Equazioni esponenziali

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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.

Equazioni esponenziali

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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	$3^x = -3$	*impossibile*
6	$4^x = 16$	2
7	$7^x = 7$	1
8	$2^x = 0$	*impossibile*
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	$4^x = 8$	$\frac{3}{2}$

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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	$5^{x^2} = \frac{1}{25}$	*impossibile*
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

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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	$a^x = -2 \qquad a > 0 \ \wedge \ a \neq 1$	*impossibile*
34	$a^{6x} = a^{x^2} \qquad a > 0 \ \wedge \ a \neq 1$	$0; \quad 6$
35	$8^{x^2-3x} = 1$	$0; \quad 3$
36	$7^{x^2+4x+3} = \frac{1}{7}$	-2
37	$4^{x+8} = \frac{1}{4^{2x-5}}$	-1
38	$243^{\frac{2}{x}-1} = 27^{2(x+1)}$	$-\frac{5}{2}; \quad \frac{2}{3}$
39	$7^{x^2-4x} - 1 = 0$	$0; \quad 4$
40	$2^{x^2+x-20} = 1$	$-5; \quad 4$
41	$3^{x^2-3x+6} = 1$	*impossibile*
42	$9^{x+2} = 27$	$-\frac{1}{2}$
43	$3^{x+2} = 81$	2

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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	$3^{2x} + 9 = 0$	*impossibile*
49	$4\left(\frac{1}{2}\right)^{3x} = 1$	$\frac{2}{3}$
50	$3(3^x - 1) = -2$	-1
51	$7^{x^2-1} - 343 = 0$	$-2;\quad 2$
52	$4^{\sqrt{x+1}} = 16$	3
53	$4^{\sqrt{x+2}} = 4$	-1
54	$7^{\sqrt{x^2-1}} = 49$	$\sqrt{5};\quad -\sqrt{5}$
55	$4^{\sqrt{x+1}} = 16$	3
56	$2^{x+2} + 2^x = 640$	7
57	$3^{x+1} - 3^x = 162$	4

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58	$108 \cdot 3^{2x} = 72 \cdot 4^{x}$	$-\frac{1}{2}$
59	$(3^{x} - 1)\left(5^{2x} - \frac{1}{5}\right) = 0$	$0;\quad -\frac{1}{2}$
	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	$3^{2x} - 4 \cdot 3^{x} + 3 = 0$	$0;\quad 1$
63	$4^{x} - 6 \cdot 2^{x} - 16 = 0$	3
64	$9^{x} - 2 \cdot 3^{x} + 1 = 0$	0
65	$\left(\frac{1}{2}\right)^{2x} - 5\left(\frac{1}{2}\right)^{x} + 4 = 0$	$-2;\quad 0$
66	$10^{2x} + 3 \cdot 10^{x} + \frac{5}{4} = 0$	*impossibile*
67	$25^{x} - 2 \cdot 5^{x+1} + 25 = 0$	1
68	$2^{x+3} + 4^{x+1} = 320$	3
69	$20^{2x+1} + 2 = 9 \cdot 20^{x}$	*impossibile*
70	$3^{4\sqrt{x}} - 4 \cdot 3^{2\sqrt{x}} + 3 = 0$	$0;\quad \frac{1}{4}$
71	$16^{x} - \frac{3}{2}4^{x} + \frac{1}{2} = 0$	$-\frac{1}{2};\quad 0$

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

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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	$2^x=-3$	$impossibile$
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	$2^{x+1}=3^x$	$\frac{ln\,2}{ln\,3-ln\,2}$

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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	$\left(\frac{3}{4}\right)^{3x} = 2$	$\frac{log_{\frac{3}{4}}\,2}{3}$
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	$3^{x+1} = 2^{1-x}$	$\frac{log2 - log3}{log3 + log2}$
112	$3^{2x} - 3^{x+1} = -2$	$0;\quad \frac{ln\,2}{ln\,3}$

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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	$3^{2x-1} + 3^{2x-1} = 2 \cdot 5^{2x-1}$	$\frac{1}{2}$

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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	$7 \cdot 2^{x-1} + 2^x = 3^x - 7 \cdot 3^{x+1}$	$impossibile$
131	$4^{\frac{x}{2}} + 4^{2x} = 9^{x+1} + 2^x$	$\frac{ln\,9}{ln\,16 - ln\,9}$
132	$5^{2\sqrt{x}} - 5^{\sqrt{x}+1} + 4 = 0$	$0;\quad (log_5\,4)^2$
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	$\frac{1}{2}^{x+3} - 4 \cdot 64^x = 0$		$-\frac{1}{2}$
146	$\left(\frac{4}{5}\right)^{\frac{x-2}{3}} - \sqrt{\frac{5}{4}} = 0$		$\frac{1}{2}$
147	$\left(\sqrt[3]{5}\right)^{2x+1} = 125$		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	$3^{4-x} = \sqrt[5]{81^{3x-1} \cdot 27^x}$		$\frac{6}{5}$

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151	$\left(\sqrt{a}\right)^{x-1} = (a^{-1})^{x^2-x} \qquad a > 0 \ \wedge \ a \neq 1$	$-\frac{1}{2}; \quad 1$
152	$3^{4x+2} - 37 \cdot 3^{2x} + 4 = 0$	$-1; \quad \frac{ln\,2}{ln\,3}$
153	$\frac{5^{\sqrt{3x+10}}}{5^x} = 5^4$	$-3; \quad -2$
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	$3^{\frac{x+3}{2}} - 26\left(\sqrt{3}\right)^{\frac{x+1}{2}} - 9 = 0$	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	$2 - \left(\frac{1}{5}\right)^{3x-1} = \frac{3\left(\frac{1}{5}\right)^{3x-1} - 4\left(\frac{1}{5}\right)^{\frac{3x-1}{2}} + 3}{2}$	$\frac{1}{3}$

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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	$10^{2\sqrt{x}-1}\cdot 0.1^{\sqrt{x}}=4$	$(1+log4)^2$
167	$3^{1-2x}-\frac{13}{3^x}=3^{x+1}-13$	$0;\quad \pm 1$
168	$25^{\sqrt{x+1}}=5^{\sqrt{2x-5}}$	$impossibile$
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	$\frac{3^{\frac{2x-1}{3x}}\cdot 9^{-x}}{\sqrt{3}}=\left(\frac{1}{3}\right)^{x-1}$	$impossible$
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	$\sqrt[x]{25} = \left(\frac{1}{5}\right)^{x-4}$	*impossibile*
176	$\sqrt[4x]{3^{2-x}} = \sqrt[3x]{2^{4x-1}}$	*impossibile*
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	$a^x \left(1 - a^{3x+4}\right) = 0 \quad a > 0$	$-\frac{4}{3}$
180	$\left(\left(\frac{1}{4}\right)^{-x} - 16\right)\left(7^x - \frac{1}{49}\right) = 0$	± 2
181	$(7 - 49^{x-1})\left(\sqrt{3} - 9^{2x-1}\right) = 0$	$\frac{3}{2}$; $\frac{5}{8}$
182	$\left(2^{3x^2} - \frac{1}{4}\right)\left(3^{\frac{2x+3}{4}} - 9\right) = 0$	$\frac{5}{2}$
183	$\left(a^{\frac{4x^2-4x+1}{2x}} - 1\right)\left(\frac{1}{a} - a^{2x^2}\right) = 0$ $\quad a > 0 \ \wedge \ a \neq 1$	$\frac{1}{2}$

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

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