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**CONCURSUL INTERJUDETEAN DE MATEMATICA**
**"Al.Papiu Ilarian"**
**07.11.2009**
**EDITIA a XIV - a**
**CLASA a V - a**

## BAREM DE EVALUARE

### Subiectul I.

$a = 10^2$..........................................................................................................2p
$b = 2007^2$......................................................................................................3p
$c = (5*2^n)^2$...................................................................................................2p

### Subiectul II.

a) S=par numai daca numarul termenilor sai este par. Deci n = 2k .............3p
b) $U(2009^1+2009^2)=0$, $U(2009^3+2009^4)=0$, ... , $U(2009^{2k-1}+2009^{2k})=0$ .........3p
Deci, $S \vdots 10$ ...........................................................................................1p

### Subiectul III.

x = nr. probleme corect rezolvate ;
y = nr. probleme gresit rezolvate.
x = 27.........................................................................................................3p
y = 11 ........................................................................................................3p
Elevul nu a promovat in faza urmatoare .......................................................1p

### Subiectul IV.

a) $n = 10(a+b)$ ..............................................................................3p
b) $9(a+b)+(a+b) = 9c+8$ .........................................................2p
$(a+b) = 8$ ...........................................................................1p
$n = 80$ ....................................................................................1p

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## "Al.Papiu Ilarian"
## 07.11.2009
## EDITIA a XIV - a
## CLASA a VI - a

## BAREM DE EVALUARE

**Subiectul I.**

a) U(n)=3, deci "n" nu este patrat perfect ..........................................................3p

b) $a = 3^{2n+1} \cdot 2^{3n+1}\left(3 \cdot 2^2 + 2 + 1\right)$.........................................................................2p

$a = 3^{2n+1} 2^{3n+1} 15$ ..............................................................................1p

Finalizare ....................................................................................................1p

**Subiectul II.**

a) $\frac{3n+5}{2n+7}$ reductibila daca exista $d \neq 1$ astfel incat $(3n+5) \vdots d$ si $(2n+7) \vdots d$ ...........1p

d=11 ..............................................................................................................2p

$(n-2) \vdots d \Rightarrow n = 11a + 2$ ............................................................................1p

b) $n_0 = 2, n_1 = 11 \cdot 1 + 2, ..., n_{2008} = 11 \cdot 2008 + 2$ ..........................................................1p

$S = 11(0 + 1 + 2 + ... + 2008) + 2 \cdot 2009$ ...............................................................1p

$S = 11046 \cdot 2009$ .............................................................................................1p

Finalizare ....................................................................................................1p

**Subiectul III.**

a) $AM_6 = \frac{AB}{2^6} = 2^{2003}$ ..................................................................................3p

b) S = $2^{2008}$ +$2^{2007}$ + ...+2+1 = 2 ( $2^{2007}$+ $2^{2006}$ + ... + 1 ) + 1 = 2k+1 ....................4p

**Subiectul IV.**

$s + m(AOB) = 180^0$
$c + m(BOC) = 90^0$ ..........................................................................................1p

$m(AOB) + m(BOC) = m(AOC)$ ...........................................................................1p

$m(AOB) + \frac{1}{2} m(BOC) = c$ ........................................................................1p

$m(BOC) + \frac{1}{2} m(AOB) = s$ ........................................................................1p

$\frac{5}{2}[m(AOB) + m(BOC)] = 270^0$ ................................................................2p

$m(AOC) = 108^0$ ..........................................................................................1p

COLEGIUL NAȚIONAL "Al.Papiu-Ilarian" TÎRGU MUREȘ
"Per aspera ad astra!"

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## BAREM DE EVALUARE

**Subiectul I**

a)

$$x=\left[2\left(\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+...+\frac{1}{2010\cdot 2011}\right)\right]^n\cdot\frac{2011^n}{2^n}=2010^n \text{..........}1p$$

$$x=2^n\cdot 5^n\cdot 3^n\cdot 67^n \text{..........}1p$$

$$\sigma(x)=(n+1)^4 \text{..........}1p$$

$$(n+1)^4=256=4^4\Rightarrow n+1=4\Rightarrow n=3 \text{..........}1p$$

b)

$$2009^{2009}=2009\cdot 2009^{2008}=7^2\cdot 41\cdot 2009^{2008} \text{..........}1p$$

$$2009^{2009}=7^2\left(4^2+5^2\right)\cdot 2009^{2008} \text{..........}1p$$

$$2009^{2009}=\left(28\cdot 2009^{1004}\right)^2+\left(35\cdot 2009^{1004}\right)^2 \text{..........}1p$$

**Subiectul II**

**a)** $7^{2x}=41^y=2009\Rightarrow 49^x=49\cdot 41$ si $41^y=49\cdot 41$..........1p

$\left(49^x\right)^y=49^y\cdot 41^y$ si $\left(41^y\right)^x=49^x\cdot 41^x$..........1p

Inmultind cele doua relatii avem: $2009^{xy}=2009^{x+y}$..........1p

$xy=x+y\Rightarrow\frac{1}{x}+\frac{1}{y}=1$..........1p

b) Se observa ca, pentru n = 4, numerele considerate sunt toate prime..........1p

**Unicitate ..........2p**

Pentru $n\geq 5$, numerele considerate nu sunt toate prime.

Exemplu, $n=5k, k\in N\Rightarrow n+15=5p$, deci nu este prim, etc

**Subiectul III**

a) $\Delta APM\,(AP=AM)$ is

$\Big| \Rightarrow AP=AQ\Rightarrow\Delta APQ$ is ..........2p

$\Delta AMQ\,(AM=AQ)$ is

b) $A_{\Delta ABC}=A_{\Delta AMB}+A_{\Delta AMC}\Rightarrow\frac{AB\cdot ME}{2}+\frac{AC\cdot MF}{2}=A_{\Delta ABC}\Rightarrow MP+MQ=\frac{4A_{\Delta ABC}}{AB}=constant$. ...3p

c) $\Delta AB'C'$, $C'M\perp AB, B'M\perp AC$ si $AM\cap B'M\cap C'M=\{M\}\Rightarrow AM\perp B'C'$ ..........2p

**Subiectul IV**

a) Reciproca teoremei liniei mijloci in $\Delta ABC, respectiv \Delta ABD \Rightarrow O$ mij (AC), (BD) . Deci, ABCD paralelogram ......................................................................................................................2p

b) $\Delta ARQ \equiv \Delta BRC \Rightarrow m(\prec DAQ) = 180^0 \Rightarrow D, A, Q$ coliniare ...............................................3p

c) Se demonstreaza ca AP mediatoare in triunghiul PRM .......................................................1p

Finalizare ...........................................................................................................................1p

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**BAREM DE EVALUARE**

**Subiectul I**

a) **a)** $7^{2x} = 41^y = 2009 \Rightarrow 49^x = 49 \cdot 41$ si $41^y = 49 \cdot 41$ ........1p

$(49^x)^y = 49^y \cdot 41^y$ si $(41^y)^x = 49^x \cdot 41^x$ ........1p

Inmultind cele doua relatii avem: $2009^{xy} = 2009^{x+y}$ ........1p

$xy = x + y \Rightarrow \frac{1}{x} + \frac{1}{y} = 1$........1p

b)

$2009^{2009} = 2009 \cdot 2009^{2008} = 7^2 \cdot 41 \cdot 2009^{2008}$........1p

$2009^{2009} = 7^2(4^2 + 5^2) \cdot 2009^{2008}$........1p

$2009^{2009} = (28 \cdot 2009^{1004})^2 + (35 \cdot 2009^{1004})^2$........1p

**Subiectul II**

a) $3(x^2 + 4x + 4) + 5(y^2 + 2y + 1) + 2(z^2 - 2z + 1) = 0$........1p

$3(x+2)^2 + 5(y+1)^2 + 2(z-1)^2 = 0$........1p

x = - 2; y = - 1; z = 1 ........1p

b) Demonstreaza ca $\frac{\sqrt{ab}}{\frac{a+b}{2}} \prec 1$ ........1p

$$\left(\frac{\sqrt{1\cdot 2}}{\frac{1+2}{2}} + \frac{\sqrt{2\cdot 3}}{\frac{2+3}{2}} + \dots + \frac{\sqrt{2000\cdot 2001}}{\frac{2000+2001}{2}}\right) \prec \underbrace{1+1+1+\dots+1}_{2000} = 2000$$ ........3p

**Subiectul III**

$(BE bis \prec ABC \Rightarrow \prec ABE \equiv \prec EBC (= 30^0) \Rightarrow AE = \frac{BE}{2}$........2p

$\Delta BEC is \Rightarrow BE = CE \Rightarrow \frac{CE}{AE} = 2$........2p

$\frac{AP}{PB} \cdot \frac{BD}{DC} \cdot \frac{CE}{EA} = \frac{3}{2} \cdot \frac{1}{3} \cdot 2 = 1$ ........2p

Teorema lui Ceva implica $CP \cap AD \cap BE = \{T\}$........1p

**Subiectul IV**

a) $P_{\Delta ABC} = a\sqrt{3} + a$ ..........................................................................................................1p

b) Dem. ca $d\left(M, \left(ABC\right)\right) = MO$, unde O mijlocul lui (BC) ..........................................1p

MO = $\frac{a\sqrt{6}}{3}$ ..........................................................................................................1p

c) $AB \perp OP, AB \perp MO \Rightarrow AB \perp \left(MOP\right)$ ..........................................................................1p

d) Dem. ca $\frac{MG_2}{G_2 N} = \frac{MG_1}{G_1 P}$ ..........................................................................................1p

$G_1G_2 \parallel NP$ ..........................................................................................................1p

Finalizare ..........................................................................................................1p