

Mind Generation
 Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
 Multimea numerelor reale. Operatii.
 Probleme rezolvate.

Notiuni teorie multimile N, Z, Q, R:

1. a). Fie multimea $A = \{ \sqrt{5^2 \cdot 2^3}; \sqrt{6 + \frac{1}{4}}; \sqrt{3^2 + 4^2}; \sqrt{5 \frac{1}{9}}; \sqrt{3^2 \cdot 5^4}; \sqrt{11 + \frac{1}{9}}; \sqrt{16 + \frac{1}{5}} \}$
 Determinati:
 $A \cap N; A \cap (Q \setminus Z); A \cap (R \setminus Q)$

Rezolvare: facem calculele de sub fiecare radical !

$$\sqrt{5^2 \cdot 2^3} = \sqrt{5^2 \cdot 2^2 \cdot 2} = 5 \cdot 2 \cdot \sqrt{2} = 10\sqrt{2}$$

$$\sqrt{6 + \frac{1}{4}} = \sqrt{\frac{24+1}{4}} = \sqrt{\frac{25}{4}} = \frac{5}{2}$$

$$\sqrt{3^2 + 4^2} = \sqrt{9+16} = \sqrt{25} = 5$$

$$\sqrt{5 \frac{1}{9}} = \sqrt{\frac{5 \cdot 9+1}{9}} = \sqrt{\frac{46}{9}} = \frac{\sqrt{46}}{3}$$

$$\sqrt{3^2 \cdot 5^4} = 3^2 \cdot 5^2 = 9 \cdot 25 = 225$$

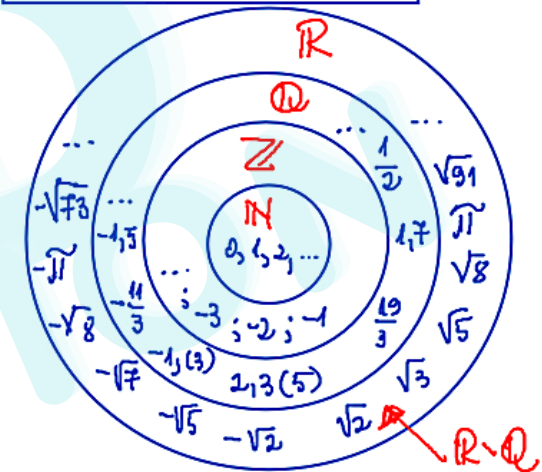
$$\sqrt{11 + \frac{1}{9}} = \sqrt{\frac{99+1}{9}} = \sqrt{\frac{100}{9}} = \frac{10}{3}$$

$$\sqrt{16 + \frac{1}{5}} = \sqrt{\frac{80+1}{5}} = \sqrt{\frac{81}{5}} = \frac{9}{\sqrt{5}}$$

Obs: Dacă sub radical avem "+"
 sau "-", facem calculele,
 NU putem aplica radicalul
 fiecărui termen!

$$\text{Deci: } \sqrt{3^2 + 4^2} \neq \sqrt{3^2} + \sqrt{4^2} = 3 + 4 = 7$$

NU facem așa!



N = mult. nr. naturale
 Z = mult. nr. întregi
 Q = mult. nr. rationale
 R = mult. nr. reale

$R \setminus Q$ = mult. nr. irrationale

ex: $\sqrt{11} \in R \setminus Q$

$\sqrt{2} \in R \setminus Q$

$-\sqrt{7} \in R \setminus Q$

$$N \subset Z \subset Q \subset R$$

Mind Generation
Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
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Probleme rezolvate.

$$\Rightarrow A = \left\{ 10\sqrt{2}; \frac{5}{2}; 5; \frac{\sqrt{46}}{3}; 225; \frac{10}{3}; \frac{9}{\sqrt{5}} \right\}$$

$10\sqrt{2} \in \mathbb{R} \setminus \mathbb{Q}$ este irational

$$\frac{5}{2} \in \mathbb{Q}; 5 \in \mathbb{N}; \frac{\sqrt{46}}{3} \in \mathbb{R} \setminus \mathbb{Q} \text{ este irational}; 225 \in \mathbb{N}; \frac{10}{3} \in \mathbb{Q}$$

$\frac{9}{\sqrt{5}}$: cine a invatat rationalizarea numitorului va face in continuare:
 $\frac{9}{\sqrt{5}} = \frac{9\sqrt{5}}{5} \in \mathbb{R} \setminus \mathbb{Q}$ este irational

cine nu a invatat rationalizarea numitorului: ramane sub aceasta forma

$$\frac{9}{\sqrt{5}} \in \mathbb{R} \setminus \mathbb{Q} \text{ este irational}$$

$$\Rightarrow A \cap \mathbb{N} = \{5; 225\}$$

$$A \cap (\mathbb{Q} \setminus \mathbb{Z}) = \left\{ \frac{5}{2}; \frac{10}{3} \right\} \text{ (cautam numerele } \underline{\text{rationale care NU sunt intregi}})$$

$$A \cap (\mathbb{R} \setminus \mathbb{Q}) = \left\{ 10\sqrt{2}; \frac{\sqrt{46}}{3}; \frac{9}{\sqrt{5}} \right\} \text{ (cautam numerele } \underline{\text{irationale}})$$

Pag.2

Mind Generation
Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
Multimea numerelor reale. Operatii.
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b). Fie multimea $A = \{-4; \sqrt{0,9}; \sqrt{12}; \frac{\sqrt{64}}{4}; \sqrt{20}; 3,8; -\frac{1}{4}; \frac{-27}{-9}; -\sqrt{18}\}$
Determinati:
 $A \cap \mathbb{N}; A \cap \mathbb{Z}; A \cap \mathbb{Q}; A \cap (\mathbb{R} \setminus \mathbb{Q}); A \setminus \mathbb{R}; A \setminus \mathbb{Q}; A \setminus \mathbb{Z}$

Rezolvare: $-4 \in \mathbb{Z}$

$$\sqrt{0,9} = \sqrt{\frac{1}{9}} = \frac{1}{3} \in \mathbb{Q}$$

$$\sqrt{12} = \sqrt{3 \cdot 4} = 2\sqrt{3} \in \mathbb{R} \setminus \mathbb{Q}$$

$$\frac{\sqrt{64}}{4} = \frac{8}{4} = 2 \in \mathbb{N}$$

$$\sqrt{20} = \sqrt{4 \cdot 5} = 2\sqrt{5} \in \mathbb{R} \setminus \mathbb{Q}$$

$$3,8 = \frac{38}{10} = \frac{19}{5} \in \mathbb{Q}$$

$$-\frac{1}{4} \in \mathbb{Q}$$

$$\frac{-27}{-9} = 3 \in \mathbb{N}$$

$$-\sqrt{18} = -\sqrt{2 \cdot 9} = -3\sqrt{2} \in \mathbb{R} \setminus \mathbb{Q}$$

$$\Rightarrow A = \{-4; \frac{1}{3}; 2\sqrt{3}; 2; 2\sqrt{5}; \frac{19}{5}; -\frac{1}{4}; 3; -3\sqrt{2}\}$$

$$\rightarrow A \cap \mathbb{N} = \{2, 3\}$$

$$A \cap \mathbb{Z} = \{-4; 2; 3\}$$

$$A \cap \mathbb{Q} = \{-4; \frac{1}{3}; 2; \frac{19}{5}; -\frac{1}{4}; 3\}$$

$$A \cap (\mathbb{R} \setminus \mathbb{Q}) = \{2\sqrt{3}; 2\sqrt{5}; -3\sqrt{2}\}$$

$$A \setminus \mathbb{R} = \emptyset; A \setminus \mathbb{Q} = \{2\sqrt{3}; 2\sqrt{5}; -3\sqrt{2}\}$$

$$A \setminus \mathbb{Z} = \{\frac{1}{3}; 2\sqrt{3}; 2\sqrt{5}; \frac{19}{5}; -3\sqrt{2}\}$$

Pag.3

Mind Generation
 Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
 Multimea numerelor reale. Operatii.
 Probleme rezolvate.

2. Calculati:

$$a) \frac{-\sqrt{252}}{\sqrt{7}} = -\sqrt{\frac{252}{7}} = -\sqrt{36} = -6$$

$$b) \frac{\sqrt{432}}{-\sqrt{3}} = -\sqrt{\frac{432}{3}} = -\sqrt{144} = -12$$

$$c) \frac{\sqrt{6}-\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{6}}{\sqrt{2}} - \frac{\sqrt{2}}{\sqrt{2}} = \sqrt{\frac{6}{2}} - \sqrt{\frac{2}{2}} = \sqrt{3} - 1$$

$$d) \frac{3\sqrt{28} - \sqrt{21}}{\sqrt{7}} = \frac{3\sqrt{28}}{\sqrt{7}} - \frac{\sqrt{21}}{\sqrt{7}} = 3\sqrt{\frac{28}{7}} - \sqrt{\frac{21}{7}} =$$

$$= 3\sqrt{4} - \sqrt{3} = 3 \cdot 2 - \sqrt{3} = 6 - \sqrt{3}$$

$$e) -\sqrt{2} \cdot \left(-\sqrt{4\frac{1}{2}}\right) = \sqrt{2} \cdot \sqrt{\frac{4 \cdot 2 + 1}{2}} =$$

$$= \sqrt{2} \cdot \sqrt{\frac{9}{2}} = \sqrt{2} \cdot \frac{\sqrt{9}}{\sqrt{2}} = \sqrt{9} = 3$$

$$f) \sqrt{\frac{8}{15}} \cdot \sqrt{1\frac{1}{5}} = \sqrt{\frac{8}{15}} \cdot \sqrt{\frac{1 \cdot 5 + 1}{5}} = \sqrt{\frac{8}{15}} \cdot \sqrt{\frac{6}{5}} =$$

$$= \sqrt{\frac{8 \cdot 6}{15 \cdot 5}} = \sqrt{\frac{24}{25}} = \frac{\sqrt{24}}{\sqrt{25}} = \frac{2\sqrt{6}}{5}$$

$$\begin{array}{r} 24 \mid 2 > 2 \\ 12 \mid 2 \\ 6 \mid 2 \\ 3 \mid 3 \\ 1 \end{array}$$

$$g) \sqrt{7\frac{1}{2}} \cdot \sqrt{0,370} =$$

$$= \sqrt{\frac{7 \cdot 2 + 1}{2}} \cdot \sqrt{\frac{370}{1000}} = \sqrt{\frac{15}{2}} \cdot \sqrt{\frac{370}{1000}} = \sqrt{\frac{15 \cdot 370}{2 \cdot 1000}} =$$

$$= \sqrt{\frac{3 \cdot 5 \cdot 2 \cdot 5 \cdot 37}{2 \cdot 1000}} = \sqrt{\frac{2 \cdot 3 \cdot 5^2 \cdot 37}{2 \cdot 3^3 \cdot 2^3 \cdot 5^3}} = \sqrt{\frac{5^2}{3^2}} = \frac{5}{3}$$

$$15 = 3 \cdot 5$$

$$370 = 2 \cdot 5 \cdot 37$$

$$999 \mid 3 \Rightarrow 999 = 3^3 \cdot 37$$

$$\begin{array}{r} 999 \mid 3 \\ 333 \mid 3 \\ 111 \mid 3 \\ 37 \mid 37 \\ 1 \end{array}$$

Mind Generation
Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
Multimea numerelor reale. Operatii.
Probleme rezolvate.

3. Comparati numerele:

a) $5\sqrt{5}$ si $7\sqrt{3}$

Introducem sub radical \Rightarrow

$$\begin{aligned} \Rightarrow 5\sqrt{5} &= \sqrt{5^2 \cdot 5} = \sqrt{25 \cdot 5} = \sqrt{125} \\ 7\sqrt{3} &= \sqrt{7^2 \cdot 3} = \sqrt{49 \cdot 3} = \sqrt{147} \end{aligned} \quad \left. \vphantom{\begin{aligned} \Rightarrow 5\sqrt{5} &= \sqrt{5^2 \cdot 5} = \sqrt{25 \cdot 5} = \sqrt{125} \\ 7\sqrt{3} &= \sqrt{7^2 \cdot 3} = \sqrt{49 \cdot 3} = \sqrt{147} \end{aligned}} \right\} \Rightarrow$$

$$\Rightarrow \sqrt{125} < \sqrt{147} \Rightarrow 5\sqrt{5} < 7\sqrt{3}$$

b) $-4\sqrt{2}$ si $-2\sqrt{5}$

$$\begin{aligned} -4\sqrt{2} &= -\sqrt{4^2 \cdot 2} = -\sqrt{16 \cdot 2} = -\sqrt{32} \\ -2\sqrt{5} &= -\sqrt{2^2 \cdot 5} = -\sqrt{4 \cdot 5} = -\sqrt{20} \end{aligned} \quad \left. \vphantom{\begin{aligned} -4\sqrt{2} &= -\sqrt{4^2 \cdot 2} = -\sqrt{16 \cdot 2} = -\sqrt{32} \\ -2\sqrt{5} &= -\sqrt{2^2 \cdot 5} = -\sqrt{4 \cdot 5} = -\sqrt{20} \end{aligned}} \right\} \Rightarrow$$

$$\Rightarrow -\sqrt{32} < -\sqrt{20} \Rightarrow -4\sqrt{2} < -2\sqrt{5}$$

c) $2\sqrt{5}-4\sqrt{3}$ si 0

$$\begin{aligned} 2\sqrt{5}-4\sqrt{3} &= \sqrt{2^2 \cdot 5} - \sqrt{4^2 \cdot 3} = \sqrt{4 \cdot 5} - \sqrt{16 \cdot 3} = \\ &= \sqrt{20} - \sqrt{48} < 0 \text{ deoarece } \sqrt{20} < \sqrt{48} \end{aligned}$$

d) $2\sqrt{7}-5$ si $2-\sqrt{5}$

$$\begin{aligned} 2\sqrt{7}-5 &= \sqrt{2^2 \cdot 7} - \sqrt{25} = \sqrt{4 \cdot 7} - \sqrt{25} = \sqrt{28} - \sqrt{25} > 0 \\ 2-\sqrt{5} &= \sqrt{4} - \sqrt{5} < 0 \end{aligned} \quad \left. \vphantom{\begin{aligned} 2\sqrt{7}-5 &= \sqrt{2^2 \cdot 7} - \sqrt{25} = \sqrt{4 \cdot 7} - \sqrt{25} = \sqrt{28} - \sqrt{25} > 0 \\ 2-\sqrt{5} &= \sqrt{4} - \sqrt{5} < 0 \end{aligned}} \right\} \text{ deoarece } 28 > 25$$

$$\Rightarrow \sqrt{4} - \sqrt{5} < 0 < \sqrt{28} - \sqrt{25} \Rightarrow$$

$$\Rightarrow 2 - \sqrt{5} < 2\sqrt{7} - 5$$

Mind Generation
 Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
 Multimea numerelor reale. Operatii.
 Probleme rezolvate.

4. Calculati:

a) $|2\sqrt{2}-3|$

Teorie folosita: definitia modului:

$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

Pentru a calcula modulul, trebuie sa vedem ce semn are expresia din modul iar apoi sa aplicam definitia modului.
 Pentru a determina semnul expresiei: $2\sqrt{2}-3$ trebuie sa comparam: $2\sqrt{2}$ si 3

$$\Rightarrow \left. \begin{aligned} 2\sqrt{2} &= \sqrt{2^2 \cdot 2} = \sqrt{4 \cdot 2} = \sqrt{8} \\ 3 &= \sqrt{9} \end{aligned} \right\} \Rightarrow \sqrt{8} < \sqrt{9} \Rightarrow$$

$$\Rightarrow 2\sqrt{2} < 3 \Leftrightarrow 2\sqrt{2}-3 < 0 \Rightarrow$$

$$\Rightarrow |2\sqrt{2}-3| = -(2\sqrt{2}-3) = -2\sqrt{2}+3 = 3-2\sqrt{2}$$

conform def. modului: daca se
 avem in modul este negativ, aplicam semnul
 "-" in fata!

b) $|5-2\sqrt{6}|$

Care este semnul pt $5-2\sqrt{6}$? \Rightarrow
 \Rightarrow Comparăm 5 si $2\sqrt{6}$

$$\left. \begin{aligned} 5 &= \sqrt{25} \\ 2\sqrt{6} &= \sqrt{2^2 \cdot 6} = \sqrt{4 \cdot 6} = \sqrt{24} \end{aligned} \right\} \Rightarrow \sqrt{25} > \sqrt{24} \Rightarrow$$

$$\Rightarrow 5 > 2\sqrt{6} \Rightarrow 5-2\sqrt{6} > 0 \Rightarrow$$

$$\Rightarrow |5-2\sqrt{6}| = 5-2\sqrt{6}$$

c) $|2\sqrt{3}-3\sqrt{2}|$

Comparăm $2\sqrt{3}$ si $3\sqrt{2}$ \Rightarrow

$$\Rightarrow \left. \begin{aligned} 2\sqrt{3} &= \sqrt{4 \cdot 3} = \sqrt{12} \\ 3\sqrt{2} &= \sqrt{9 \cdot 2} = \sqrt{18} \end{aligned} \right\} \Rightarrow \sqrt{12} < \sqrt{18} \Rightarrow$$

$$\Rightarrow 2\sqrt{3} < 3\sqrt{2} \Rightarrow 2\sqrt{3}-3\sqrt{2} < 0 \Rightarrow$$

$$\Rightarrow |2\sqrt{3}-3\sqrt{2}| = -(2\sqrt{3}-3\sqrt{2}) = 3\sqrt{2}-2\sqrt{3}$$

Mind Generation
Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
Multimea numerelor reale. Operatii.
Probleme rezolvate.

5. Calculati:

$$a) |\sqrt{3}-\sqrt{5}| + |\sqrt{3}| - |\sqrt{5}-1|$$

$$\sqrt{3} < \sqrt{5} \Rightarrow \sqrt{3}-\sqrt{5} < 0 \Rightarrow |\sqrt{3}-\sqrt{5}| = -(\sqrt{3}-\sqrt{5}) = \sqrt{5}-\sqrt{3} \quad (1)$$

$$|\sqrt{3}| = \sqrt{3} \quad (2)$$

$$\sqrt{5} > \sqrt{1} \Rightarrow \sqrt{5}-1 > 0 \Rightarrow |\sqrt{5}-1| = \sqrt{5}-1 \quad (3)$$

Din (1), (2), (3) \Rightarrow

$$\begin{aligned} \Rightarrow |\sqrt{3}-\sqrt{5}| + |\sqrt{3}| - |\sqrt{5}-1| &= \\ &= \sqrt{5}-\sqrt{3} + \sqrt{3} - (\sqrt{5}-1) = \sqrt{5}-\sqrt{5}+1 = 1. \end{aligned}$$

$$b) |1-\sqrt{3}| + |\sqrt{5}-\sqrt{3}| - |2-\sqrt{5}|$$

$$\sqrt{1} < \sqrt{3} \Rightarrow 1-\sqrt{3} < 0 \Rightarrow |1-\sqrt{3}| = -(1-\sqrt{3}) = \sqrt{3}-1 \quad (1)$$

$$\begin{aligned} \sqrt{5} > \sqrt{3} \Rightarrow \sqrt{5}-\sqrt{3} > 0 \Rightarrow |\sqrt{5}-\sqrt{3}| &= \sqrt{5}-\sqrt{3} \quad (2) \\ 2 = \sqrt{4} < \sqrt{5} \Rightarrow 2-\sqrt{5} < 0 \Rightarrow |2-\sqrt{5}| &= -(2-\sqrt{5}) = \\ &= \sqrt{5}-2 \quad (3) \end{aligned}$$

Din (1), (2) si (3) \Rightarrow

$$\begin{aligned} \Rightarrow |1-\sqrt{3}| + |\sqrt{5}-\sqrt{3}| - |2-\sqrt{5}| &= \\ = \sqrt{3}-1 + \sqrt{5}-\sqrt{3} - (\sqrt{5}-2) &= \sqrt{3}-1-\sqrt{5}+2 = \\ = 2-1 = 1. \end{aligned}$$

6. Calculati:

$$\begin{aligned} a) 4\sqrt{3} - (6\sqrt{2} - 2\sqrt{3}) - (8\sqrt{3} - 6\sqrt{2}) - \sqrt{3} &= \\ = 4\sqrt{3} - 6\sqrt{2} + 2\sqrt{3} - 8\sqrt{3} + 6\sqrt{2} - \sqrt{3} &= \\ = \sqrt{3}(4+2-8-1) = -3\sqrt{3} \end{aligned}$$

Pag.7

Mind Generation
 Centru de Matematica si Informatica

~ Matematica pt cîs a VII-a ~
 Multimea numerelor reale. Operatii.
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$$\begin{aligned} \Rightarrow & -3\sqrt{125} + 2\sqrt{20} - 2\sqrt{80} + 11\sqrt{5} = \\ & = -3 \cdot 5\sqrt{5} + 2 \cdot 2\sqrt{5} - 2 \cdot 4\sqrt{5} + 11\sqrt{5} = \\ & = -15\sqrt{5} + 4\sqrt{5} - 8\sqrt{5} + 11\sqrt{5} = \\ & = \sqrt{5} (-15 + 4 - 8 + 11) = -8\sqrt{5} \end{aligned}$$

$$c) -\frac{5}{11}\sqrt{605} + \frac{7}{3}\sqrt{45} - 1,3\sqrt{180} = ?$$

$$\sqrt{605} = 11\sqrt{5}$$

$$\sqrt{45} = 3\sqrt{5}$$

$$\begin{aligned} \sqrt{180} &= 2 \cdot 3\sqrt{5} = \\ &= 6\sqrt{5} \end{aligned}$$

$$1,3 = \frac{13-1}{9} = \frac{12}{9} = \frac{4}{3}$$

$$\begin{array}{r|l} 605 & 5 \\ 121 & 11 > 11 \\ 11 & 11 \\ 1 & \end{array}$$

$$\begin{array}{r|l} 45 & 5 \\ 9 & 3 > 3 \\ 3 & 3 \\ 1 & \end{array}$$

$$\begin{array}{r|l} 180 & 2 > 2 \\ 90 & 2 \\ 45 & 3 > 3 \\ 15 & 3 \\ 5 & 5 \\ 1 & \end{array}$$

$$\begin{aligned} \Rightarrow & -\frac{5}{11}\sqrt{605} + \frac{7}{3}\sqrt{45} - 1,3\sqrt{180} = \\ & = -\frac{5}{11} \cdot 11\sqrt{5} + \frac{7}{3} \cdot 3\sqrt{5} - \frac{4}{3} \cdot 6\sqrt{5} = \\ & = -5\sqrt{5} + 7\sqrt{5} - 8\sqrt{5} = \sqrt{5}(-5+7-8) = -6\sqrt{5} \end{aligned}$$

$$d) \sqrt{\frac{72}{25}} - \left(\sqrt{\frac{98}{225}} + \sqrt{\frac{32}{9}} \right) =$$

$$= \frac{\sqrt{72}}{\sqrt{25}} - \left(\frac{\sqrt{98}}{\sqrt{225}} + \sqrt{\frac{32}{9}} \right) = \frac{\sqrt{72}}{5} - \left(\frac{\sqrt{98}}{15} + \frac{\sqrt{32}}{3} \right)$$

$$\sqrt{72} = \sqrt{2 \cdot 36} = 6\sqrt{2}$$

$$\sqrt{98} = \sqrt{2 \cdot 49} = 7\sqrt{2}$$

$$\sqrt{32} = \sqrt{2 \cdot 16} = 4\sqrt{2}$$

$$= -\frac{3}{5}\sqrt{2}$$

$$= \frac{6\sqrt{2}}{5} - \frac{7\sqrt{2}}{15} - \frac{4\sqrt{2}}{3} =$$

$$= \sqrt{2} \left(\frac{6}{5} - \frac{7}{15} - \frac{4}{3} \right) =$$

$$= \sqrt{2} \cdot \frac{18-7-20}{15} = \sqrt{2} \cdot \frac{-9}{15} = -\frac{3}{5}\sqrt{2}$$

Mind Generation
 Centru de Matematica si Informatica

~ Matematica pt cls a VII-a ~
 Multimea numerelor reale. Operatii.
 Probleme rezolvate.

$$e) \left(\sqrt{\frac{845}{144}} + \sqrt{\frac{45}{16}} \right) - \left(\sqrt{\frac{500}{36}} - \sqrt{\frac{605}{4}} \right) =$$

$$= \frac{\sqrt{845}}{\sqrt{144}} + \frac{\sqrt{45}}{\sqrt{16}} - \frac{\sqrt{500}}{\sqrt{36}} + \frac{\sqrt{605}}{\sqrt{4}} =$$

$$= \frac{\sqrt{845}}{12} + \frac{\sqrt{45}}{4} - \frac{\sqrt{500}}{6} + \frac{\sqrt{605}}{2} =$$

845	5	=>	$\sqrt{845} = 13\sqrt{5}$
169	13		$\sqrt{45} = 3\sqrt{5}$
13	13		$\sqrt{500} = \sqrt{5 \cdot 100} = 10\sqrt{5}$
1	1		$\sqrt{605} = 11\sqrt{5}$

605	5	=>	$\sqrt{845} = 13\sqrt{5}$
121	11		$\sqrt{45} = 3\sqrt{5}$
11	11		$\sqrt{500} = \sqrt{5 \cdot 100} = 10\sqrt{5}$
1	1		$\sqrt{605} = 11\sqrt{5}$

$$= \frac{13\sqrt{5}}{12} + \frac{3\sqrt{5}}{4} - \frac{10\sqrt{5}}{6} + \frac{11\sqrt{5}}{2} = \sqrt{5} \left(\frac{13}{12} + \frac{3}{4} - \frac{5}{3} + \frac{11}{2} \right)$$

$$= \frac{13+9-20+66}{12} \sqrt{5} = \frac{68}{12} \sqrt{5} = \frac{17}{3} \sqrt{5}$$

f) $(27\sqrt{10}) : (-9\sqrt{2}) = - (27:9) \sqrt{10:2} = -3\sqrt{5}$

g) $(-10\sqrt{72}) : (-5\sqrt{18}) = (10:5) \sqrt{72:18} = 2\sqrt{4} = 2 \cdot 2 = 4$

h) $(14\sqrt{6} + 7\sqrt{14}) : (7\sqrt{2}) = (14\sqrt{6}) : (7\sqrt{2}) + (7\sqrt{14}) : (7\sqrt{2}) =$
 $= (14:7)\sqrt{6:2} + (7:7)\sqrt{14:2} = 2\sqrt{3} + \sqrt{7}$

i) $(8\sqrt{20}) : (4\sqrt{10}) - 15\sqrt{6} : (-3\sqrt{3}) + 6\sqrt{14} : (-2\sqrt{7}) =$
 $= (8:4) \cdot (\sqrt{20:10}) + (15:3)\sqrt{6:3} - (6:2)\sqrt{14:7} =$
 $= 2\sqrt{2} + 5\sqrt{2} - 3\sqrt{2} = \sqrt{2}(2+5-3) = 4\sqrt{2}$