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Άσκηση 1

α. -10+(5-8)-(4-20)=-10+$\left[5+(-8)\right]-\left[4+(-20)\right]=-10+\left[-(8-5)\right]-\left[-(20-4)\right]=$
$=-10+(-3)-(-16)=-10-3+16=-13+16=+3$

β. 25+(18-7)-(16-22)-(14+30)=25+(+11)-$\left[16+(-20)\right]-(+44)=$
$=25+(+11)-\left[-(20-16)\right]-(+44)=25+11-(-4)-44=25+11+4-44=40-44=-4$

Άσκηση 2

α. ισχύει : (-5)-(+2)=(-5)+(-2)=-(5+2)=-8
β. δεν ισχύει : (-8)-(-3)=(-8)+(+3)=-(8-3)=-5
γ. ισχύει : (+5)-(+8)=(+5)+(-8)=-(8-5)=-3

Άσκηση 3

a. (-5)+(-6)-(+3)-(-7)+(-12)-(-13)=(-11)-(-4)+(1)=-7+1=-6
β. (-7)-(+8)+(-3)+(+7)-(-3)-(+1)=-7-8-3+7+3-1=-8-1=-9
γ. -3-(8-7)-(-12+11)-(5+2)=-3-(+1)-(-1)-(+7)=-3-1+1-7=-3-7=-10
δ. 3-$\left[-2-(8+2)\right]-12-(8-3)=3-\left[-2-(+10)\right]-12-(+5)=3-(-2-10)-12-5=$
$=3-(-12)-12-5=3+12-12-5=3-5=-2$
ε. 7-(-8+3)-$\left[-5-(10-13)-3\right]-1=7-(-5)-\left[-5-(-13)-3\right]-1=7-(-5)-(-5+13-3)-1=$
$=7+5-(+5)-1=7-1=6$
$\sigma\tau$. -(-3+1)-$\left[-5+(-3+7)-\left[-3-(-7+1)\right]\right]-(8-5)=-(-2)-\left[-5+(+4)-\left[-3-(-6)\right]\right]-(+3)=$
$=-(-2)-\left[-5+4-(-3+6)\right]-3=2-\left[-5+4-(+3)\right]-3=2-(-5+4-3)-3=2-(-4)-3=$
$=2+4-3=3$

Άσκηση 4

$\alpha)$ -2-$\left[36-8-\left(9-28\right)\right]=-2-\left[36-8-(-19)\right]=-2-(36-8+19)=-2-(47)=$
$=-2-47=-49$

$\beta)$ -4-(-5+3)-$\left[6-(-4+9)+(-1-2+7)\right]-(12-16)=-4-(-2)-\left[6-(+5)+(+4)\right]-(-4)=$
$=-4-(-2)-(6-5+4)-(-4)=-4+2-(+5)+4=-4+2-5+4=-3$

$\gamma)$ -(-5)+(-12)-$\left[-(+5)-(-12)\right]-\left[-(-36)\right]=-(-5)+(-12)-(-5+12)-(+36)=$
$=+5-12-(+7)-36=5-12-7-36=5-55=-50$

$\delta)$ -$\left(-\frac{1}{4}+\frac{1}{8}\right)-2-\left(\frac{3}{10}-\frac{2}{5}\right)=-\left(\frac{-2+1}{8}\right)-2-\left(\frac{3-4}{10}\right)=-\left(-\frac{1}{8}\right)-2-\left(-\frac{1}{10}\right)=$
$=\frac{1}{8}-2+\frac{1}{10}=\frac{5-80+4}{40}=\frac{-71}{40}=-\frac{71}{40}$

$\varepsilon)$ $-\frac{3}{10}+\frac{2}{15}-\frac{1}{30}+\frac{7}{5}-\frac{5}{6}-\frac{11}{30}=\frac{-9+4-1+42-25-11}{30}=\frac{-5+41-36}{30}=$
$=\frac{36-36}{30}=\frac{0}{30}=0$

$\sigma\tau)$ $\frac{1}{4}-\left(-\frac{2}{3}-5+7\right)+\left(-4+8\right)-\left(\frac{1}{2}-5\right)=\frac{1}{4}-\left(\frac{-2-15+21}{3}\right)+\left(+4\right)-\left(\frac{1-10}{2}\right)=$
$=\frac{1}{4}-\left(+\frac{4}{3}\right)+\left(+4\right)-\left(-\frac{9}{2}\right)=\frac{1}{4}-\frac{4}{3}+4+\frac{9}{2}=\frac{3-16+48+54}{12}=-\frac{-13+102}{12}=\frac{89}{12}$

Άσκηση 5

α) (–3) · (+5) · (–2) · (–4) = -(3·5·2·4) = -120

β) $\left(-\frac{4}{5}\right)\cdot\left(+\frac{2}{3}\right)\cdot\left(-\frac{3}{4}\right)\cdot\left(-\frac{5}{2}\right)=-\left(\frac{4\cdot2\cdot3\cdot5}{5\cdot3\cdot4\cdot2}\right)=-1$

γ) (–2) · (+2) + 3 · (12 – 9) – 5 · (2 – 4) = -(2·2)+3·3-5·(-2) =-4+9+10=15

δ) [3-(3-4)]·[5+(2-3)]·(6-4) = [3-(-1)]·[5+(-1)]·2 = (3+1)·(5-1)·2 = 4·4·2=16

ε) $\left(3-\frac{2}{3}\right)\cdot[4-\left(+\frac{2}{5}\right)\cdot(-\frac{10}{3})]\cdot\left(\frac{1}{2}-\frac{1}{3}\right)=\left(\frac{9-2}{3}\right)\bullet[4-\left(-\frac{4}{3}\right]\cdot\left(\frac{3-2}{6}\right)=$

$=\left(\frac{7}{2}\right)\cdot\left(4+\frac{4}{3}\right)\cdot\left(\frac{1}{6}\right)=\frac{7}{2}\cdot\left(\frac{12+4}{3}\right)\cdot\frac{1}{6}=\frac{7}{2}\cdot\frac{16}{3}\cdot\frac{1}{6}=\frac{7\cdot8}{3\cdot6}=\frac{7\cdot4}{3\cdot3}=\frac{28}{9}$

στ) $\left(-3\right)\cdot\left(7+6-\frac{2}{3}\right)-4\cdot\left(4-\frac{3}{4}\right)\cdot\left(7-\frac{1}{2}\right)\cdot\left(-1\right)=\left(-3\right)\cdot\left(\frac{21+18-2}{3}\right)-4\cdot\left(\frac{16-3}{4}\right)\cdot\left(\frac{14-1}{2}\right)\cdot\left(-1\right)=$

$=\left(-3\right)\cdot\left(\frac{37}{3}\right)-4\cdot\left(\frac{13}{4}\right)\left(\frac{13}{2}\right)\cdot\left(-1\right)=\left(-37\right)-4\left(-\frac{169}{8}\right)=\left(-37\right)+\frac{169}{2}=\frac{-74+169}{2}=\frac{95}{2}$

Άσκηση 6

$\alpha)\ \left(-3\right)\cdot\left(-\frac{1}{2}\right)\cdot\left(-7\right)\cdot\left(+2\right)=-(3\cdot\frac{1}{2}\cdot7\cdot2)=-\left(\frac{3\cdot1\cdot7\cdot2}{2}\right)=-21$

$\beta)\ \left(-\frac{1}{2}\right)\cdot\left(+\frac{3}{8}\right)\cdot\left(-\frac{2}{3}\right)\cdot\left(+\frac{8}{2}\right)=+\left(\frac{1\cdot3\cdot2\cdot8}{2\cdot8\cdot3\cdot2}\right)=+\frac{1}{2}$

$\gamma)\ \left(-\frac{1}{2}\right)\cdot\left[\left(-4\right)+\left(-\frac{2}{3}\right)-\left(-3\right)\right]=\left(-\frac{1}{2}\right)\cdot\left[\frac{-12-2+9}{3}\right]=\left(-\frac{1}{2}\right)\cdot\left(-\frac{5}{3}\right)=$

$=+\left(\frac{1\cdot5}{2\cdot3}\right)=\frac{5}{6}$

$\delta)\ \left(-7\right)\cdot\left[\left(-4\right):\left(+\frac{1}{2}\right)\right]\cdot\left(+\frac{9}{2}\right):\left(-9\right)=\left(-7\right)\cdot\left[-\left(4\cdot2\right)\right]\cdot\left[-\left(\frac{9\cdot1}{2\cdot9}\right)\right]=$

$=\left(-7\right)\cdot\left(-8\right)\cdot\left(-\frac{1}{2}\right)=-\left(\frac{7\cdot8\cdot1}{2}\right)=-28$

Άσκηση 7

$$\alpha)\quad (12+6-15):(-2)=(18-15):(-2)=(3):(-2)=-\frac{3}{2}$$

$$\beta)\quad \left(-\frac{5}{12}+\frac{1}{4}-2\right):\left(-\frac{1}{2}\right)=\left(\frac{-5+3-6}{12}\right):\left(-\frac{1}{2}\right)=\left(\frac{-2-6}{12}\right):\left(-\frac{1}{2}\right)=\left(\frac{-8}{12}\right):\left(-\frac{1}{2}\right)=$$

$$=\left(-\frac{8}{12}\right):\left(-\frac{1}{2}\right)=+\left(\frac{8\cdot 2}{12\cdot 1}\right)=\frac{4}{3}$$

$$\gamma)\quad \left[60\cdot(-8)\cdot(-12)\right]:(-3)=\left[+(60\cdot 8\cdot 12)\right]:(-3)=-\left(\frac{60\cdot 8\cdot 12}{3}\right)=$$

$$=-(60\cdot 8\cdot 4)=-(480\cdot 4)=-1920$$

$$\delta)\quad \left(\frac{6}{7}-\frac{1}{14}+\frac{3}{7}\right):\left(\frac{2}{3}-\frac{3}{4}\right)=\left(\frac{12-1+6}{14}\right):\left(\frac{8-9}{12}\right)=\left(\frac{17}{14}\right):\left(-\frac{1}{12}\right)=$$

$$=-\left(\frac{17}{14}\right)\cdot\frac{12}{1}=-\frac{17\cdot 6}{7}=-\frac{102}{7}$$

Άσκηση 8

$\alpha.\ 6^2\cdot 6^2=6^{2+3}=6^5$ $\beta.\ 2^3\cdot 2^4\cdot 2^5=2^{3+4+5}=2^{12}$ $\gamma.\ 5^2\cdot 5^{-5}=5^{2+(-5)}=5^{-3}=\frac{1}{5^3}$

$\delta.\ (7\cdot 3\cdot 2)^2=7^2\cdot 3^2\cdot 2^2=49\cdot 9\cdot 2=882$ $\varepsilon.\ \left(+\frac{8}{5}\right)^2=\frac{8^2}{5^2}=\frac{64}{25}$ $\sigma\tau.\ \frac{2^5}{2^7}=2^{5-7}=2^{-2}=\frac{1}{2^2}=\frac{1}{4}$

$\zeta.\ \frac{10^3}{7^3}=\left(\frac{10}{7}\right)^3=1{,}43^3$ $\eta)\ \left(5^2\right)^3=5^{2\cdot 3}=5^6$

Άσκηση 9

$\alpha.\ \left[\left(-10\right)^3\right]^4=\left(-10\right)^{3\cdot4}=\left(-10\right)^{12}=10^{12}$ β. $2^4\cdot2^2=2^{2+4}=2^6$

$\gamma.\ \left(-2\right)^3\cdot10^2=(-8)\cdot100=-800$ δ. $\left(7^2\cdot7^1\right)^0=\left(7^{2+1}\right)^0=\left(7^3\right)^0=7^{3\cdot0}=7^0=1$

$\varepsilon.\ \left(-\frac{3}{4}\right)^3\cdot\left(+\frac{1}{3}\right)^3=\left[\left(-\frac{3}{4}\right)\cdot\left(+\frac{1}{3}\right)\right]^3=\left(-\frac{3\cdot1}{4\cdot3}\right)^3=\left(-\frac{1}{4}\right)^3=-\frac{1}{4^3}=-\frac{1}{64}$

$\sigma\tau.\ 12^4:12^6=\frac{12^4}{12^6}=12^{4-6}=12^{-2}=\frac{1}{12^2}=\frac{1}{144}$

Άσκηση 10

$\alpha.\ \left(-3\right)^2=+3^2=3\cdot3=9$ β. $-4^2=-(4)^2=-(4\cdot4)=-16$ γ. $(-3)^3=-(3)^3=-\left(3\cdot3\cdot3\right)=-27$

$\delta.\ \left(\frac{1}{3}\right)^5=\frac{1^5}{3^5}=\frac{1\cdot1\cdot1\cdot1\cdot1}{3\cdot3\cdot3\cdot3\cdot3}=\frac{1}{243}$ ε. $\left(-\frac{1}{2}\right)^4=+\left(\frac{1}{2}\right)^4=\frac{1^4}{2^4}=\frac{1\cdot1\cdot1\cdot1}{2\cdot2\cdot2\cdot2}=\frac{1}{16}$

$\sigma\tau.\ 0^{40}=0\cdot0\cdot\underbrace{0\cdot....\cdot0}_{40}=0\quad\left(0^\nu=0,\nu\ \text{φυσικός}\ \right)$ ζ. $\left(10^2\right)^3=\left(10\right)^{2\cdot3}=10^6=1.000.000$

$\eta.\ -\left(\frac{1}{2}-\frac{5}{23}\right)^0=1$, $\alpha^0=1$ για καθε $\alpha\neq0$ θ. $-\left(-\frac{1}{2}\right)^3=-\left(-\frac{1^3}{2^3}\right)=-\left(-\frac{1}{8}\right)=\frac{1}{8}$

$\eta'.\ \left(2\alpha^2\right)^4=\left(2\cdot\alpha^2\right)^4=\left(2\right)^4\cdot\left(\alpha^2\right)^4=16\cdot\alpha^{2\cdot4}=16\alpha^8$ ι. $\left(-\frac{2}{3}\right)^3=-\left(\frac{2^3}{3^3}\right)=-\frac{8}{27}$

$\iota\alpha.\ -0,5^3=-\left(\frac{1}{2}\right)^3=-\left(\frac{1^3}{2^3}\right)=-\frac{1}{8}$ ιβ. $\left(-1\right)^9=-(1^9)=-1$ ιγ. $-1^8=-(1^8)=-1$

$\iota\delta.\ -2^4=-(2^4)=-(2\cdot2\cdot2\cdot2)=-16$ ιε. $(-2)^4=+(2)^4=2\cdot2\cdot2\cdot2=16$

Άσκηση 11

$$A=\frac{(-10)^4}{5^4}-\frac{21^3}{7^3}+\frac{56^5}{28^5}=\left(\frac{-10}{5}\right)^4-\left(\frac{21}{7}\right)^3+\left(\frac{56}{28}\right)^5=(-2)^4-(3^3)+(2)^5=+16-27+32=21$$

Άσκηση 12

$$A=(-7+5)^3\cdot\left[-(6-2)^2+3^3\right]=(-2)^3\cdot\left[-(4)^2+27\right]=(-8)\cdot(-16+27)=(-8)\cdot(11)=-88$$

$$B=(3-5)^2-5^2:\left[8-2\cdot2^3-(-1)^6:(-0,25)\right]=(-2)^2-25:\left[8-2^{3+1}-(1):(-\frac{1}{4})\right]=$$

$$=4-25:\left[8-2^4-(-1\cdot4)\right]=4-25:(8-16+4)=4-25:(-8+4)=4-25:(-4)=$$

$$=4-(-25\cdot4)=4-(-100)=4+100=104$$

Άσκηση 13

$$A=\frac{(-2)^{15}\cdot3^8\cdot5^9}{4^7\cdot3^6\cdot25^4}=\frac{(-2)^{15}\cdot3^8\cdot5^9}{(2^2)^7\cdot3^6\cdot(5^2)^4}=\frac{(-2)^{15}\cdot3^8\cdot5^9}{2^{2\cdot7}\cdot3^6\cdot5^{2\cdot4}}=\frac{(-2)^{15}\cdot3^8\cdot5^9}{2^{14}\cdot3^6\cdot5^8}=$$

$$=\frac{(-2)^{15}}{2^{14}}\cdot\frac{3^8}{3^6}\cdot\frac{5^9}{5^8}=-(2)^{15-14}\cdot3^{8-6}\cdot5^{9-8}=-(2^1)\cdot3^2\cdot5^1=-2\cdot9\cdot5=-90$$

$$B=\frac{(-3)^2+2^3-(-2)^3}{(-4)^2-5^2}\cdot\frac{2^4+1}{-2\cdot(-1)^3}=\frac{9+8-(-8)}{16-25}\cdot\frac{16+1}{-2\cdot(-1)}=\frac{17+8}{-9}\cdot\frac{17}{2}=-\frac{25}{9}\cdot\frac{17}{2}=$$

$$=-\frac{425}{18}$$

$$\Gamma=-\frac{1}{8}\cdot\left(-\frac{2}{3}\right)^2-(-6)\cdot3^2\cdot\left(-\frac{1}{3}\right)^4=-\frac{1}{8}\cdot\left(\frac{2^2}{3^2}\right)-(-6)\cdot9\cdot\left(\frac{1^4}{3^4}\right)=-\frac{1}{8}\cdot\left(\frac{4}{9}\right)+6\cdot9\cdot\frac{1}{81}=$$

$$=-\frac{1\cdot4}{8\cdot9}+\frac{6\cdot9\cdot1}{81}=-\frac{1}{2\cdot9}+\frac{6\cdot1}{9}=-\frac{1}{18}+\frac{12}{18}=\frac{-1+12}{18}=\frac{11}{18}$$

Άσκηση 14

$\alpha.\quad \left(-\frac{1}{2}\right)^3 \cdot \left[\left(-\frac{1}{2}\right)^{-4}\right]^2 \cdot \left(-\frac{1}{2}\right)^5 = \left(-\frac{1}{2}\right)^3 \cdot \left(-\frac{1}{2}\right)^{(-4)\cdot 2} \cdot \left(-\frac{1}{2}\right)^5 =$

$= \left(-\frac{1}{2}\right)^3 \cdot \left(-\frac{1}{2}\right)^{-8} \cdot \left(-\frac{1}{2}\right)^5 = \left(-\frac{1}{2}\right)^{3+(-8)+5} = \left(-\frac{1}{2}\right)^0 = 1$

$\beta.\quad 8^2 \cdot 9^3 \cdot 5^6 = \left(2^3\right)^2 \cdot \left(3^2\right)^3 \cdot 5^6 = 2^{2\cdot 3} \cdot 3^{2\cdot 3} \cdot 5^6 = 2^6 \cdot 3^6 \cdot 5^6 = (2\cdot 3\cdot 5)^6 = 30^6$

$\gamma.\quad (3^4)^2 + 3^{10} : 9 + 3^5 \cdot 3^3 - 2\cdot 3^9 = 3^{4\cdot 2} + \frac{3^{10}}{3^2} + 3^{5+3} - 2\cdot 3^9 = 3^8 + 3^{10-2} + 3^8 - 2\cdot 3^9 =$

$= 3^8 + 3^8 + 3^8 - 2\cdot 3^9 = 3\cdot 3^8 - 2\cdot 3^9 = 3^1 \cdot 3^8 - 2\cdot 3^9 = 3^{1+8} - 2\cdot 3^9 = 3^9 - 2\cdot 3^9 =$

$= -1\cdot 3^9 = -3^9$