

Exercises of Quadratic and biquadratic equations

1) Find all real solutions of the following equations:

a) $x^2 - 144 = 0$

b) $x^2 - 10x = 0$

c) $x^2 - 16 = 0$

d) $x^2 - 3x = 0$

e) $-x^2 + 169 = 0$

f) $3x^2 = -42x$

2) Find out all real solutions of the following quadratic equations:

a) $6x^2 - 11x = 0$

b) $4x^2 = 9$

c) $8x^2 + 5x = 0$

d) $-1 = -4x^2$

e) $9x^2 + 11x = 0$

f) $9k^2 - 4 = 0$

3) Find all real solutions of the following equations:

a) $9x^2 - 8 = 0$

b) $-2x^2 + 1 = 0$

c) $9x^2 - 71 = 0$

d) $4x^2 + 13 = 0$

e) $14x^2 = 3$

f) $9x^2 - 14 = 0$

4) Find out all real solutions of the following quadratic equations:

a) $2x^2 = 26x - 80$

b) $-x^2 + 6x + 55 = 0$

c) $x^2 - 15x + 36 = 0$

d) $-23x = -x^2 - 132$

e) $-x^2 + 30x - 224 = 0$

f) $x^2 - 21x + 110 = 0$

5) Find all real solutions of the following equations:

a) $4x^2 - 27x + 38 = 0$

b) $6x^2 - 11x + 5 = 0$

c) $5x^2 - 3x = 2$

d) $9x^2 + 15x + 4 = 0$

e) $-12x^2 + 23x - 11 = 0$

f) $4x^2 = -8x - 3$

6) Find all real solutions of the following equations:

a) $-22x = -x^2 - 104$

b) $3x^2 - 14x - 7 = 0$

c) $9x^2 - 12x - 46 = 0$

d) $x^2 - 28x + 152 = 0$

e) $12x^2 + 40x + 35 = 0$

f) $-x^2 + 18x - 64 = 0$

7) Solve the following equations:

a) $\frac{x^2 - 10x}{10} = \frac{7x^2 - 25x - 30}{20}$

b) $\frac{8x^2 + 5x + 18}{20} = \frac{9x - 10}{4} + \frac{9}{5}$

c) $\frac{2x^2 + 10x}{3} = \frac{11x^2 - 5x - 48}{12}$

d) $\frac{8x^2 + 16x + 53}{48} = \frac{8x^2 - 1}{16} - \frac{5}{6}$

e) $\frac{5x^2 - 10x}{8} = \frac{19x^2 - 50x - 56}{24}$

f) $\frac{5x^2 + 17}{6} + \frac{1}{3} = \frac{17x^2 + 4x - 13}{18}$

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8) Solve the following equations:

a) $\frac{-6x^2 + 29x - 18}{12} = \frac{4x - 15}{6}$

b) $\frac{-x^2 - 16}{7} - 2 = \frac{17x^2 - 35x - 106}{28}$

c) $\frac{19x^2 + 30x + 77}{18} = \frac{5x^2 + 7}{6}$

d) $\frac{x^2 + 44x - 49}{70} = \frac{3x^2 + 2x + 3}{10} - \frac{12}{7}$

e) $\frac{8x^2 + 19x + 75}{20} = \frac{-x + 13}{4}$

f) $\frac{-9x^2 - 27x + 61}{30} = \frac{-6x - 16}{15} + \frac{9}{10}$

9) Solve the following equations:

a) $\frac{5x^2 + 11x + 6}{12} = \frac{13x^2 - 11x - 30}{24}$

b) $\frac{3x^2 + 34x - 29}{6} = \frac{-10x + 2}{3} + \frac{9}{2}$

c) $\frac{15x^2 - 17x - 61}{60} = \frac{3x - 11}{10}$

d) $\frac{-16x^2 + 9x - 107}{80} = \frac{5x + 1}{16} - \frac{8}{5}$

e) $\frac{-4x + 3}{12} = \frac{3x^2 + 35x + 30}{48}$

f) $\frac{12x + 18}{5} + \frac{7}{2} = \frac{10x^2 - 37x + 12}{20}$

10) Solve the following equations:

a) $\frac{8x - 8}{x + 5} + \frac{8x + 7}{x} = 15$

b) $\frac{4x + 4}{x - 3} - \frac{8x + 6}{x} = -2$

c) $\frac{6x + 8}{x} - 17 = \frac{-7x - 5}{x + 3}$

d) $\frac{5x + 1}{x + 5} + \frac{3x + 7}{x} = 7$

e) $\frac{4x - 8}{x - 3} - \frac{3x + 4}{x} = 4$

f) $\frac{8x + 6}{x} - 9 = \frac{-2x + 12}{x + 3}$

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11) Solve the following equations:

a) $\frac{2x-1}{x+6} - \frac{-3x-5}{x} = -1$

b) $\frac{2x-10}{x} + 15 = \frac{-4x+1}{x+2}$

c) $\frac{5x-9}{x+2} + \frac{-5x-4}{x} = -15$

d) $\frac{3x-6}{x-8} - \frac{8x+7}{x} = -11$

e) $\frac{x-10}{x} + 8 = \frac{-8x}{x+7}$

f) $\frac{x-9}{x-1} + \frac{x+6}{x} = -3$

12) Solve the following equations:

a) $\frac{2x-6}{x-2} + \frac{-4x-11}{x} = 16$

b) $\frac{-x+1}{x-4} - \frac{-3x+8}{x} = 14$

c) $\frac{x-4}{x} - 13 = \frac{-4x-7}{x-1}$

d) $\frac{x-12}{x+1} + \frac{-6x-9}{x} = -15$

e) $\frac{-5x-9}{x+3} - \frac{4x+2}{x} = -18$

f) $\frac{3x-1}{x} - 6 = \frac{-8x+3}{x-7}$

13) Solve the following equations:

a) $-x^4 + 77x^2 + 324 = 0$

b) $-x^4 + 65x^2 - 64 = 0$

c) $-x^4 + 10x^2 - 9 = 0$

d) $x^4 - 50x^2 + 49 = 0$

e) $x^4 - 5x^2 + 4 = 0$

f) $x^4 - 80x^2 - 81 = 0$

14) Solve the following equations:

a) $9x^4 - 85x^2 + 36 = 0$

b) $9x^4 - 82x^2 + 9 = 0$

c) $-49x^4 + 113x^2 - 64 = 0$

d) $-4x^4 - 23x^2 + 6 = 0$

e) $25w^4 - 11w^2 - 36 = 0$

f) $49x^4 + 48x^2 - 1 = 0$

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Answers:

- 1) a) $x = -12$; $x = 12$ b) $x = 0$; $x = 10$ c) $x = -4$; $x = 4$
 d) $x = 0$; $x = 3$ e) $x = -13$; $x = 13$ f) $x = -14$; $x = 0$
- 2) a) $x = 0$; $x = \frac{11}{6}$ b) $x = \frac{-3}{2}$; $x = \frac{3}{2}$ c) $x = \frac{-5}{8}$; $x = 0$
 d) $x = \frac{-1}{2}$; $x = \frac{1}{2}$ e) $x = \frac{-11}{9}$; $x = 0$ f) $k = \frac{-2}{3}$; $k = \frac{2}{3}$
- 3) a) $x = -\sqrt{\frac{8}{9}} \cong -0.94280904\dots$, $x = \sqrt{\frac{8}{9}} \cong 0.94280904\dots$
 b) $x = -\sqrt{\frac{1}{2}} \cong -0.70710678\dots$, $x = \sqrt{\frac{1}{2}} \cong 0.70710678\dots$
 c) $x = -\sqrt{\frac{71}{9}} \cong -2.8087166\dots$, $x = \sqrt{\frac{71}{9}} \cong 2.8087166\dots$
 d) *No real solution.*
 e) $x = -\sqrt{\frac{3}{14}} \cong -0.46291005\dots$, $x = \sqrt{\frac{3}{14}} \cong 0.46291005\dots$
 f) $x = -\sqrt{\frac{14}{9}} \cong -1.2472191\dots$, $x = \sqrt{\frac{14}{9}} \cong 1.2472191\dots$
- 4) a) $x = 5$; $x = 8$ b) $x = -5$; $x = 11$ c) $x = 3$; $x = 12$
 d) $x = 11$; $x = 12$ e) $x = 14$; $x = 16$ f) $x = 10$; $x = 11$
- 5) a) $x = 2$; $x = \frac{19}{4}$ b) $x = \frac{5}{6}$; $x = 1$ c) $x = \frac{-2}{5}$; $x = 1$
 d) $x = \frac{-4}{3}$; $x = \frac{-1}{3}$ e) $x = \frac{11}{12}$; $x = 1$ f) $x = \frac{-3}{2}$; $x = \frac{-1}{2}$
- 6) a) $x = 11 - \sqrt{17} \cong 6.8768944\dots$, $x = 11 + \sqrt{17} \cong 15.123106\dots$
 b) $x = \frac{7 - \sqrt{70}}{3} \cong -0.45553342\dots$, $x = \frac{7 + \sqrt{70}}{3} \cong 5.1222001\dots$
 c) $x = \frac{2 - \sqrt{50}}{3} \cong -1.6903559\dots$, $x = \frac{2 + \sqrt{50}}{3} \cong 3.0236893\dots$
 d) $x = 14 - \sqrt{44} \cong 7.3667504\dots$, $x = 14 + \sqrt{44} \cong 20.63325\dots$
 e) *No real solution.*
 f) $x = 9 - \sqrt{17} \cong 4.8768944\dots$, $x = 9 + \sqrt{17} \cong 13.123106\dots$
- 7) a) $x = -2$; $x = 3$ b) $x = 1$; $x = 4$ c) $x = -1$; $x = 16$
 d) $x = -2$; $x = 3$ e) $x = -2$; $x = 7$ f) $x = -7$; $x = 5$
- 8) a) $x = \frac{-1}{2}$; $x = 4$ b) $x = \frac{2}{3}$; $x = 1$ c) $x = -4$; $x = \frac{-7}{2}$
 d) $x = -1$; $x = \frac{5}{2}$ e) $x = \frac{-5}{2}$; $x = \frac{-1}{2}$ f) $x = \frac{-11}{3}$; $x = 2$

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- 9) a) $x = \frac{11 - \sqrt{177}}{2} \cong -1.1520673\dots$, $x = \frac{11 + \sqrt{177}}{2} \cong 12.152067\dots$
 b) $x = -9 - \sqrt{101} \cong -19.049876\dots$, $x = -9 + \sqrt{101} \cong 1.0498756\dots$
 c) $x = \frac{7 - \sqrt{37}}{6} \cong 0.15287291\dots$, $x = \frac{7 + \sqrt{37}}{6} \cong 2.1804604\dots$
 d) $x = \frac{-1 - \sqrt{5}}{2} \cong -1.618034\dots$, $x = \frac{-1 + \sqrt{5}}{2} \cong 0.61803399\dots$
 e) $x = \frac{-17 - \sqrt{265}}{2} \cong -16.63941\dots$, $x = \frac{-17 + \sqrt{265}}{2} \cong -0.3605897\dots$
 f) $x = \frac{17 - \sqrt{497}}{4} \cong -1.3233742\dots$, $x = \frac{17 + \sqrt{497}}{4} \cong 9.8233742\dots$
- 10) a) $x = 1$; $x = 35$ b) $x = -1$; $x = 9$ c) $x = -6$; $x = 1$
 d) $x = 5$; $x = 7$ e) $x = -1$; $x = 4$ f) $x = 3$; $x = 6$
- 11) a) $x = -3$; $x = \frac{-5}{3}$ b) $x = \frac{-5}{3}$; $x = \frac{4}{7}$ c) $x = -1$; $x = \frac{8}{15}$
 d) $x = \frac{8}{3}$; $x = \frac{7}{2}$ e) $x = \frac{-70}{17}$; $x = 1$ f) $x = \frac{-3}{5}$; $x = 2$
- 12) a) $x = \frac{23 - \sqrt{2113}}{36} \cong -0.63798277\dots$, $x = \frac{23 + \sqrt{2113}}{36} \cong 1.9157605\dots$
 b) $x = \frac{37 - \sqrt{2905}}{24} \cong -0.7040855\dots$, $x = \frac{37 + \sqrt{2905}}{24} \cong 3.7874188\dots$
 c) $x = \frac{15 - \sqrt{353}}{16} \cong -0.23676839\dots$, $x = \frac{15 + \sqrt{353}}{16} \cong 2.1117684\dots$
 d) $x = \frac{6 - \sqrt{126}}{10} \cong -0.52249722\dots$, $x = \frac{6 + \sqrt{126}}{10} \cong 1.7224972\dots$
 e) $x = \frac{-31 - \sqrt{1177}}{18} \cong -3.6281908\dots$, $x = \frac{-31 + \sqrt{1177}}{18} \cong 0.18374631\dots$
 f) $x = \frac{-17 - \sqrt{149}}{10} \cong -2.9206556\dots$, $x = \frac{-17 + \sqrt{149}}{10} \cong -0.47934444\dots$
- 13) a) $x = \pm 9$ b) $x = \pm 8$; $x = \pm 1$ c) $x = \pm 3$; $x = \pm 1$
 d) $x = \pm 1$; $x = \pm 7$ e) $x = \pm 1$; $x = \pm 2$ f) $x = \pm 9$
- 14) a) $x = \pm 3$; $x = \pm \frac{2}{3}$ b) $x = \pm 3$; $x = \pm \frac{1}{3}$ c) $x = \pm 1$; $x = \pm \frac{8}{7}$
 d) $x = \pm \frac{1}{2}$ e) $w = \pm \frac{6}{5}$ f) $x = \pm \frac{1}{7}$