



# THE HARMONY SOUTH AFRICAN MATHEMATICS OLYMPIAD

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organised by the SUID-AFRIKAANSE AKADEMIE VIR WETENSKAP EN KUNS  
in collaboration with HARMONY GOLD MINING, AMESA and SAMS

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## SECOND ROUND 2004 JUNIOR SECTION: GRADES 8 AND 9 13 MAY 2004 TIME: 120 MINUTES NUMBER OF QUESTIONS: 20

### Instructions :

1. Do not open this booklet until told to do so by the invigilator.
2. This is a multiple choice question paper. Each question is followed by answers marked A, B, C, D and E. Only one of these is correct.
3. Scoring rules :

For each correct answer	in Part A:	4 marks
	in Part B:	5 marks
	in Part C:	6 marks
For each wrong answer:		-1 mark
For no answer:		0 marks
4. You must use an HB pencil.  
Rough paper, a ruler and a rubber are permitted.  
**Calculators and geometry instruments are not permitted.**
5. Diagrams are not necessarily drawn to scale.
6. The centre page is an information and formula sheet. Please tear it out for your use.
7. Indicate your answers on the sheet provided.
8. Start when the invigilator tells you to do so.  
You have 120 minutes to complete the question paper.
9. Answers and solutions will be available in June at  
<http://science.up.ac.za/samo/>

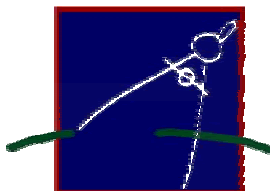
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UNTIL YOU ARE TOLD TO DO SO.**

**DRAAI DIE BOEKIE OM VIR DIE AFRIKAANSE VRAESTEL**

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## PRACTICE EXAMPLES

1.  $23 + 6 - 4 =$

- A) 6      B) 23      C) 25      D) 29      E) 33

2.  $\frac{1}{5} + \frac{2}{3} \times \frac{1}{2}$  equals

- A)  $\frac{1}{15}$       B)  $\frac{3}{11}$       C)  $\frac{21}{50}$       D)  $\frac{8}{15}$       E)  $9\frac{4}{5}$

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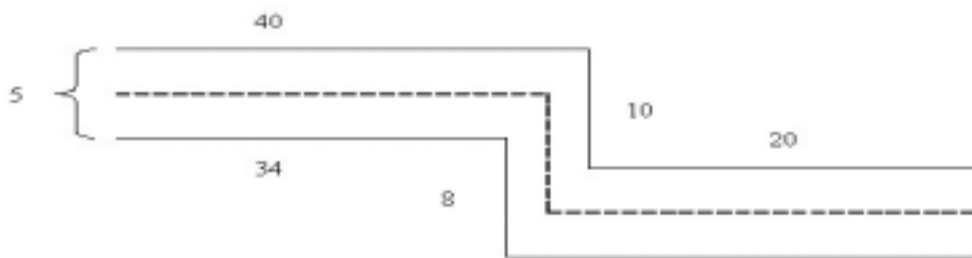
**PART A**

1. If  $\frac{6}{5} = 1,2$ , then the value of  $\frac{0,06}{0,5}$  is
- A) 1,2      B) 0,12      C) 0,012      D) 0,0012      E) 0,00012
- 

2. If  $x \square y$  is defined to be the remainder when  $x$  is divided by  $y$  (for example  $8 \square 5 = 3$ ), then the value of  $13 \square (11 \square 3)$  is
- A) 0      B) 1      C) 2      D) 3      E) 4
- 

3. If  $10^x \cdot 10^y \cdot 10^z = 10^6$ , then the average of  $x$ ,  $y$  and  $z$  is
- A) 1      B)  $\frac{5}{3}$       C) 2      D)  $\frac{7}{3}$       E) 3
- 

4.



The length of the broken line, in metres, down the middle of a road is

- A) 67      B) 67,5      C) 68      D) 69      E) 70
- 
5. In an isosceles triangle  $ABC$ ,  $AB = 2BC$ . If the perimeter of triangle  $ABC$  is  $300\text{ mm}$ , then the length of  $AC$  in millimetres is.
- A) 40      B) 60      C) 80      D) 100      E) 120
-

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## PART B

6. Half of  $2^{2004}$  is

- A)  $2^{1002}$     B)  $2^{2002}$     C)  $2^{2003}$     D)  $1^{2004}$     E)  $1^{1002}$
- 

7. You are given four fractions

$$\frac{5}{12}; a; b; c$$

Two fractions  $a$  and  $b$  are equally spaced between  $\frac{5}{12}$  and  $c$ . If  $a + b = \frac{4}{3}$ , then find the value of  $c$ .

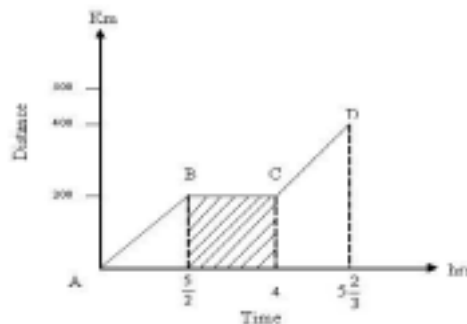
- A)  $\frac{7}{12}$     B)  $\frac{2}{3}$     C)  $\frac{3}{4}$     D)  $\frac{5}{6}$     E)  $\frac{11}{12}$
- 

8. What is the sum of the digits of the following product?

$$999\,999 \times 666\,666$$

- A) 54    B) 63    C) 72    D) 81    E) 90
- 

9. A lady travels by car at a uniform speed, from  $A$  to  $B$  and then from  $C$  to  $D$ . Determine the average travelling speed of the vehicle from  $A$  to  $D$  in km/h.



- A) 92    B) 96    C) 100    D) 104    E) 120

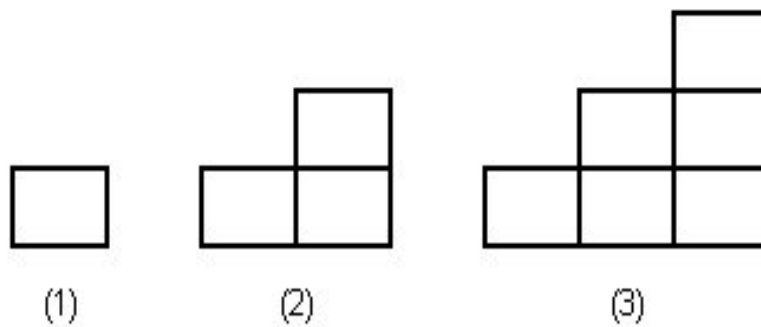


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13. Twenty 1 centimetre cubes all have white sides. Forty four 1 centimetre cubes all have blue sides. These 64 cubes are glued together to form one large cube. What is the minimum surface area that could be white?

A) 20      B) 16      C) 14      D) 12      E) 8

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14. Four matchsticks are used to construct the first figure, 10 matchsticks for the second figure, 18 matchsticks for the third figure and so on.

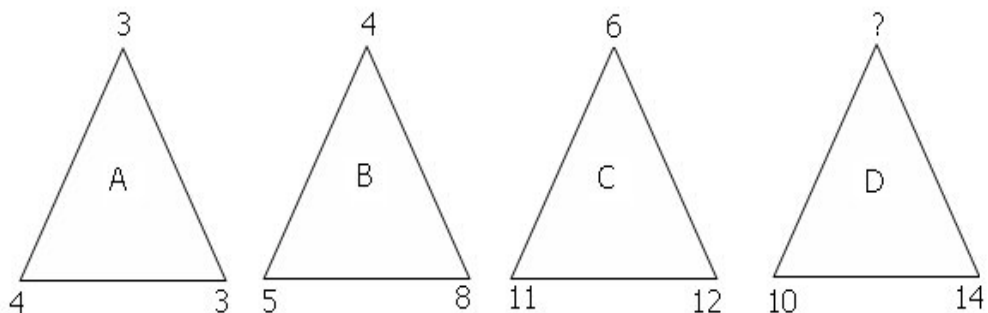


How many matchsticks are needed to construct the 30<sup>th</sup> figure?

A) 900      B) 990      C) 1080      D) 2700      E) 3000

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15. After careful observation, the value and location of one number of every triangle is derived. Determine the missing number at the apex of triangle D.



A) 9      B) 8      C) 7      D) 6      E) 5

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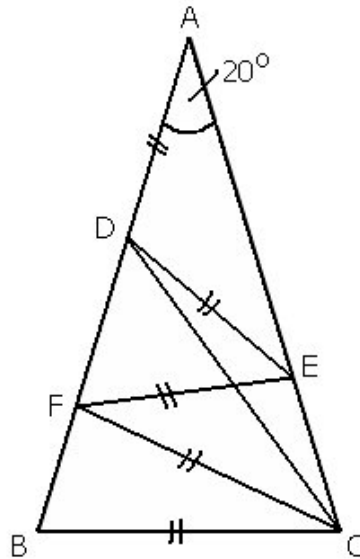
**PART C**

**16.** The product of the *HCF* and *LCM* of two numbers is 384. If one number is 8 more than the other number, then the sum of the two numbers is

- A) 48      B) 40      C) 36      D) 24      E) 18
- 

**17.** In the given figure  $\triangle ABC$ ,  $\angle A = 20^\circ$ .  $DE, DC, EF$  and  $FC$  are joined such that  $AD = DE = EF = FC = BC$ .

The size of  $\angle ACD$  is



- A)  $10^\circ$       B)  $20^\circ$       C)  $30^\circ$       D)  $40^\circ$       E)  $60^\circ$
- 

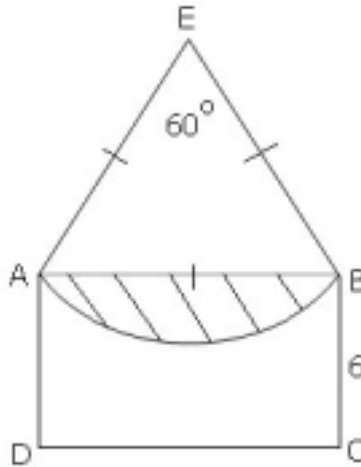
**18.** The value of

$$100^2 - 98^2 + 96^2 - 94^2 + \dots + 8^2 - 6^2 + 4^2 - 2^2$$

is

- A) 5 200      B) 5 100      C) 5 000      D) 4 900      E) 4 800
-

- 
19. In the diagram,  $\triangle EBA$  is an equilateral triangle.  $ABCD$  is a square of sides 6.  $E$  is the centre of the circle which passes through points  $A$  and  $B$ . The area of the shaded region is



- A)  $9\pi - \sqrt{27}$     B)  $6\pi - \sqrt{27}$     C)  $9\pi - 3\sqrt{27}$   
D)  $6\pi - 3\sqrt{27}$     E)  $4\pi - 3\sqrt{27}$

- 
20. The diagram is a “non-traditional” magic square that totals 105. This total can be obtained by adding the 4 numbers along a diagonal. There are other sets of 4 numbers giving the same total. The maximum number of other combinations that give a total of 105 is

12	19	28	35
16	23	32	39
18	25	34	41
13	20	29	36

- A) 16    B) 18    C) 20    D) 22    E) 24

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**THE END**

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## Formula and Information Sheet

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**1.1** The natural numbers are 1; 2; 3; 4; 5; ...

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**1.2** The whole numbers (counting numbers) are 0; 1; 2; 3; 4; 5; ...

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**1.3** The integers are ...; -4; -3; -2; -1; 0; 1; 2; 3; 4; 5; ...

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**2.** In the fraction  $\frac{a}{b}$ ,  $a$  is called the numerator and  $b$  the denominator.

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**3.1** Exponential notation:

$$2 \times 2 \times 2 \times 2 \times 2 = 2^5$$

$$3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$$

$$a \times a \times a \times a \times \dots \times a = a^n \text{ (} n \text{ factors of } a\text{)}$$

( $a$  is the base and  $n$  is the index (exponent))

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**3.2** Factorial notation:

$$1 \times 2 \times 3 \times 4 = 4!$$

$$1 \times 2 \times 3 \times \dots \times n = n!$$

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**4** Area of a

**4.1** rectangle is:      length  $\times$  width =  $lw$   
                                 length  $\times$  breadth =  $lb$

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**4.2** square is:            side  $\times$  side =  $s^2$

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**4.3** rhombus is:             $\frac{1}{2} \times$  (product of diagonals)

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**4.4** trapezium is:         $\frac{1}{2} \times$  (sum of parallel sides)  $\times$  height

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**4.5** circle is:               $\pi r^2$  ( $r$  = radius)

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5 Surface area of a:

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5.1 rectangular prism is:  $2lb + 2lh + 2bh$  ( $h = \text{height}$ )

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5.2 sphere is:  $4\pi r^2$

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6 Perimeter of a:

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6.1 rectangle is:  $2 \times \text{length} + 2 \times \text{breadth}$   
 $2l + 2b$   
or  $2l + 2w$  ( $w = \text{width}$ )

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6.2 square is:  $4s$

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7. Circumference of a circle is:  $2\pi r$

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8. Volume of a:

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8.1 cube is:  $s \times s \times s = s^3$

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8.2 rectangular prism is:  $l \times b \times h$

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8.3 cylinder is:  $\pi r^2 h$

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9.1 Volume of a right prism is: area of cross-section  $\times$  perpendicular height  
or area of base  $\times$  perpendicular height

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9.2 Surface area of a right prism is: perimeter of base  $\times h + 2 \times$  area of base

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10. Sum of the interior angles of a polygon is:  $180^\circ(n - 2)$  ( $n = \text{number of sides}$ )

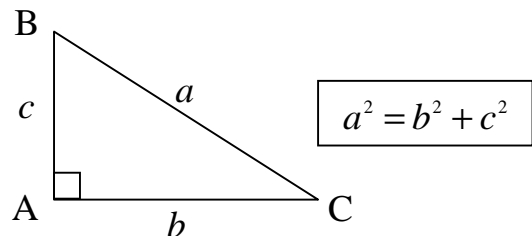
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11. Distance is: speed  $\times$  time ( $d = s \times t$ )

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12 Pythagoras:

$\triangle ABC$  is a right-angled triangle



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13. Conversions:

$1 \text{ cm}^3 = 1 \text{ ml}$  ;  $1000 \text{ cm}^3 = 1 \ell$

$1000 \text{ m} = 1 \text{ km}$  ;  $1000 \text{ g} = 1 \text{ kg}$  ;  $100 \text{ cm} = 1 \text{ m}$

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