^{x^2} \quad a > 0 \wedge a \neq 1$	0; 6
35	$8^{x^2-3x} = 1$	0; 3
36	$7^{x^2+4x+3} = \frac{1}{7}$	-2
37	$4^{x+8} = \frac{1}{4^{2x-5}}$	-1
38	$243^{\frac{2}{x}-1} = 27^{2(x+1)}$	$-\frac{5}{2}; \frac{2}{3}$
39	$7^{x^2-4x} - 1 = 0$	0; 4
40	$2^{x^2+x-20} = 1$	-5; 4
41	$3^{x^2-3x+6} = 1$	<i>impossibile</i>
42	$9^{x+2} = 27$	$-\frac{1}{2}$
43	$3^{x+2} = 81$	2

44	$4 \cdot 2^x = 1$	-2
45	$9 \cdot 3^x = 3$	-1
46	$3^{x+2} = 81$	2
47	$\left(\frac{1}{2}\right)^x - 4 = 0$	-2
48	$3^{2x} + 9 = 0$	<i>impossibile</i>
49	$4 \left(\frac{1}{2}\right)^{3x} = 1$	$\frac{2}{3}$
50	$3(3^x - 1) = -2$	-1
51	$7^{x^2-1} - 343 = 0$	-2; 2
52	$4^{\sqrt{x+1}} = 16$	3
53	$4^{\sqrt{x+2}} = 4$	-1
54	$7^{\sqrt{x^2-1}} = 49$	$\sqrt{5}$; $-\sqrt{5}$
55	$4^{\sqrt{x+1}} = 16$	3
56	$2^{x+2} + 2^x = 640$	7
57	$3^{x+1} - 3^x = 162$	4


58	$108 \cdot 3^{2x} = 72 \cdot 4^x$	$-\frac{1}{2}$
59	$(3^x - 1) \left(5^{2x} - \frac{1}{5}\right) = 0$	$0; -\frac{1}{2}$
2. equazioni esponenziali risolubili mediante una variabile ausiliaria		
60	$4^x + 2^x - 2 = 0$	0
61	$e^{2x} + e^x - 2 = 0$	0
62	$3^{2x} - 4 \cdot 3^x + 3 = 0$	$0; 1$
63	$4^x - 6 \cdot 2^x - 16 = 0$	3
64	$9^x - 2 \cdot 3^x + 1 = 0$	0
65	$\left(\frac{1}{2}\right)^{2x} - 5 \left(\frac{1}{2}\right)^x + 4 = 0$	$-2; 0$
66	$10^{2x} + 3 \cdot 10^x + \frac{5}{4} = 0$	<i>impossibile</i>
67	$25^x - 2 \cdot 5^{x+1} + 25 = 0$	1
68	$2^{x+3} + 4^{x+1} = 320$	3
69	$20^{2x+1} + 2 = 9 \cdot 20^x$	<i>impossibile</i>
70	$3^{4\sqrt{x}} - 4 \cdot 3^{2\sqrt{x}} + 3 = 0$	$0; \frac{1}{4}$
71	$16^x - \frac{3}{2}4^x + \frac{1}{2} = 0$	$-\frac{1}{2}; 0$

72	$\left(\frac{1}{3}\right)^{x-1} + \left(\frac{1}{3}\right)^{1-x} = 2$	1
73	$2^{3x-2} - 2^{3x-3} - 2^{3x-4} = 4$	2
74	$3^{2-x} + 3^{x+1} = 12$	0; 1
75	$3^{2x+1} - 28 \cdot 3^x + 9 = 0$	-1; 2
76	$-2 \cdot 5^{x+2} + 25^{x+1} = 375$	1
77	$3^{x+2} + 3^{2-x} = 82$	-2; 2
78	$5^{x+2} - 4 \cdot 5^{1-x} - 30 = -5^{2-x}$	-1; 0
79	$3^{x+1} - 4 \cdot 3^{\frac{x}{2}} + 1 = 0$	-2; 0
80	$4^{x-1} - 3 \cdot 2^{x-1} - 4 = 0$	3
81	$\left(\frac{1}{4}\right)^{\frac{x+1}{3}} - 5 \left(\frac{1}{2}\right)^{\frac{x+1}{3}} + 4 = 0$	-7; 1
82	$\left(\frac{1}{4}\right)^{x^2-2x} - \left(\frac{1}{2}\right)^{\frac{2x^2-4x-1}{2}} = 0$	$\frac{2 \pm \sqrt{2}}{2}$
83	$\frac{4^x + 2^{x+1} + 11}{7} = 2^x + 1$	0; 2
84	$4^{x+8} = \frac{1}{4^{2x-5}}$	-1

85	$\frac{5^{2x} - 125}{5^x - 1} = 0$	$\frac{3}{2}$
3. equazioni esponenziali risolubili mediante l'uso di logaritmi		
86	$2^x = 3$	$\log_2 3$
87	$3^x = 2$	$\log_3 2$
88	$2^x = 5$	$\log_2 5$
89	$2^x = -3$	<i>impossibile</i>
90	$\left(\frac{1}{2}\right)^x = 3$	$\log_{\frac{1}{2}} 3$
91	$\left(\frac{1}{3}\right)^x = \frac{1}{5}$	$\log_3 5$
92	$5^x = 9$	$\log_5 9$
93	$3^{2x} = 2$	$\log_3 \sqrt{2}$
94	$4^{3x} = 5$	$\log_4 \sqrt[3]{5}$
95	$7^{2x} = 5^3$	$\log_7 5\sqrt{5}$
96	$3^x - 4 = 0$	$\log_3 4$
97	$2^{\frac{x}{2}} - 3 = 0$	$2 \log_2 3$
98	$2^{x+1} = 3^x$	$\frac{\ln 2}{\ln 3 - \ln 2}$

99	$3^x = 5^{x-2}$	$\frac{2 \ln 5}{\ln 5 - \ln 3}$
100	$3 \left(\frac{1}{3}\right)^{4x} = 2$	$\frac{1 - \log_3 2}{4}$
101	$\left(\frac{3}{4}\right)^{3x} = 2$	$\frac{\log_3 2}{\frac{4}{3}}$
102	$\left(\frac{3}{2}\right)^{x+1} = 2^x$	$\frac{\ln 3 - \ln 2}{\ln 4 - \ln 3}$
103	$3^{2x} \left(\frac{1}{2}\right)^x = 7$	$\frac{\ln 7}{\ln 9 - \ln 2}$
104	$\left(\frac{2}{3}\right)^{-x+1} = 3$	$1 - \frac{\ln 3}{\ln 2 - \ln 3}$
105	$2^{1-x} = \frac{1}{\sqrt[3]{5}}$	$1 + \frac{\ln 5}{3 \ln 2}$
106	$2^x \cdot 3^x = 10$	$\frac{1}{\log 6}$
107	$3^x = 5^{3(x+1)}$	$\frac{3 \ln 5}{\ln 3 - 3 \ln 5}$
108	$25^x \cdot 7^{x-1} = 2$	$\frac{\ln 14}{\ln 175}$
109	$\frac{5^{2x}}{7^x} = 3$	$-\frac{\ln 3}{\ln 7 - \ln 25}$
110	$2e^{2x} + 5e^x = 3$	$\ln \frac{1}{2}$
111	$3^{x+1} = 2^{1-x}$	$\frac{\log 2 - \log 3}{\log 3 + \log 2}$
112	$3^{2x} - 3^{x+1} = -2$	$0; \frac{\ln 2}{\ln 3}$

113	$9^x - 3^{x+1} + 2 = 0$	$0; \frac{\ln 2}{\ln 3}$
114	$2^{2x} + 2^{x+1} - 1 = 0$	$\log_2(\sqrt{2} - 1)$
115	$\frac{3^{2x} - 3^{x+1}}{2} = -1$	$0; \frac{\ln 2}{\ln 3}$
116	$\frac{3^{x+1}}{2} = 7^x 4^{-x}$	$\frac{\ln 3 - \ln 2}{\ln 7 - \ln 12}$
117	$20 \cdot 7^x - 3 \cdot 2^x = 4 \cdot 7^x + 2^x$	$-2 \frac{\ln 2}{\ln 7 - \ln 2}$
118	$10^{x+3} - 2^{x+4} = 10^{x+2} - 2^x$	$-\frac{\ln 60}{\ln 5}$
119	$\frac{3}{4} \cdot 5^x + 7 \cdot 3^x = \frac{2}{3} \cdot 5^x + 10 \cdot 3^x$	$\frac{2 \ln 6}{\ln 5 - \ln 3}$
120	$5^{\frac{x+1}{2}} - 4 = 0$	$2 \log_5 4 - 1$
121	$7^{2x-1} - 14^{2x} = 0$	$-\frac{\ln 7}{\ln 4}$
122	$3^{2x} = 5 \cdot 2^x$	$\frac{\ln 5}{\ln 9 - \ln 2}$
123	$5^{3x+1} - 2 \cdot 3^x = 0$	$\frac{\ln 2 - \ln 5}{\ln 125 - \ln 3}$
124	$\left(\frac{1}{2}\right)^{-x} = 10^x - 2^{x+1}$	$\log_5 3$
125	$2 + 4^{\frac{x}{2}} = 3^{-x} + 2^x$	$-\frac{\ln 2}{\ln 3}$
126	$3^{2x-1} + 3^{2x-1} = 2 \cdot 5^{2x-1}$	$\frac{1}{2}$

127	$3 \cdot 7^x + 4 \cdot 3^x = 7^x + 10 \cdot 3^x$	$\frac{\ln 6 - \ln 2}{\ln 7 - \ln 3}$
128	$5^{x+1} + 2^{x+1} = 3 \cdot 5^x + 5 \cdot 2^x$	$\frac{\ln 3 - \ln 2}{\ln 5 - \ln 2}$
129	$3^{\frac{2}{x-1}} = 5^{3(x+1)}$	$\pm \frac{\sqrt{3}}{3} \sqrt{\frac{\ln 1125}{\ln 5}}$
130	$7 \cdot 2^{x-1} + 2^x = 3^x - 7 \cdot 3^{x+1}$	<i>impossibile</i>
131	$4^{\frac{x}{2}} + 4^{2x} = 9^{x+1} + 2^x$	$\frac{\ln 9}{\ln 16 - \ln 9}$
132	$5^{2\sqrt{x}} - 5^{\sqrt{x}+1} + 4 = 0$	0; $(\log_5 4)^2$
133	$\frac{2^{2x-3}}{4^{3x}} = \frac{3^x}{2}$	$-\frac{\ln 4}{\ln 48}$
134	$\frac{\sqrt[3]{2^x}}{\sqrt{3^{x+1}}} = 7$	$-\frac{3 \ln 147}{\ln 27 - \ln 4}$
135	$\frac{1}{7^{2x}} - \frac{1}{(7^x - 1)^2} = -\frac{2}{7^x - 7^{2x}}$	$-\frac{\ln 2}{\ln 49}$
4. equazioni esponenziali di riepilogo 		
136	$2^{5x} \cdot 4^x = 1$	0
137	$e^{\frac{x-1}{x^2}} = 1$	1
138	$\left(\frac{1}{2}\right)^{2x^2-3} - 8 = 0$	0
139	$5^{x^2-7x+12} = 1$	3; 4

140	$a^{2x} - \sqrt{a} = 0$	$a > 0 \wedge a \neq 1$	$\frac{1}{4}$
141	$a^{\frac{3x-1}{2x}} - \frac{1}{a^2} = 0$	$a > 0 \wedge a \neq 1$	$\frac{1}{7}$
142	$3^{1-x} = 16$		$1 - \log_3 16$
143	$2^{\frac{x+4}{1-x}} = \frac{1}{4}$		6
144	$\left(\frac{1}{2}\right)^{x+3} - 4 \cdot 64^x = 0$		$-\frac{5}{7}$
145	$\frac{1^{x+3}}{2} - 4 \cdot 64^x = 0$		$-\frac{1}{2}$
146	$\left(\frac{4}{5}\right)^{\frac{x-2}{3}} - \sqrt{\frac{5}{4}} = 0$		$\frac{1}{2}$
147	$(\sqrt[3]{5})^{2x+1} = 125$		4
148	$\frac{4^{x+2} - 2 \cdot 4^{x+1}}{2} = 16^{x+1}$		-1
149	$\frac{5}{3} 3^x = 3 \frac{5^{2x-1}}{5^x}$		2
150	$3^{4-x} = \sqrt[5]{81^{3x-1} \cdot 27^x}$		$\frac{6}{5}$

151	$(\sqrt{a})^{x-1} = (a^{-1})^{x^2-x} \quad a > 0 \wedge a \neq 1$	$-\frac{1}{2}; 1$
152	$3^{4x+2} - 37 \cdot 3^{2x} + 4 = 0$	$-1; \frac{\ln 2}{\ln 3}$
153	$\frac{5^{\sqrt{3x+10}}}{5^x} = 5^4$	$-3; -2$
154	$\left(\frac{2}{3}\right)^{2(x^2-1)} + 2\left(\frac{2}{3}\right)^{x^2-1} - 3 = 0$	± 1
155	$3^{2x} - 3^{2x+3} + 9^{x+2} = 165$	$\frac{1}{2}$
156	$3(2^x + 1)^2 - 2(2^{2x} - 1) = 5(2^x - 1)^2$	2
157	$4^{1+x} - \frac{6}{4^{x-1}} = 20$	$\frac{\ln 6}{\ln 4}$
158	$3^{\frac{x+3}{2}} - 26(\sqrt{3})^{\frac{x+1}{2}} - 9 = 0$	7
159	$5 \cdot \left(\frac{1}{5}\right)^{-3x+1} = 25^{\frac{x}{2}} \cdot \left(\frac{1}{125}\right)^{\frac{x+1}{3}}$	$-\frac{1}{3}$
160	$3^{2x} + 3^{2x-1} = 4 + 9^x$	$\frac{\ln 12}{\ln 9}$
161	$2 - \left(\frac{1}{5}\right)^{3x-1} = \frac{3\left(\frac{1}{5}\right)^{3x-1} - 4\left(\frac{1}{5}\right)^{\frac{3x-1}{2}} + 3}{2}$	$\frac{1}{3}$

162	$\frac{1 + 2^{3x-1}}{2^x + \frac{1}{2}} = 2$	1
163	$2^{3x+1} + 5^{2x+1} = 2^{3x+2} + 5^{2x}$	$\frac{\ln 2}{3 \ln 2 - 2 \ln 5}$
164	$\frac{(2^x + 5)^2}{5} - 5 = 2^x(2^x - 4)$	$\log_2 \frac{15}{2}$
165	$\frac{10^{\frac{2x+2}{x}}}{3^x} = 1$	$\frac{1 \pm \sqrt{1 + \log 9}}{\log 3}$
166	$10^{2\sqrt{x}-1} \cdot 0.1^{\sqrt{x}} = 4$	$(1 + \log 4)^2$
167	$3^{1-2x} - \frac{13}{3^x} = 3^{x+1} - 13$	0; ± 1
168	$25^{\sqrt{x+1}} = 5^{\sqrt{2x-5}}$	<i>impossibile</i>
169	$\left(\frac{3^x + 3}{3^x - 4}\right)^2 - 5\left(\frac{3^x + 3}{3^x - 4}\right) = 0$	$\frac{\ln 23 - \ln 4}{\ln 3}$
170	$2^{2x-1} \cdot 3^x = \frac{1}{2 \cdot 3^x}$	0
171	$\frac{3^{\frac{2x-1}{3x}} \cdot 9^{-x}}{\sqrt{3}} = \left(\frac{1}{3}\right)^{x-1}$	<i>impossibile</i>
172	$\left(\frac{2}{3}\right)^{\sqrt{x}} \cdot 5 = \frac{1}{2}$	$\left(\frac{\ln 10}{\ln 3 - \ln 2}\right)^2$
173	$9^{\frac{1}{x}} - 10\left(\frac{1}{3}\right)^{\frac{x-1}{x}} + 1 = 0$	± 1

174	$\left(\frac{1}{3}\right)^{\frac{2x(x-1)-3}{3}} + 2 \cdot \left(\frac{1}{3}\right)^{\frac{x(x-1)}{3}} = 1$	$\frac{1 \pm \sqrt{13}}{2}$
175	$\sqrt[x]{25} = \left(\frac{1}{5}\right)^{x-4}$	<i>impossibile</i>
176	$\sqrt[4x]{3^{2-x}} = \sqrt[3x]{2^{4x-1}}$	<i>impossibile</i>
177	$a^{x-3} = \sqrt[x]{a^{10}} \quad a > 0 \wedge a \neq 1$	5
178	$2^{\frac{x^2-3x+10}{2}} - 2^{\frac{x^2-3x+14}{4}} - 8 = 0$	1; 2
179	$a^x (1 - a^{3x+4}) = 0 \quad a > 0$	$-\frac{4}{3}$
180	$\left(\left(\frac{1}{4}\right)^{-x} - 16\right)\left(7^x - \frac{1}{49}\right) = 0$	± 2
181	$(7 - 49^{x-1})(\sqrt{3} - 9^{2x-1}) = 0$	$\frac{3}{2}; \frac{5}{8}$
182	$\left(2^{3x^2} - \frac{1}{4}\right)\left(3^{\frac{2x+3}{4}} - 9\right) = 0$	$\frac{5}{2}$
183	$\left(a^{\frac{4x^2-4x+1}{2x}} - 1\right)\left(\frac{1}{a} - a^{2x^2}\right) = 0 \quad a > 0 \wedge a \neq 1$	$\frac{1}{2}$

184	$\left(\sqrt[3]{a^{-2x}} - \frac{1}{a^{2x}}\right)\left(\frac{1}{a^3} - \frac{1}{a^{2x^2+1}}\right) = 0 \quad a > 0 \wedge a \neq 1$	0; ± 1
185	$(9^{2x} - 3)\left(\left(\frac{1}{2}\right)^x - 6 \cdot \left(\frac{1}{2}\right)^{\frac{x}{2}} + 8\right) = 0$	-4; -2; $\frac{1}{4}$
186	$\frac{(\sqrt{2})^{2-x} \cdot 4^{x-1}}{2^{1-2x}} = \frac{1}{2} \cdot 16^{-x}$	$\frac{2}{15}$
187	$\frac{5 - 5^x}{5 + 5^x} - \frac{5 + 5^x}{5^x - 5} = -\frac{10}{3}$	$1 + \log_5 2$
188	$\frac{\left(3^x - \frac{\sqrt{3}}{3}\right)\left(\left(\frac{1}{4}\right)^{x+1} - \left(\frac{1}{2}\right)^x\right)}{9^{2x} - 12 \cdot 3^{2x} + 27} = 0$	-2; $-\frac{1}{2}$
189	$\frac{4\left(\frac{1}{4}\right)^{\frac{x+1}{3}} - 4\left(\frac{1}{2}\right)^{\frac{x+1}{3}} + 1}{3^x - 9} = 0$	<i>impossibile</i>
190	$\frac{5^{2(x^2-1)} - 6 \cdot 5^{\frac{2x^2-3}{2}} + 1}{\left(\frac{1}{2}\right)^{\sqrt{x}} + \sqrt{2}} = 0$	$\frac{\sqrt{2}}{2}$; $\frac{\sqrt{6}}{2}$