Uitwerkingen hoofdstuk 10

Wiskunde 2

10.1

a. $x^2 = 9 \to x = \pm\sqrt{9} = \pm3$

b. $4x^2 = 16 \to \sqrt{4x^2} = \pm\sqrt{16} \to 2x = \pm4 \to x = \pm\frac{4}{2} = \pm2$

c. $3x^2 + 1 = 13 \to 3x^2 = 13 - 1 = 12 \to x^2 = \frac{12}{3} = 4 \to x = \pm\sqrt{4} = \pm2$

d. $-2x^2 + 21 = 3 \to -2x^2 = 3 - 21 = -18 \to x^2 = \frac{-18}{-2} = 9 \to x = \pm\sqrt{9} = \pm3$

e. $2x^2 - 48 = 50 \to 2x^2 = 50 + 48 = 98 \to x^2 = \frac{98}{2} = 49 \to x = \pm\sqrt{49} = \pm7$

10.2

a. $3x^2 - 2 = x^2 + 2 \to 3x^2 - x^2 = 2 + 2 \to 2x^2 = 4$

$\to x^2 = 2 \qquad \to \boldsymbol{x = \pm\sqrt{2}}$

b. $x^2 - 15 = 2x^2 - 2 \to \qquad x^2 - 2x^2 = -2 + 15 \to \qquad -x^2 = 13$

$\to x^2 = -13 \qquad$ dus geen oplossing: kwadraat van een getal kan niet negatief zijn

c. $12 - x^2 = x^2 - 4 \to \qquad 12 + 4 = x^2 + x^2 \to \qquad 16 = 2x^2 \to \quad 8 = x^2$

$\to x^2 = 8 \to \quad x = \pm\sqrt{8} \qquad \to x = \pm\sqrt{2*2*2} \qquad \to \boldsymbol{x = \pm2\sqrt{2}}$

d. $3(2 - x^2) = x^2 + 6 \to \qquad 6 - 3x^2 = x^2 + 6 \to \qquad -3x^2 - x^2 = 6 - 6 = 0 \to$
$\to -4x^2 = 0 \to \qquad x^2 = 0 \to \qquad x = 0$

e. $-2(1 - x^2) = x^2 \to \qquad -2 + 2x^2 = x^2 \to \quad 2x^2 - x^2 = 2 \to \qquad x^2 = 2$
$\to \boldsymbol{x = \pm\sqrt{2}}$

10.3

a. $\frac{1}{2}x^2 = 2 \rightarrow \quad x^2 = 4 \rightarrow \quad x = \pm\sqrt{4} \rightarrow \quad x = \pm 2$

b. $\frac{2}{3}x^2 = \frac{1}{2} \rightarrow \quad x^2 = \frac{1}{2} * \frac{3}{2} = \frac{3}{4} \rightarrow \quad x = \pm\sqrt{\frac{3}{4}} \rightarrow x = \pm\frac{\sqrt{3}}{2} = \pm\frac{1}{2}\sqrt{3}$

c. $\frac{3}{2}x^2 = \frac{2}{3} \rightarrow \quad x^2 = \frac{2}{3} * \frac{2}{3} = \frac{4}{9} \rightarrow \quad x = \pm\sqrt{\frac{4}{9}} = \pm\frac{2}{3}$

d. $\frac{4}{5}x^2 = \frac{5}{4} \rightarrow \quad x^2 = \frac{5}{4} * \frac{5}{4} = \frac{25}{16} \rightarrow \quad x = \pm\sqrt{25/16} = \pm\frac{5}{4}$

e. $2x^2 = \frac{9}{4} \rightarrow \quad x^2 = \frac{9}{8} \rightarrow x = \pm\sqrt{\frac{9}{8}} = \pm\frac{3}{2\sqrt{2}} = \pm\frac{3}{2}*\frac{1}{\sqrt{2}} \rightarrow \pm\frac{3}{2}*\frac{1}{\sqrt{2}}*\frac{\sqrt{2}}{\sqrt{2}} =$

$$\pm\frac{3}{2}*\frac{1}{2}\sqrt{2} = \pm\frac{3}{4}\sqrt{2}$$

N.B.

Het is handig om te onthouden dat $\frac{1}{\sqrt{2}}$ hetzelfde is als $\frac{1}{2}\sqrt{2}$ ("half wortel 2") zoals bij vraag e. naar voren kwam.

10.4

a. $\frac{1}{2}x^2 + \frac{2}{3} = \frac{5}{6} \rightarrow \quad x^2 = \left(\frac{5}{6} - \frac{2}{3}\right)*\frac{2}{1} = \frac{1}{6}*2 = \frac{1}{3} \rightarrow \quad x = \pm\sqrt{\frac{1}{3}} = \pm\frac{1}{\sqrt{3}} = \pm\frac{1}{3}\sqrt{3}$

b. $\frac{1}{3}x^2 - \frac{1}{2} = \frac{1}{4} \rightarrow \quad x^2 = \left(\frac{1}{4} + \frac{1}{2}\right)*\frac{3}{1} = \frac{3}{4}*3 = \frac{9}{4} \rightarrow \quad x = \pm\sqrt{\frac{9}{4}} = \pm\frac{3}{2}$

c. $-\frac{2}{5}x^2 - \frac{3}{7} = \frac{4}{3} \rightarrow \quad x^2 = \left(\frac{4}{3} + \frac{3}{7}\right)* -\frac{5}{2} = \left(\frac{28}{21} + \frac{9}{21}\right)* -\frac{5}{2} = \frac{37}{21}* -\frac{5}{2} = -\frac{185}{42}$

kan niet... kwadraat van een getal kan niet negatief zijn: dus geen oplossing.

d. $\frac{1}{8}x^2 + \frac{3}{4} = \frac{5}{2} \rightarrow \quad x^2 = \left(\frac{5}{2} - \frac{3}{4}\right)*\frac{8}{1} = \frac{7}{4}*8 = \frac{56}{4} = 14 \rightarrow x = \pm\sqrt{14}$

e. $\frac{1}{3}\left(x^2 - \frac{1}{2}\right) = \frac{1}{4} \rightarrow \quad \frac{1}{3}x^2 - \frac{1}{6} = \frac{1}{4} \rightarrow x^2 = \left(\frac{1}{4} + \frac{1}{6}\right)*\frac{3}{1} = \frac{5}{12}*3 = \frac{15}{12} = \frac{5}{4} \rightarrow$

$$x = \pm\sqrt{\frac{5}{4}} = \pm\frac{\sqrt{5}}{2} = \pm\frac{1}{2}\sqrt{5}$$

10.5

a. $x(x + 3) = 0 \rightarrow \quad x = 0 \ of \ (x + 3) = 0 \rightarrow \quad x = 0 \ of \ x = -3$

b. $(x + 1)(x - 5) = 0 \rightarrow (x + 1) = \ 0 \ of \ (x - 5) = 0 \rightarrow x = -1 \ of \ x = 5$

c. $(x - 1)(x + 1) = 0 \rightarrow (x - 1) = 0 \ of \ (x + 1) = 0 \rightarrow \ x = 1 \ of \ x = -1$

d. $(x + 7)(x - 2) = 0 \rightarrow (x + 7) = 0 \ of \ (x - 2) = 0 \rightarrow \ x = -7 \ of \ x = 2$

e. $(x - 3)(x + 9) = 0 \rightarrow (x - 3) = 0 \ of \ (x + 9) = 0 \rightarrow \ x = 3 \ of \ x = -9$

10.6

a. $x(2x - 1) = 0 \rightarrow \quad x = 0 \ of \ 2x - 1 = 0 \rightarrow x = 0 \ of \ 2x = 1 \rightarrow \ x = 0 \ of \ x = \frac{1}{2}$

b. $(2x + 1)(x - 3) = 0 \rightarrow \ 2x + 1 = 0 \ of \ x - 3 = 0 \rightarrow \ 2x = -1 \ of \ x = 3$
$$\rightarrow \ x = -\frac{1}{2} \ of \ x = 3$$

c. $(3x + 2)(2x - 3) = 0 \rightarrow 3x + 2 \ = 0 \ of \ 2x - 3 = 0 \rightarrow 3x = -2 \ of \ 2x = 3 \rightarrow$
$$\rightarrow x = -\frac{2}{3} \ of \ x = \frac{3}{2}$$

d. $(5x + 3)(3x - 5) = 0 \rightarrow 5x + 3 = 0 \ of \ 3x - 5 = 0 \rightarrow \ 5x = -3 \ of \ 3x = 5$
$$\rightarrow x = -\frac{3}{5} \ of \ x = \frac{5}{3}$$

e. $(2 - 3x)(3x - 2) = 0 \rightarrow \ 2 - 3x = 0 \ of \ 3x - 2 = 0 \rightarrow 3x = 2 \ of \ 3x = 2$
$$\rightarrow x = \frac{2}{3} \ of \ x = \frac{2}{3} \rightarrow x = \frac{2}{3}$$

10.7

a. $3(x-1)(x+3) = 0 \rightarrow \quad x-1 = 0 \; of \; x+3 = 0 \rightarrow x = 1 \; of \; x = -3$

b. $5(x-1)(x+5) = 0 \rightarrow \quad x-1 = 0 \; of \; x+5 = 0 \rightarrow x = 1 \; of \; x = -5$

c. $-2(2x+1)(3x-4) = 0 \rightarrow \quad 2x+1 = 0 \; of \; 3x-4 = 0$

$$\rightarrow 2x = -1 \; of \; 3x = 4 \rightarrow x = -\frac{1}{2} \; of \; x = \frac{4}{3}$$

d. $4(3x+2)(6x+3) = 0 \rightarrow \quad 3x+2 = 0 \; of \; 6x+3 = 0$

$$\rightarrow 3x = -2 \; of \; 6x = -3 \rightarrow x = -\frac{2}{3} \; of \; x = -\frac{3}{6} = -\frac{1}{2}$$

e. $-5(3x-2)(3x+2) = 0 \rightarrow \quad 3x-2 = 0 \; of \; 3x+2 = 0 \rightarrow$

$$\rightarrow 3x = 2 \; of \; 3x = -2 \rightarrow x = \frac{2}{3} \; of \; x = -\frac{2}{3}$$

10.8

a. $\left(\frac{1}{2}x + 3\right)\left(x - \frac{2}{3}\right) = 0 \rightarrow \frac{1}{2}x + 3 = 0 \; of \; x - \frac{2}{3} = 0 \rightarrow$

$$\frac{1}{2}x = -3 \; of \; x = \frac{2}{3} \rightarrow x = -6 \; of \; x = \frac{2}{3}$$

b. $\left(\frac{2}{3}x - \frac{4}{5}\right)\left(\frac{1}{3}x - \frac{2}{7}\right) = 0 \rightarrow \frac{2}{3}x - \frac{4}{5} = 0 \; of \; \frac{1}{3}x - \frac{2}{7} = 0$

$$\rightarrow \frac{2}{3}x = \frac{4}{5} \; of \; \frac{1}{3}x = \frac{2}{7} \rightarrow x = \frac{4}{5} * \frac{3}{2} = \frac{12}{10} = \frac{6}{5} \; of \; x = \frac{2}{7} * \frac{3}{1} = \frac{6}{7}$$

$$\rightarrow x = \frac{6}{5} \; of \; x = \frac{6}{7}$$

c. $\frac{1}{2}\left(\frac{3}{4}x - \frac{4}{3}\right)\left(\frac{1}{3}x - \frac{1}{2}\right) = 0 \rightarrow \frac{3}{4}x - \frac{4}{3} = 0 \; of \; \frac{1}{3}x - \frac{1}{2} = 0$

$$\rightarrow \frac{3}{4}x = \frac{4}{3} \; of \; \frac{1}{3}x = \frac{1}{2} \rightarrow x = \frac{4}{3} * \frac{4}{3} = \frac{16}{9} \; of \; x = \frac{1}{2} * \frac{3}{1} = \frac{3}{2}$$

$$\rightarrow x = \frac{3}{2} \; of \; x = \frac{16}{9}$$

10.9

a. $x^2 + 4x + 1 = 0 \rightarrow x^2 + 4x + \left(\frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2 + 1 = 0 \rightarrow (x + 2)^2 - 2^2 + 1 = 0 \rightarrow$

$(x + 2)^2 = 2^2 - 1 = 3 \rightarrow (x + 2) = \pm\sqrt{3} \rightarrow x = -2 \pm \sqrt{3}$

$$\rightarrow x = -2 + \sqrt{3} \quad of \quad x = -2 - \sqrt{3}$$

b. $x^2 + 6x - 2 = 0 \rightarrow x^2 + 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 - 2 = 0 \rightarrow (x + 3)^2 - 3^2 - 2 = 0 \rightarrow$

$(x + 3)^2 = 3^2 + 2 = 11 \rightarrow (x + 3) = \pm\sqrt{11} \rightarrow x = -3 \pm \sqrt{11}$

$$\rightarrow x = -3 + \sqrt{11} \quad of \quad x = -3 - \sqrt{11}$$

c. $x^2 + 8x + 3 = 0 \rightarrow x^2 + 8x + \left(\frac{8}{2}\right)^2 - \left(\frac{8}{2}\right)^2 + 3 = 0 \rightarrow (x + 4)^2 - 4^2 + 3 = 0 \rightarrow$

$(x + 4)^2 = 4^2 - 3 = 13 \rightarrow (x + 4) = \pm\sqrt{13} \rightarrow x = -4 \pm \sqrt{13}$

$$\rightarrow x = -4 + \sqrt{13} \quad of \quad x = -4 - \sqrt{13}$$

d. $x^2 - 2x - 1 = 0 \rightarrow x^2 - 2x + \left(-\frac{2}{2}\right)^2 - \left(-\frac{2}{2}\right)^2 - 1 = 0 \rightarrow (x - 1)^2 - 1^2 - 1 = 0 \rightarrow$

$(x - 1)^2 = 1 + 1 = 2 \rightarrow (x - 1) = \pm\sqrt{2} \rightarrow x = 1 \pm \sqrt{2}$

$$\rightarrow x = 1 + \sqrt{2} \quad of \quad x = 1 - \sqrt{2}$$

e. $x^2 + 10x + 5 = 0 \rightarrow x^2 + 10x + \left(\frac{10}{2}\right)^2 - \left(\frac{10}{2}\right)^2 + 5 = 0 \rightarrow (x + 5)^2 - 5^2 + 5 = 0 \rightarrow$

$(x + 5)^2 = 5^2 - 5 = 20 \rightarrow (x + 5) = \pm\sqrt{20} = \pm 2\sqrt{5} \rightarrow x = -5 \pm 2\sqrt{5}$

$$\rightarrow x = -5 + 2\sqrt{5} \quad of \quad x = -5 - 2\sqrt{5}$$

10.10

a. $x^2 - 12x + 6 = 0 \rightarrow x^2 - 12x + \left(-\frac{12}{2}\right)^2 - \left(-\frac{12}{2}\right)^2 + 6 = 0 \rightarrow (x-6)^2 - 6^2 + 6 = 0 \rightarrow$

$(x-6)^2 = 6^2 - 6 = 30 \rightarrow (x-6) = \pm\sqrt{30} \rightarrow x = 6 + \sqrt{30} \quad of \quad x = 6 - \sqrt{30}$

b. $x^2 - 13x - 7 = 0 \rightarrow x^2 - 13x + \left(-\frac{13}{2}\right)^2 - \left(-\frac{13}{2}\right)^2 - 7 = 0 \rightarrow \left(x - \frac{13}{2}\right)^2 - \left(\frac{13}{2}\right)^2 - 70 \rightarrow$

$\left(x - \frac{13}{2}\right)^2 = \left(\frac{13}{2}\right)^2 + 7 = \frac{169}{4} + \frac{28}{4} = \frac{197}{4} \rightarrow \left(x - \frac{13}{2}\right)^2 = \frac{197}{4}$

$\rightarrow \left(x - \frac{13}{2}\right) = \pm\sqrt{\frac{197}{4}} = \pm\frac{\sqrt{197}}{2} = \pm\frac{1}{2}\sqrt{197} \rightarrow x = \frac{13}{2} \pm \frac{1}{2}\sqrt{197}$

c. $x^2 + x - 42 = 0 \rightarrow x^2 + x + \left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - 42 = 0 \rightarrow \left(x + \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - 42 = 0 \rightarrow$

$\rightarrow \left(x + \frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^2 + 42 = \frac{169}{4} \rightarrow x + \frac{1}{2} = \pm\sqrt{\frac{169}{4}} = \pm\frac{\sqrt{169}}{2} = \pm\frac{1}{2} * 13 = \pm\frac{13}{2}$

$\rightarrow x = \pm\frac{13}{2} - \frac{1}{2} \rightarrow x = \frac{12}{2} = 6 \quad of \quad x = -\frac{14}{2} = -7$

d. $x^2 - 12x + 27 = 0 \rightarrow x^2 - 12x + \left(-\frac{12}{2}\right)^2 - \left(-\frac{12}{2}\right)^2 + 27 = 0 \rightarrow$

$(x-6)^2 - (-6)^2 + 27 = 0 \rightarrow (x-6)^2 = 36 - 27 = 9$

$\rightarrow x - 6 = \pm\sqrt{9} = \pm 3 \rightarrow \quad x = 9 \quad of \quad x = 3$

e. $x^2 + 6x - 12 = 0 \rightarrow x^2 + 6x + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 - 12 = 0 \rightarrow (x+3)^2 - 3^2 - 12 = 0 \rightarrow$

$(x+3)^2 = 3^2 + 12 = 21 \rightarrow x + 3 = \pm\sqrt{21} \rightarrow x = -3 \pm \sqrt{21}$

10.11

a. $x^2 + 7x - 1 = 0 \rightarrow x^2 + 7x + \left(\frac{7}{2}\right)^2 - \left(\frac{7}{2}\right)^2 - 1 = 0 \rightarrow \left(x + \frac{7}{2}\right)^2 - \left(\frac{7}{2}\right)^2 - 1 = 0 \rightarrow$

$\left(x + \frac{7}{2}\right)^2 = \left(\frac{7}{2}\right)^2 + 1 = \frac{53}{4} \rightarrow x + \frac{7}{2} = \pm\sqrt{\frac{53}{4}} = \pm\frac{\sqrt{53}}{\sqrt{4}} = \pm\frac{\sqrt{53}}{2} = \pm\frac{1}{2}\sqrt{53}$

$\rightarrow x = -\frac{7}{2} \pm \frac{1}{2}\sqrt{53}$

b. $x^2 + 3x - 4 = 0 \rightarrow x^2 + 3x + \left(\frac{3}{2}\right)^2 - \left(\frac{3}{2}\right)^2 - 4 = 0 \rightarrow \left(x + \frac{3}{2}\right)^2 - 4 - \left(\frac{3}{2}\right)^2 = 0 \rightarrow$

$\left(x + \frac{3}{2}\right)^2 = \frac{25}{4} \rightarrow x + \frac{3}{2} = \pm\sqrt{\frac{25}{4}} = \pm\frac{1}{2}\sqrt{25} = \pm\frac{1}{2} * 5 = \pm\frac{5}{2} \rightarrow x = \pm\frac{5}{2} - \frac{3}{2}$

$\rightarrow x = \frac{2}{2} = 1 \quad of \quad x = -\frac{8}{2} = -4$

c. $x^2 + 4x + 4 = 0 \rightarrow (x + 2)^2 = 0 \rightarrow (x + 2) = 0 \rightarrow x = -2$

d. $x^2 - 4x - 4 = 0 \rightarrow x^2 - 4x + (-2)^2 - (-2)^2 - 4 = 0 \rightarrow$

$(x - 2)^2 = 4 + 4 = 8 \rightarrow x - 2 = \pm\sqrt{8} = \pm2\sqrt{2} \rightarrow x = 2 \pm 2\sqrt{2}$

e. $x^2 - 11x + 7 = 0 \rightarrow x^2 - 11x + \left(-\frac{11}{2}\right)^2 - \left(-\frac{11}{2}\right)^2 + 7 = 0 \rightarrow \left(x - \frac{11}{2}\right)^2 - \frac{121}{4} + 7 = 0$

$\left(x - \frac{11}{2}\right)^2 = \frac{121}{4} - 7 = \frac{93}{4} \rightarrow x - \frac{11}{2} = \pm\sqrt{\frac{93}{4}} = \pm\frac{1}{2}\sqrt{93} \rightarrow x = \frac{11}{2} \pm \frac{1}{2}\sqrt{93}$

10.12

a. $x^2 + 20x + 60 = 0 \rightarrow x^2 + 20x + \left(\frac{20}{2}\right)^2 - \left(\frac{20}{2}\right)^2 + 60 = 0 \rightarrow (x+10)^2 - \left(\frac{20}{2}\right)^2 + 60 = 0$

$(x+10)^2 = 10^2 - 60 = 40 \rightarrow x + 10 = \pm\sqrt{40} = \pm 2\sqrt{10} \rightarrow$

$\rightarrow x = -10 \pm 2\sqrt{10}$

b. $x^2 - 18x - 80 = 0 \rightarrow x^2 - 18x + \left(-\frac{18}{2}\right)^2 - \left(-\frac{18}{2}\right)^2 - 80 = 0 \rightarrow$

$$\left(x - \frac{18}{2}\right)^2 - \left(-\frac{18}{2}\right)^2 - 80 = 0 \rightarrow$$

$(x-9)^2 = \left(-\frac{18}{2}\right)^2 + 80 = 161 \rightarrow x - 9 = \pm\sqrt{161} \rightarrow$

$\rightarrow x = 9 \pm \sqrt{161}$

c. $x^2 + 13x - 42 = 0 \rightarrow x^2 + 13x + \left(\frac{13}{2}\right)^2 - \left(\frac{13}{2}\right)^2 - 42 = 0 \rightarrow$

$$\left(x + \frac{13}{2}\right)^2 - \left(\frac{13}{2}\right)^2 - 42 = 0 \rightarrow$$

$\left(x + \frac{13}{2}\right)^2 = \left(\frac{13}{2}\right)^2 + 42 = \frac{169}{4} + \frac{168}{4} = \frac{337}{4} \rightarrow x + \frac{13}{2} = \pm\sqrt{\frac{337}{4}} = \pm\frac{1}{2}\sqrt{337} \rightarrow$

$\rightarrow x = -\frac{13}{2} \pm \frac{1}{2}\sqrt{337}$

d. $x^2 - 15x + 56 = 0 \quad \rightarrow x^2 - 15x + \left(-\frac{15}{2}\right)^2 - \left(-\frac{15}{2}\right)^2 + 56 = 0 \rightarrow$

$$\left(x - \frac{15}{2}\right)^2 - \left(-\frac{15}{2}\right)^2 + 56 = 0 \rightarrow$$

$\left(x - \frac{15}{2}\right)^2 = \left(-\frac{15}{2}\right)^2 - 56 = \frac{225}{4} - \frac{224}{4} = \frac{1}{4} \rightarrow x - \frac{15}{2} = \pm\sqrt{\frac{1}{4}} = \pm\frac{1}{2} \rightarrow x = \frac{15}{2} \pm \frac{1}{2}$

$\rightarrow x = \frac{16}{2} = 8 \quad of \quad x = \frac{14}{2} = 7$

e. $x^2 + 60x + 800 = 0 \rightarrow x^2 + 60x + \left(\frac{60}{2}\right)^2 - \left(\frac{60}{2}\right)^2 + 800 = 0 \rightarrow$

$(x + 30)^2 - 30^2 + 800 = 0 \rightarrow$

$(x + 30)^2 = 30^2 - 800 = 100 \rightarrow x + 30 = \pm\sqrt{100} = \pm 10 \rightarrow x = \pm 10 - 30 \rightarrow$

$\rightarrow x = -40 \quad of \quad x = -20$

10.13

a. $\quad x^2 + \frac{1}{2}x - \frac{3}{4} = 0 \rightarrow x^2 + \frac{1}{2}x + \left(\frac{\frac{1}{2}}{2}\right)^2 - \left(\frac{\frac{1}{2}}{2}\right)^2 - \frac{3}{4} = 0 \rightarrow \left(x + \frac{\frac{1}{2}}{2}\right)^2 - \left(\frac{1}{4}\right)^2 - \frac{3}{4} = 0 \rightarrow$

$\left(x + \frac{1}{4}\right)^2 = \left(\frac{1}{4}\right)^2 + \frac{3}{4} = \frac{1}{16} + \frac{12}{16} = \frac{13}{16} \rightarrow x + \frac{1}{4} = \pm\sqrt{\frac{13}{16}} = \pm\frac{\sqrt{13}}{4} \rightarrow x = -\frac{1}{4} \pm \frac{1}{4}\sqrt{13}$

b. $\quad x^2 + \frac{4}{3}x - \frac{5}{9} = 0 \rightarrow x^2 + \frac{4}{3}x + \left(\frac{\frac{4}{3}}{2}\right)^2 - \left(\frac{\frac{4}{3}}{2}\right)^2 - \frac{5}{9} = 0 \rightarrow \left(x + \frac{4}{6}\right)^2 - \left(\frac{4}{6}\right)^2 - \frac{5}{9} = \left(x + \frac{2}{3}\right)^2 -$

$\left(\frac{2}{3}\right)^2 - \frac{5}{9} = 0 \rightarrow \qquad \left(x + \frac{2}{3}\right)^2 = \left(\frac{2}{3}\right)^2 + \frac{5}{9} = \frac{4}{9} + \frac{5}{9} = \frac{9}{9} = 1$

$\left(x + \frac{2}{3}\right) = \pm\sqrt{1} = \pm 1 \rightarrow x = \pm 1 - \frac{2}{3} \rightarrow x = 1 - \frac{2}{3} = \frac{1}{3} \;\; of \;\; x = -1 - \frac{2}{3} = -\frac{5}{3}$

c. $\quad x^2 - \frac{1}{3}x - \frac{1}{9} = 0 \rightarrow x^2 - \frac{1}{3}x + \left(-\frac{\frac{1}{3}}{2}\right)^2 - \left(-\frac{\frac{1}{3}}{2}\right)^2 - \frac{1}{9} = 0 \rightarrow \left(x - \frac{1}{6}\right)^2 - \left(-\frac{1}{6}\right)^2 - \frac{1}{9} = 0 \rightarrow$

$\left(x - \frac{1}{6}\right)^2 = \left(-\frac{1}{6}\right)^2 + \frac{1}{9} = \frac{1}{36} + \frac{1}{9} = \frac{1}{36} + \frac{4}{36} = \frac{5}{36} \rightarrow x - \frac{1}{6} = \pm\sqrt{\frac{5}{36}} = \pm\frac{\sqrt{5}}{6} \rightarrow x = \frac{1}{6} \pm \frac{1}{6}\sqrt{5}$

d. $\quad x^2 + \frac{3}{2}x - \frac{5}{8} = 0 \rightarrow x^2 + \frac{3}{2}x + \left(\frac{\frac{3}{2}}{2}\right)^2 - \left(\frac{\frac{3}{2}}{2}\right)^2 - \frac{5}{8} = 0 \rightarrow \left(x + \frac{3}{4}\right)^2 - \left(\frac{3}{4}\right)^2 - \frac{5}{8} = 0 \rightarrow$

$\left(x + \frac{3}{4}\right)^2 = \left(\frac{3}{4}\right)^2 + \frac{5}{8} = \frac{9}{16} + \frac{5}{8} = \frac{9}{16} + \frac{10}{16} = \frac{19}{16} \rightarrow \left(x + \frac{3}{4}\right) = \pm\sqrt{\frac{19}{16}} =$
$\pm\frac{1}{4}\sqrt{19} \qquad\qquad \rightarrow x = -\frac{3}{4} \pm \frac{1}{4}\sqrt{19}$

e. $\quad x^2 - \frac{2}{5}x - \frac{1}{5} = 0 \rightarrow x^2 - \frac{2}{5}x + \left(-\frac{\frac{2}{5}}{2}\right)^2 - \left(-\frac{\frac{2}{5}}{2}\right)^2 - \frac{1}{5} = 0 \rightarrow \left(x - \frac{1}{5}\right)^2 + \left(-\frac{1}{5}\right)^2 - \frac{1}{5} = 0 \rightarrow$

$\left(x - \frac{1}{5}\right)^2 = \left(-\frac{1}{5}\right)^2 + \frac{1}{5} = \frac{1}{25} + \frac{5}{25} = \frac{6}{25} \rightarrow x - \frac{1}{5} = \pm\sqrt{\frac{6}{25}} = \pm\frac{1}{5}\sqrt{6}$

$\rightarrow x = \frac{1}{5} \pm \frac{1}{5}\sqrt{6}$

10.14

a. $\quad x^2 + \frac{3}{4}x - \frac{3}{8} = 0 \rightarrow x^2 + \frac{3}{4}x + \left(\frac{\frac{3}{4}}{2}\right)^2 - \left(\frac{\frac{3}{4}}{2}\right)^2 - \frac{3}{8} = 0 \rightarrow \left(x + \frac{3}{8}\right)^2 - \left(\frac{3}{8}\right)^2 - \frac{3}{8} = 0 \rightarrow$

$$\left(x+\tfrac{3}{8}\right)^2 = \left(\tfrac{3}{8}\right)^2 + \tfrac{3}{8} = \tfrac{9}{64} + \tfrac{3}{8} = \tfrac{9}{64} + \tfrac{24}{64} = \tfrac{33}{64} \rightarrow \left(x+\tfrac{3}{8}\right) = \pm\sqrt{\tfrac{33}{64}} = \pm\tfrac{\sqrt{33}}{8}$$

$$\rightarrow x = -\tfrac{3}{8} \pm \tfrac{1}{8}\sqrt{33}$$

b. $$x^2 + \tfrac{5}{2}x + \tfrac{3}{2} = 0 \rightarrow x^2 + \tfrac{5}{2}x + \left(\tfrac{\tfrac{5}{2}}{2}\right)^2 - \left(\tfrac{\tfrac{5}{2}}{2}\right)^2 + \tfrac{3}{2} = 0 \rightarrow \left(x+\tfrac{5}{4}\right)^2 - \left(\tfrac{5}{4}\right)^2 + \tfrac{3}{2} = 0 \rightarrow$$

$$\left(x+\tfrac{5}{4}\right)^2 = \left(\tfrac{5}{4}\right)^2 - \tfrac{3}{2} = \tfrac{25}{16} - \tfrac{24}{16} = \tfrac{1}{16} \rightarrow \left(x+\tfrac{5}{4}\right) = \pm\sqrt{\tfrac{1}{16}} = \pm\tfrac{1}{4} \rightarrow x = \pm\tfrac{1}{4} - \tfrac{5}{4}$$

$$\rightarrow x = -\tfrac{4}{4} = -1 \quad of \quad x = -\tfrac{6}{4} = -\tfrac{3}{2}$$

c. $$x^2 - \tfrac{2}{3}x + \tfrac{1}{9} = 0 \rightarrow x^2 - \tfrac{2}{3}x + \left(-\tfrac{\tfrac{2}{3}}{2}\right)^2 - \left(-\tfrac{\tfrac{2}{3}}{2}\right)^2 + \tfrac{1}{9} = 0 \rightarrow \left(x-\tfrac{1}{3}\right)^2 - \left(\tfrac{1}{3}\right)^2 + \tfrac{1}{9} = 0 \rightarrow$$

$$\left(x-\tfrac{1}{3}\right)^2 = \left(\tfrac{1}{3}\right)^2 - \tfrac{1}{9} = \tfrac{1}{9} - \tfrac{1}{9} = 0 \rightarrow \quad x - \tfrac{1}{3} = 0 \rightarrow x = \tfrac{1}{3}$$

d. $$x^2 - \tfrac{3}{2}x - \tfrac{3}{4} = 0 \rightarrow x^2 - \tfrac{3}{2}x + \left(-\tfrac{\tfrac{3}{2}}{2}\right)^2 - \left(-\tfrac{\tfrac{3}{2}}{2}\right)^2 - \tfrac{3}{4} = 0 \rightarrow \left(x-\tfrac{3}{4}\right)^2 - \left(\tfrac{3}{4}\right)^2 - \tfrac{3}{4} = 0 \rightarrow$$

$$\left(x-\tfrac{3}{4}\right)^2 = \left(\tfrac{3}{4}\right)^2 + \tfrac{3}{4} = \tfrac{9}{16} + \tfrac{12}{16} = \tfrac{21}{16} \rightarrow x - \tfrac{3}{4} = \pm\sqrt{\tfrac{21}{16}} = \pm\tfrac{1}{4}\sqrt{21} \rightarrow \quad x = \tfrac{3}{4} \pm \tfrac{1}{4}\sqrt{21}$$

e. $$x^2 + \tfrac{4}{5}x - \tfrac{4}{5} = 0 \rightarrow x^2 + \tfrac{4}{5}x + \left(\tfrac{\tfrac{4}{5}}{2}\right)^2 - \left(\tfrac{\tfrac{4}{5}}{2}\right)^2 - \tfrac{4}{5} = 0 \rightarrow \left(x+\tfrac{4}{10}\right)^2 - \left(\tfrac{4}{10}\right)^2 - \tfrac{4}{5} = 0 \rightarrow$$

$$\left(x+\tfrac{2}{5}\right)^2 = \left(\tfrac{2}{5}\right)^2 + \tfrac{4}{5} = \tfrac{4}{25} + \tfrac{20}{25} = \tfrac{24}{25} \rightarrow \left(x+\tfrac{2}{5}\right) = \pm\sqrt{\tfrac{24}{25}} = \pm\tfrac{1}{5}\sqrt{24} = \pm\tfrac{2}{5}\sqrt{6}$$

$$\rightarrow x = -\tfrac{2}{5} \pm \tfrac{2}{5}\sqrt{6}$$

10.15

a. $$x^4 + 4x^2 - 5 = 0 \rightarrow y = x^2 \rightarrow y^2 + 4y - 5 = 0 \rightarrow \quad y^2 + 4y + \left(\tfrac{4}{2}\right)^2 - \left(\tfrac{4}{2}\right)^2 - 5 = 0 \rightarrow$$

$$\rightarrow (y+2)^2 - 2^2 - 5 = 0 \rightarrow (y+2)^2 = 2^2 + 5 = 9 \rightarrow (y+2) = \pm\sqrt{9} = \pm 3$$

$$\rightarrow y = \pm 3 - 2 \rightarrow \qquad y = 1 \quad of \quad y = -5 \rightarrow x^2 = 1 \quad of \quad x^2 = -5 \rightarrow$$

$$\rightarrow x^2 = -5 \quad kan\ niet, dus\ valt\ af \rightarrow x^2 = 1 \rightarrow x = \pm\sqrt{1} = \pm 1$$

b. $\quad x^4 - 6x^2 = 7 \rightarrow y = x^2 \rightarrow y^2 - 6y - 7 = 0 \rightarrow y^2 - 6y + \left(-\frac{6}{2}\right)^2 - \left(-\frac{6}{2}\right)^2 - 7 \rightarrow$

$$\rightarrow (y-3)^2 - 3^2 - 7 = 0 \rightarrow (y-3)^2 = 9 + 7 = 16 \rightarrow (y-3) = \pm\sqrt{16} = \pm 4$$

$$\rightarrow y = \pm 4 + 3 \rightarrow y = 7 \quad of \quad y = -1 \rightarrow x^2 = 7 \quad of \quad x^2 = -1 \rightarrow$$

$$\rightarrow x^2 = -1\ kan\ niet, dus\ valt\ af \rightarrow x^2 = 7 \rightarrow x = \pm\sqrt{7}$$

c. $\quad x^4 + 4x^2 + 4 = 0 \rightarrow y = x^2 \rightarrow y^2 + 4y + 4 = 0 \rightarrow \quad y^2 + 4y + \left(\frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2 + 4 = 0 \rightarrow$

$$\rightarrow (y+2)^2 - 2^2 + 4 = (y+2)^2 = 0 \rightarrow (y+2) = 0 \rightarrow y = -2 \rightarrow x^2 = -2$$

$$\rightarrow x^2 = -2\ kan\ niet, dus\ valt\ af \rightarrow geen\ oplossingen!$$

d. $\quad x^4 - 4x^2 + 4 = 0 \rightarrow y = x^2 \rightarrow y^2 - 4y + 4 = 0 \rightarrow y^2 - 4y + \left(-\frac{4}{2}\right)^2 - \left(-\frac{4}{2}\right)^2 + 4 = 0 \rightarrow$

$$\rightarrow (y-2)^2 - 2^2 + 4 = (y-2)^2 = 0 \rightarrow (y-2) = 0 \rightarrow y = 2 \rightarrow x^2 = 2$$

$$\rightarrow x = \pm\sqrt{2}$$

e. $\quad x^6 - 11x^3 = 12 \rightarrow x^6 - 11x^3 - 12 = 0 \rightarrow y = x^3 \rightarrow y^2 - 11y - 12 = 0 \rightarrow$

$$\rightarrow y^2 - 11y + \left(-\frac{11}{2}\right)^2 - \left(-\frac{11}{2}\right)^2 - 12 = 0 \rightarrow \left(y - \frac{11}{2}\right)^2 - \left(-\frac{11}{2}\right)^2 - 12 = 0 \rightarrow$$

$$\rightarrow \left(y - \frac{11}{2}\right)^2 = \frac{121}{4} + 12 = \frac{121}{4} + \frac{48}{4} = \frac{169}{4} \rightarrow \left(y - \frac{11}{2}\right) = \pm\frac{\sqrt{169}}{2} = \pm\frac{1}{2} * 13$$

$$\rightarrow y = \pm\frac{13}{2} + \frac{11}{2} \rightarrow y = \frac{24}{2} = 12 \quad of \quad y = -\frac{2}{2} = -1 \rightarrow x^3 = 12 \quad of \quad x^3 = -1$$

$$\rightarrow x = \sqrt[3]{12} \quad of \quad x = -1$$

Omdat hier sprake is van een derde macht hoeft er geen $\pm$ teken voor de wortel. De derdemachtswortel uit een positief getal is namelijk een positief getal, terwijl de derdemachtswortel uit een negatief getal een negatief getal is.

10.16

a. $\quad x - 2\sqrt{x} = 3 \left(stel\ y = \sqrt{x};\ en\ dus\ x = y^2\right) \rightarrow y^2 - 2y - 3 = 0 \rightarrow$

$\rightarrow y^2 - 2y + \left(-\frac{2}{2}\right)^2 - \left(-\frac{2}{2}\right)^2 - 3 = 0 \rightarrow (y-1)^2 - 1 - 3 = 0 \rightarrow (y-1)^2 = 4 \rightarrow$

$(y-1) = \pm\sqrt{4} = \pm2 \rightarrow y = \pm2 + 1 \rightarrow y = 3 \quad of \quad y = -1 \rightarrow \sqrt{x} = 3 \quad of \quad \sqrt{x} = -1$

$\rightarrow \sqrt{x} = -1 \text{ kan niet, dus valt af} \rightarrow \sqrt{x} = 3 \rightarrow x = 9$

b. $x - 18\sqrt{x} + 17 = 0 \rightarrow y = \sqrt{x}; \ x = y^2 \rightarrow y^2 - 18y + 17 = 0 \rightarrow$

$\rightarrow y^2 - 18y + \left(-\frac{18}{2}\right)^2 - \left(-\frac{18}{2}\right)^2 + 17 = 0 \rightarrow (y-9)^2 - 9^2 + 17 = 0 \rightarrow$

$\rightarrow (y-9)^2 = 81 - 17 = 64 \rightarrow y - 9 = \pm\sqrt{64} = \pm8 \rightarrow$

$\rightarrow y = \pm8 + 9 \rightarrow y = 17 \quad of \quad y = 1 \rightarrow \sqrt{x} = 17 \quad of \quad \sqrt{x} = 1$

$\rightarrow x = 289 \quad of \quad x = 1$

c. $x + 4\sqrt{x} = 21 \rightarrow y = \sqrt{x}; \ x = y^2 \rightarrow y^2 + 4y - 21 = 0 \rightarrow$

$\rightarrow y^2 + 4y + \left(\frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2 - 21 = 0 \rightarrow$

$\rightarrow (y+2)^2 - 2^2 - 21 = 0 \rightarrow (y+2)^2 = 4 + 21 = 25 \rightarrow$

$\rightarrow (y+2) = \pm\sqrt{25} = \pm5 \rightarrow y = \pm5 - 2 \rightarrow y = 3 \quad of \quad y = -7$

$\rightarrow \sqrt{x} = 3 \quad of \quad \sqrt{x} = -7 \rightarrow \sqrt{x} = -7 \text{ kan niet, dus valt af}$

$\rightarrow \sqrt{x} = 3 \rightarrow x = 9$

d. $x - 15\sqrt{x} + 26 = 0 \rightarrow y = \sqrt{x}; \ x = y^2 \rightarrow y^2 - 15y + 26 = 0 \rightarrow$

$\rightarrow y^2 - 15y + \left(-\frac{15}{2}\right)^2 - \left(-\frac{15}{2}\right)^2 + 26 = 0 \rightarrow \left(y - \frac{15}{2}\right)^2 - \left(-\frac{15}{2}\right)^2 + 26 = 0 \rightarrow$

$\rightarrow \left(y - \frac{15}{2}\right)^2 = \left(-\frac{15}{2}\right)^2 - 26 = \frac{225}{4} - \frac{104}{4} = \frac{121}{4} \rightarrow \left(y - \frac{15}{2}\right) = \pm\frac{\sqrt{121}}{\sqrt{4}} = \pm\frac{1}{2} * 11 \rightarrow$

$\rightarrow y = \pm\frac{11}{2} + \frac{15}{2} \rightarrow y = 13 \quad of \quad y = 2 \rightarrow \sqrt{x} = 13 \quad of \quad \sqrt{x} = 2$

$\rightarrow x = 169 \quad of \quad x = 4$

e. $x + 6\sqrt{x} = 7 \rightarrow y = \sqrt{x}; \ x = y^2 \rightarrow y^2 + 6y - 7 = 0 \rightarrow y^2 + 6y + \left(\frac{6}{2}\right)^2 - \left(\frac{6}{2}\right)^2 - 7 = 0 \rightarrow$

$\rightarrow (y+3)^2 - 3^2 - 7 = 0 \rightarrow (y+3)^2 = 9 + 7 = 16 \rightarrow (y+3) = \pm\sqrt{16} = \pm4 \rightarrow$

$y = \pm4 - 3 \rightarrow y = 1 \quad of \quad y = -7 \rightarrow \sqrt{x} = 1 \quad of \quad \sqrt{x} = -7$

$\rightarrow \sqrt{x} = -7 \text{ kan niet, dus valt af} \rightarrow \sqrt{x} = 1 \rightarrow x = 1$

10.17

Gebruik hier bij $ax^2 + bx + c = 0$ de abc-formule, zijnde $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

a.　$x^2 + 5x + 1 = 0 \rightarrow a = 1; b = 5; c = 1 \rightarrow$

$x = \frac{-5 \pm \sqrt{25 - 4*1*1}}{2*1} = \frac{-5 \pm \sqrt{21}}{2} \rightarrow x = \frac{-5 + \sqrt{21}}{2}$　of　$x = \frac{-5 - \sqrt{21}}{2}$

b.　$x^2 - 3x + 2 = 0 \rightarrow a = 1; b = -3; c = 2 \rightarrow$

$x = \frac{3 \pm \sqrt{9 - 4*1*2}}{2*1} = \frac{3 \pm \sqrt{1}}{2} = \frac{3 \pm 1}{2} \rightarrow x = \frac{4}{2} = 2$　of　$x = \frac{2}{2} = 1$

c.　$x^2 + 7x + 3 = 0 \rightarrow a = 1; b = 7; c = 3 \rightarrow$

$x = \frac{-7 \pm \sqrt{7^2 - 4*1*3}}{2*1} = \frac{-7 \pm \sqrt{49 - 12}}{2} = \frac{-7 \pm \sqrt{37}}{2}$

d.　$x^2 - x + 1 = 0 \rightarrow a = 1; b = -1; c = 1 \rightarrow$

$x = \frac{1 \pm \sqrt{(-1)^2 - 4*1*1}}{2*1} = \frac{1 \pm \sqrt{-3}}{2} \rightarrow$ kan niet, dus geen oplossingen

e.　$x^2 + 11x + 11 = 0 \rightarrow a = 1; b = 11; c = 11 \rightarrow$

$$x = \frac{-11 \pm \sqrt{11^2 - 4*1*11}}{2*1} = \frac{-11 \pm \sqrt{121 - 44}}{2} = \frac{-11 \pm \sqrt{77}}{2}$$

10.18

a.　$x^2 + 3x + 1 = 0 \rightarrow a = 1; b = 3; c = 1 \rightarrow$　$x = \frac{-3 \pm \sqrt{3^2 - 4*1*1}}{2*1} = \frac{-3 \pm \sqrt{9 - 4}}{2} = \frac{-3 \pm \sqrt{5}}{2}$

b.　　$x^2 - 4x + 3 = 0 \rightarrow a = 1; b = -4; c = 3 \rightarrow$

$x = \dfrac{4 \pm \sqrt{(-4)^2 - 4*1*3}}{2*1} = \dfrac{4 \pm \sqrt{16-12}}{2} = \dfrac{4 \pm \sqrt{4}}{2} = \dfrac{4 \pm 2}{2} \rightarrow x = \dfrac{6}{2} = 3 \quad of \quad x = \dfrac{2}{2} = 1$

c.　　$x^2 + 9x - 2 = 0 \rightarrow a = 1; b = 9; c = -2 \rightarrow$

$x = \dfrac{-9 \pm \sqrt{9^2 - 4*1*-2}}{2*1} = \dfrac{-9 \pm \sqrt{81+8}}{2} = \dfrac{-9 \pm \sqrt{89}}{2}$

d.　　$x^2 - 12x + 3 = 0 \rightarrow a = 1; b = -12; c = 3 \rightarrow$

$x = \dfrac{12 \pm \sqrt{-12^2 - 4*1*3}}{2*1} = \dfrac{12 \pm \sqrt{144-12}}{2} = \dfrac{12 \pm \sqrt{132}}{2} = 6 \pm \dfrac{\sqrt{2*2*3*11}}{2} = 6 \pm \dfrac{2\sqrt{33}}{2} = 6 \pm \sqrt{33}$

e.　　$x^2 - 5x + 1 = 0 \rightarrow a = 1; b = -5; c = 1 \rightarrow \quad x = \dfrac{5 \pm \sqrt{(-5)^2 - 4*1*1}}{2*1} = \dfrac{5 \pm \sqrt{25-4}}{2} = \dfrac{5 \pm \sqrt{21}}{2}$

10.19

a.　　$2x^2 + 4x + 3 = 0 \rightarrow a = 2; b = 4; c = 3 \rightarrow$

$x = \dfrac{-4 \pm \sqrt{4^2 - 4*2*3}}{2*2} = \dfrac{-4 \pm \sqrt{16-24}}{4} = \dfrac{-4 \pm \sqrt{-8}}{4} \rightarrow$ kan niet, dus geen oplossingen

b.　　$2x^2 - 12x + 9 = 0 \rightarrow a = 2; b = -12; c = 9 \rightarrow$

$x = \dfrac{12 \pm \sqrt{(-12)^2 - 4*2*9}}{2*2} = \dfrac{12 \pm \sqrt{144-72}}{4} = \dfrac{12 \pm \sqrt{72}}{4} = \dfrac{12 \pm \sqrt{2*2*2*3*3}}{4} = \dfrac{12 \pm 6\sqrt{2}}{4} = \dfrac{6 \pm 3\sqrt{2}}{2}$

c.　　$3x^2 + 12x - 8 = 0 \rightarrow a = 3; b = 12; c = -8 \rightarrow$

$x = \dfrac{-12 \pm \sqrt{12^2 - 4*3*-8}}{2*3} = \dfrac{-12 \pm \sqrt{144+96}}{6} = \dfrac{-12 \pm \sqrt{240}}{6} = \dfrac{-12 \pm \sqrt{2*2*2*2*3*5}}{6} = \dfrac{-12 \pm 4\sqrt{15}}{6} = \dfrac{-6 \pm 2\sqrt{15}}{3}$

d.　　$4x^2 + 12x + 1 = 0 \rightarrow a = 4; b = 12; c = 1 \rightarrow$

$x = \dfrac{-12 \pm \sqrt{12^2 - 4*4*1}}{2*4} = \dfrac{-12 \pm \sqrt{144-16}}{8} = \dfrac{-12 \pm \sqrt{128}}{8} = \dfrac{-12 \pm \sqrt{2*2*2*2*2*2*2}}{8} = \dfrac{-12 \pm 8\sqrt{2}}{8} = \dfrac{-3 \pm 2\sqrt{2}}{2}$

e.　　$6x^2 - 12x - 1 = 0 \rightarrow a = 6; b = -12; c = -1 \rightarrow$

$x = \dfrac{12 \pm \sqrt{(-12)^2 - 4*6*-1}}{2*6} = \dfrac{12 \pm \sqrt{144+24}}{12} = \dfrac{12 \pm \sqrt{168}}{12} = \dfrac{12 \pm \sqrt{2*2*2*3*7}}{12} = \dfrac{12 \pm 2\sqrt{42}}{12} = \dfrac{6 \pm \sqrt{42}}{6}$

10.20

a.　　$2x^2 + x - 1 = 0 \rightarrow a = 2; b = 1; c = -1 \rightarrow$

$$x = \frac{-1 \pm \sqrt{1^2 - 4*2*-1}}{2*2} = \frac{-1 \pm \sqrt{1+8}}{4} = \frac{-1 \pm \sqrt{9}}{4} = \frac{-1 \pm 3}{4} \rightarrow \quad x = \frac{2}{4} = \frac{1}{2} \quad of \quad x = -\frac{4}{4} = -1$$

b. $3x^2 + 2x + 1 = 0 \rightarrow a = 3; \ b = 2; \ c = 1 \rightarrow$

$$x = \frac{-2 \pm \sqrt{2^2 - 4*3*1}}{2*3} = \frac{-2 \pm \sqrt{4-12}}{6} = \frac{-2 \pm \sqrt{-8}}{6} \rightarrow \text{kan niet, dus geen oplossingen}$$

c. $2x^2 + 8x - 2 = 0 \rightarrow a = 2; \ b = 8; \ c = -2 \rightarrow$

$$x = \frac{-8 \pm \sqrt{8^2 - 4*2*-2}}{2*2} = \frac{-8 \pm \sqrt{64+16}}{4} = \frac{-8 \pm \sqrt{80}}{4} = \frac{-8 \pm \sqrt{2*2*2*2*5}}{4} = \frac{-8 \pm 4\sqrt{5}}{4} = -2 \pm \sqrt{5}$$

d. $6x^2 + 18x + 7 = 0 \rightarrow a = 6; \ b = 18; \ c = 7 \rightarrow$

$$x = \frac{-18 \pm \sqrt{18^2 - 4*6*7}}{2*6} = \frac{-18 \pm \sqrt{324-168}}{12} = \frac{-18 \pm \sqrt{156}}{12} = \frac{-18 \pm \sqrt{2*2*3*13}}{12} = \frac{-18 \pm 2\sqrt{39}}{12} = \frac{-9 \pm \sqrt{39}}{6}$$

e. $4x^2 - 8x + 1 = 0 \rightarrow a = 4; \ b = -8; \ c = 1 \rightarrow$

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4*4*1}}{2*4} = \frac{8 \pm \sqrt{64-16}}{8} = \frac{8 \pm \sqrt{48}}{8} = \frac{8 \pm \sqrt{2*2*2*2*3}}{8} = \frac{8 \pm 4\sqrt{3}}{8} = \frac{2 \pm \sqrt{3}}{2}$$

10.21

a. $-x^2 + 2x + 1 = 0 \rightarrow a = -1; \ b = 2; \ c = 1 \rightarrow$

$$x = \frac{-2 \pm \sqrt{2^2 - 4*-1*1}}{2*-1} = \frac{-2 \pm \sqrt{4+4}}{-2} = \frac{-2 \pm \sqrt{8}}{-2} = \frac{-2 \pm 2\sqrt{2}}{-2} = 1 \pm \sqrt{2}$$

b. $-2x^2 + 8x - 3 = 0 \rightarrow a = -2; \ b = 8; \ c = -3 \rightarrow$

$$x = \frac{-8 \pm \sqrt{8^2 - 4*-2*-3}}{2*-2} = \frac{-8 \pm \sqrt{64-24}}{-4} = \frac{-8 \pm \sqrt{40}}{-4} = \frac{(-8 \pm \sqrt{2*2*2*5})}{-4} = \frac{-8 \pm 2\sqrt{10}}{-4} = \frac{4 \pm \sqrt{10}}{2}$$

c. $-3x^2 + 9x - 1 = 0 \rightarrow a = -3; \ b = 9; \ c = -1 \rightarrow$

$$x = \frac{-9 \pm \sqrt{9^2 - 4*-3*-1}}{2*-3} = \frac{-9 \pm \sqrt{81-12}}{-6} = \frac{9 \pm \sqrt{69}}{6}$$

d. $-4x^2 - 12x + 9 = 0 \rightarrow a = -4; \ b = -12; \ c = 9 \rightarrow$

$$x = \frac{12 \pm \sqrt{(-12)^2 - 4*-4*9}}{2*-4} = \frac{12 \pm \sqrt{144+144}}{-8} = \frac{12 \pm \sqrt{2*2*2*2*3*3 + 2*2*2*2*3*3}}{-8} = \frac{12 \pm \sqrt{2*(2*2*2*2*3*3)}}{-8} =$$

$$\rightarrow \frac{12 \pm 2*2*3*\sqrt{2}}{-8} = \frac{12 \pm 12\sqrt{2}}{-8} = \frac{-3 \pm 3\sqrt{2}}{2}$$

e. $-x^2 + x + 1 = 0 \rightarrow a = -1; \ b = 1; \ c = 1 \rightarrow$

$$x = \frac{-1 \pm \sqrt{1^2 - 4*-1*1}}{2*-1} = \frac{-1 \pm \sqrt{1+4}}{-2} = \frac{1 \pm \sqrt{5}}{2}$$

10.22

a. $3x^2 - 4x + 3 = 0 \rightarrow a = 3; \ b = -4; \ c = 3 \rightarrow$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4*3*3}}{2*3} = \frac{4 \pm \sqrt{16-36}}{6} = \frac{4 \pm \sqrt{-20}}{6} \rightarrow \text{kan niet, dus geen oplossingen}$$

b.　$-2x^2 + 3x + 2 = 0 \rightarrow a = -2; b = 3; c = 2 \rightarrow$

$$x = \frac{-3 \pm \sqrt{3^2 - 4*-2*2}}{2*-2} = \frac{-3 \pm \sqrt{9+16}}{-4} = \frac{-3 \pm \sqrt{25}}{-4} = \frac{-3 \pm 5}{-4} = \frac{3 \pm 5}{4} \rightarrow$$

$$\rightarrow x = \frac{8}{4} = 2 \quad of \quad x = -\frac{2}{4} = -\frac{1}{2}$$

c.　$-4x^2 + 6x + 5 = 0 \rightarrow a = -4; b = 6; c = 5 \rightarrow$

$$x = \frac{-6 \pm \sqrt{6^2 - 4*-4*5}}{2*-4} = \frac{-6 \pm \sqrt{36+80}}{-8} = \frac{6 \pm \sqrt{116}}{8} = \frac{6 \pm \sqrt{2*2*29}}{8} = \frac{6 \pm 2\sqrt{29}}{8} = \frac{3 \pm \sqrt{29}}{4}$$

d.　$6x^2 + 18x - 1 = 0 \rightarrow a = 6; b = 18; c = -1 \rightarrow$

$$x = \frac{-18 \pm \sqrt{18^2 - 4*6*-1}}{2*6} = \frac{-18 \pm \sqrt{324+24}}{12} = \frac{-18 \pm \sqrt{348}}{12} = \frac{(-18 \pm \sqrt{2*2*87})}{12} = \frac{-18 \pm 2\sqrt{87}}{12} = \frac{-9 \pm \sqrt{87}}{6}$$

e.　$-x^2 - x - 1 = 0 \rightarrow a = -1; b = -1; c = -1 \rightarrow$

$$x = \frac{1 \pm \sqrt{(-1)^2 - 4*-1*-1}}{2*-1} = \frac{1 \pm \sqrt{1-4}}{-2} = \frac{1 \pm \sqrt{-3}}{-2} \rightarrow \text{kan niet, dus geen oplossingen}$$

10.23

a.　$\frac{1}{2}x^2 + x - 1 = 0 \rightarrow a = \frac{1}{2}; b = 1; c = -1 \rightarrow$

$$x = \frac{-1 \pm \sqrt{1^2 - 4*\frac{1}{2}*-1}}{2*\frac{1}{2}} = \frac{-1 \pm \sqrt{1+2}}{1} = -1 \pm \sqrt{3}$$

b.　$\frac{2}{3}x^2 + 2x - 3 = 0 \rightarrow a = \frac{2}{3}; b = 2; c = -3 \rightarrow$

$$x = \frac{-2 \pm \sqrt{2^2 - 4*\frac{2}{3}*-3}}{2*\frac{2}{3}} = \frac{-2 \pm \sqrt{4 + \frac{24}{3}}}{\frac{4}{3}} = \frac{-2 \pm \sqrt{\frac{12}{3} + \frac{24}{3}}}{\frac{4}{3}} = \frac{-2 \pm \sqrt{\frac{36}{3}}}{\frac{4}{3}} = \frac{-2 \pm \sqrt{12}}{\frac{4}{3}} = \frac{-2 \pm \sqrt{2*2*3}}{\frac{4}{3}} =$$

$$\frac{-2 \pm 2\sqrt{3}}{\frac{4}{3}} = \frac{3}{4}(-2 \pm 2\sqrt{3}) = -\frac{3}{2} \pm \frac{3}{2}\sqrt{3}$$

c.　$\frac{1}{2}x^2 - x - 1 = 0 \rightarrow a = \frac{1}{2}; b = -1; c = -1 \rightarrow$

$$x = \frac{1 \pm \sqrt{(-1)^2 - 4*\frac{1}{2}*-1}}{2*\frac{1}{2}} = \frac{1 \pm \sqrt{1+2}}{1} = 1 \pm \sqrt{3}$$

d.　$\frac{4}{5}x^2 + 3x - 2 = 0 \rightarrow a = \frac{4}{5}; b = 3; c = -2 \rightarrow$

$$x = \frac{-3 \pm \sqrt{3^2 - 4*\frac{4}{5}*-2}}{2*\frac{4}{5}} = \frac{-3 \pm \sqrt{9 + \frac{32}{5}}}{\frac{8}{5}} = \frac{-15 \pm 5\sqrt{\frac{45}{5} + \frac{32}{5}}}{8} = \frac{-15 \pm 5\sqrt{\frac{77}{5}}}{8} = \frac{-15 \pm 5\sqrt{\frac{77*5}{5*5}}}{8} =$$

$$\frac{-15 \pm \frac{1}{5}*5\sqrt{385}}{8} = \frac{-15 \pm \sqrt{385}}{8}$$

e. $\frac{5}{2}x^2 + 5x - 2 = 0 \rightarrow a = \frac{5}{2} ; b = 5 ; c = -2 \rightarrow$

$$x = \frac{-5 \pm \sqrt{5^2 - 4*\frac{5}{2}*-2}}{2*\frac{5}{2}} = \frac{-5 \pm \sqrt{25+20}}{5} = \frac{-5 \pm \sqrt{45}}{5} = \frac{-5 \pm 3\sqrt{5}}{5}$$

10.24

a. $\frac{1}{2}x^2 + \frac{3}{2}x - \frac{1}{4} = 0 \rightarrow a = \frac{1}{2} ; b = \frac{3}{2} ; c = -\frac{1}{4} \rightarrow$

$$x = \frac{-\frac{3}{2} \pm \sqrt{(\frac{3}{2})^2 - 4*\frac{1}{2}*-\frac{1}{4}}}{2*\frac{1}{2}} = \frac{-\frac{3}{2} \pm \sqrt{\frac{9}{4} + \frac{4}{8}}}{1} = -\frac{3}{2} \pm \sqrt{\frac{18}{8} + \frac{4}{8}} = -\frac{3}{2} \pm \sqrt{\frac{22}{4}} = -\frac{3}{2} \pm \frac{\sqrt{11}}{2} = \frac{-3 \pm \sqrt{11}}{2}$$

b. $-\frac{2}{3}x^2 + \frac{1}{3}x - \frac{1}{2} = 0 \rightarrow a = -\frac{2}{3} ; b = \frac{1}{3} ; c = -\frac{1}{2} \rightarrow$

$$x = \frac{-\frac{1}{3} \pm \sqrt{(\frac{1}{3})^2 - 4*-\frac{2}{3}*-\frac{1}{2}}}{2*-\frac{2}{3}} = \frac{-\frac{1}{3} \pm \sqrt{\frac{1}{9} - \frac{8}{6}}}{-\frac{4}{3}} = \frac{-\frac{1}{3} \pm \sqrt{\frac{2}{18} - \frac{24}{18}}}{-\frac{4}{3}} = \frac{-\frac{1}{3} \pm \sqrt{\frac{22}{18}}}{-\frac{4}{3}} \rightarrow$$

kan niet, dus geen oplossingen

c. $\frac{3}{4}x^2 + \frac{3}{8}x - \frac{3}{4} = 0 \rightarrow a = \frac{3}{4} ; b = \frac{3}{8} ; c = -\frac{3}{4} \rightarrow$

$$x = \frac{-\frac{3}{8} \pm \sqrt{(\frac{3}{8})^2 - 4*\frac{3}{4}*-\frac{3}{4}}}{2*\frac{3}{4}} = \frac{-\frac{3}{8} \pm \sqrt{\frac{9}{64} + \frac{36}{16}}}{\frac{6}{4}} = \frac{4}{6}\left(-\frac{3}{8} \pm \sqrt{\frac{9}{64} + \frac{36}{16}}\right) = -\frac{4.3}{6.8} \pm \frac{4}{6}\sqrt{\frac{9}{64} + \frac{36}{16}} =$$

$$-\frac{12}{48} \pm \frac{4}{6}\sqrt{\frac{9}{64} + \frac{144}{64}} = -\frac{1}{4} \pm \frac{4}{6}\sqrt{\frac{153}{64}} = -\frac{1}{4} \pm \frac{4}{6}*\frac{1}{8}\sqrt{153} = -\frac{1}{4} \pm \frac{4}{48}\sqrt{153} =$$

$$-\frac{1}{4} \pm \frac{1}{12}\sqrt{153} = -\frac{1}{4} \pm \frac{1}{12}\sqrt{3*3*17} = -\frac{1}{4} \pm \frac{1}{12}*3\sqrt{17} = -\frac{1}{4} \pm \frac{1}{4}\sqrt{17}$$

d. $\frac{2}{5}x^2 + \frac{3}{5}x - \frac{5}{4} = 0 \rightarrow a = \frac{2}{5} ; b = \frac{3}{5} ; c = -\frac{5}{4} \rightarrow$

$$x = \frac{-\frac{3}{5} \pm \sqrt{\frac{3}{5}^2 - 4 * \frac{2}{5} * -\frac{5}{4}}}{2 * \frac{2}{5}} = \frac{-\frac{3}{5} \pm \sqrt{\frac{9}{25} + \frac{40}{20}}}{\frac{4}{5}} = \frac{5 * -\frac{3}{5} \pm 5 * \sqrt{\frac{36}{100} + \frac{200}{100}}}{4} = \frac{-\frac{15}{5} \pm 5\sqrt{\frac{236}{100}}}{4} = \frac{-3 \pm 5\left(\frac{\sqrt{2*2*59}}{10}\right)}{4} =$$

$$= \frac{-3 \pm \frac{5}{10} 2\sqrt{59}}{4} = \frac{-3 \pm \sqrt{59}}{4}$$

e. $-\frac{3}{2}x^2 + \frac{1}{4}x - \frac{1}{8} = 0 \rightarrow a = -\frac{3}{2}; b = \frac{1}{4}; c = -\frac{1}{8} \rightarrow$

$$x = \frac{-\frac{1}{4} \pm \sqrt{(\frac{1}{4})^2 - 4 * -\frac{3}{2} * -\frac{1}{8}}}{2 * -\frac{3}{2}} = \frac{-\frac{1}{4} \pm \sqrt{\frac{1}{16} - \frac{12}{16}}}{-\frac{6}{2}} = \frac{-\frac{1}{4} \pm \sqrt{-\frac{11}{16}}}{-3} \rightarrow$$

 kan niet, dus geen oplossingen

10.25

a. $x(1 - x) = -2 \rightarrow x - x^2 = -2 \rightarrow x - x^2 + x + 2 = 0 \rightarrow a = -1; b = 1; c = 2 \rightarrow$

$$x = \frac{-1 \pm \sqrt{1^2 - 4 * -1 * 2}}{2 * -1} = \frac{-1 \pm \sqrt{1 + 8}}{-2} \rightarrow \frac{-1 \pm 3}{-2} = \frac{1 \pm 3}{2} \rightarrow x = \frac{4}{2} = 2 \quad of \quad x = -\frac{2}{2} = -1$$

b. $(3x + 1)(x + 3) = 1 \rightarrow 3x^2 + 9x + x + 3 = 1 \rightarrow 3x^2 + 10x + 2 = 0 \rightarrow$

$a = 3; b = 10; c = 2 \rightarrow x = \frac{-10 \pm \sqrt{10^2 - 4*3*2}}{2*3} = \frac{-10 \pm \sqrt{100 - 24}}{6} = \frac{-10 \pm \sqrt{76}}{6} = \frac{-10 \pm \sqrt{2*2*19}}{6} =$
$\frac{-10 \pm 2\sqrt{19}}{6} = \frac{-5 \pm \sqrt{19}}{3}$

c. $(x - 2)(2 - 3x) = x \rightarrow -3x^2 + 2x + 6x - 4 = x \rightarrow -3x^2 + 7x - 4 = 0 \rightarrow$

$a = -3; b = 7; c = -4 \rightarrow x = \frac{-7 \pm \sqrt{7^2 - 4 * -3 * -4}}{2 * -3} = \frac{-7 \pm \sqrt{49 - 48}}{-6} = \frac{-7 \pm 1}{-6} = \frac{7 \pm 1}{6} \rightarrow$

$x = \frac{8}{6} = \frac{4}{3} \quad of \quad x = \frac{6}{6} = 1$

d. $(5 - x)(5 + x) = 5 \rightarrow -x^2 - 5x + 5x + 25 = 5 \rightarrow -x^2 + 20 = 0 \rightarrow$

$a = -1; b = 0; c = 20 \rightarrow \quad x = \frac{\pm \sqrt{-4 * -1 * 20}}{2 * -1} = \frac{\pm \sqrt{80}}{-2} \rightarrow \frac{\pm \sqrt{2*2*2*2*5}}{-2} = \frac{\pm 4\sqrt{5}}{-2} = \pm 2\sqrt{5}$

e. $(1 - x)(2 - x) = 3 - x \rightarrow x^2 - x - 2x + 2 = 3 - x \rightarrow x^2 - x - 2x + 2 - 3 + x \rightarrow$
$x^2 - 2x - 1 = 0 \rightarrow a = 1; b = -2; c = -1 \rightarrow x = \frac{2 \pm \sqrt{(-2)^2 - 4 * 1 * -1}}{2 * 1} = \frac{2 \pm \sqrt{4 + 4}}{2} = \frac{2 \pm 2\sqrt{2}}{2} =$
$$1 \pm \sqrt{2}$$

10.26

a. $(x^2 - 4)(x^2 - 1) = 5 \rightarrow x^4 - x^2 - 4x^2 + 4 = 5 \rightarrow x^4 - 5x^2 - 1 = 0 \rightarrow$

       $y = x^2 \rightarrow y^2 - 5y - 1 = 0 \rightarrow a = 1; b = -5; c = -1 \rightarrow$

       $y = \frac{5 \pm \sqrt{(-5)^2 - 4*1*-1}}{2*1} = \frac{5 \pm \sqrt{25+4}}{2} = \frac{5 \pm \sqrt{29}}{2} \rightarrow x^2 = \frac{5 \pm \sqrt{29}}{2}$

        $\frac{5 - \sqrt{29}}{2}$ is negatief, immers $\sqrt{29} > 5$, dit kan niet, dus valt af $\rightarrow x^2 = \frac{5 + \sqrt{29}}{2} \rightarrow$ $x =$
$\pm\sqrt{\frac{5 + \sqrt{29}}{2}} = \pm\sqrt{\frac{2*5 + 2*\sqrt{29}}{2*2}} = \pm\frac{1}{2}\sqrt{10 + 2\sqrt{29}}$

b. $(1 - x^2)(1 + 2x^2) = x^2 \rightarrow -2x^4 - x^2 + 2x^2 + 1 = x^2 \rightarrow -2x^4 + 1 = 0 \rightarrow$

       $y = x^2 \rightarrow -2y^2 + 1 = 0 \rightarrow a = -2; b = 0; c = 1 \rightarrow$

       $y = \frac{0 \pm \sqrt{0^2 - 4*-2*1}}{2*-2} = \frac{\pm\sqrt{8}}{-4} = \frac{\pm 2\sqrt{2}}{4} = \pm\frac{1}{2}\sqrt{2} \rightarrow x^2 = \pm\frac{1}{2}\sqrt{2}$

       $\rightarrow -\frac{1}{2}\sqrt{2}$ valt af $\rightarrow x^2 = \frac{1}{2}\sqrt{2} \rightarrow x = \pm\sqrt{\frac{1}{2}\sqrt{2}} = \pm\sqrt{\frac{2}{4}\sqrt{2}} = \pm\frac{1}{2}\sqrt{2\sqrt{2}}$

       Het is mooier om van $\sqrt{2\sqrt{2}}$ 1 wortel te maken.

       Dit doen we als volgt: $\sqrt{2\sqrt{2}} = \sqrt{\sqrt{8}} = \left((8)^{\frac{1}{2}}\right)^{\frac{1}{2}} = (8)^{\frac{1}{4}} = \sqrt[4]{8}$

       En het antwoord is dus $\pm\frac{1}{2}\sqrt[4]{8}$

c. $(\sqrt{x} - 1)(\sqrt{x} - 3) = 1 \rightarrow x - \sqrt{x} - 3\sqrt{x} + 3 = 1 \rightarrow x - 4\sqrt{x} + 2 = 0 \rightarrow$

       $\rightarrow y = \sqrt{x}$ en $x = y^2 \rightarrow y^2 - 4y + 2 = 0 \rightarrow a = 1; b = -4; c = 2 \rightarrow$

       $y = \frac{4 \pm \sqrt{(-4)^2 - 4*1*2}}{2*1} = \frac{4 \pm \sqrt{16-8}}{2} = \frac{4 \pm \sqrt{8}}{2} = \frac{4 \pm 2\sqrt{2}}{2} = 2 \pm \sqrt{2} \rightarrow$

       $\rightarrow x = y^2 \rightarrow x = \left(2 \pm \sqrt{2}\right)^2$, dit geeft 2 oplossingen, namelijk:

$x = \left(2 + \sqrt{2}\right)^2 = (2 + \sqrt{2})(2 + \sqrt{2}) = 4 + 2\sqrt{2} + 2\sqrt{2} + 2 = 6 + 4\sqrt{2}$ en
$x = \left(2 - \sqrt{2}\right)^2 = (2 - \sqrt{2})(2 - \sqrt{2}) = 4 - 2\sqrt{2} - 2\sqrt{2} + 2 = 6 - 4\sqrt{2}$

d. $\sqrt{x}(1 + \sqrt{x}) = 1 - \sqrt{x} \rightarrow \sqrt{x} + \sqrt{x}^2 = 1 - \sqrt{x} \rightarrow \sqrt{x} + x^2 = 1 - \sqrt{x} \rightarrow$
          $x + 2\sqrt{x} - 1 = 0 \rightarrow y = \sqrt{x} \rightarrow x = y^2 \rightarrow y^2 + 2y - 1 = 0 \rightarrow$

          $\rightarrow a = 1; b = 2; c = -1 \rightarrow$

       $y = \frac{-2 \pm \sqrt{2^2 - 4*1*-1}}{2*1} = \frac{-2 \pm \sqrt{4+4}}{2} = \frac{-2 \pm \sqrt{8}}{2} = \frac{-2 \pm 2\sqrt{2}}{2} = -1 \pm \sqrt{2} \rightarrow \sqrt{x} = -1 \pm \sqrt{2}$

$-1 - \sqrt{2}$ is negatief, dit kan niet, dus valt af.

$-1 + \sqrt{2}$ is positief, dit kan wel

$$\rightarrow \sqrt{x} = -1 + \sqrt{2} \rightarrow x = \left(-1 + \sqrt{2}\right)^2 = \left(-1 + \sqrt{2}\right)\left(-1 + \sqrt{2}\right) =$$
$$1 - \sqrt{2} - \sqrt{2} + 2 = 3 - 2\sqrt{2}$$

e. $(1 - x^3)(2 - x^3) = x^3 \rightarrow x^6 - 2x^3 - x^3 + 2 = x^3 \rightarrow x^6 - 4x^3 + 2 = 0 \rightarrow$

$\rightarrow y = x^3 \rightarrow \quad y^2 - 4y + 2 = 0 \rightarrow \quad a = 1; b = -4; c = 2 \rightarrow$

$y = \frac{4 \pm \sqrt{(-4)^2 - 4*1*2}}{2*1} = \frac{4 \pm \sqrt{16 - 8}}{2} = \frac{4 \pm \sqrt{8}}{2} = \frac{4 \pm 2\sqrt{2}}{2} = 2 \pm \sqrt{2} \rightarrow x^3 = 2 \pm \sqrt{2}$

$\rightarrow x = \sqrt[3]{2 \pm \sqrt{2}}$