



## THE HARMONY SOUTH AFRICAN MATHEMATICS OLYMPIAD

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Organised by the SOUTH AFRICAN MATHEMATICS FOUNDATION.  
Sponsored by HARMONY GOLD MINING.

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### FIRST ROUND 2005 JUNIOR SECTION: GRADES 8 AND 9 15 MARCH 2005 TIME: 60 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:  
Each correct answer is worth 5 marks. There is no penalty for an incorrect or an unanswered question.
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 60 minutes to complete the question paper.
9. Answers and solutions will be available at <http://science.up.ac.za/samo/>

**DO NOT TURN THE PAGE  
UNTIL YOU ARE TOLD TO DO SO.**

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

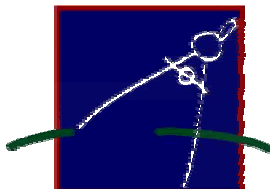
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Organisations involved: AMESA, SA Mathematical Society, SA Akademie vir  
Wetenskap en Kuns

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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)  $9\frac{4}{5}$

**DO NOT TURN THE PAGE  
UNTIL YOU ARE TOLD TO DO SO.**

1. Calculate:  $2 - 2 \times 2 + 2$ .

- A) 0      B) 1      C) 2      D) 4      E) 6
- 

2. In 2004, 16 June falls on a Wednesday. On what day of the week will 16 June fall in 2010?

- A) Monday      B) Tuesday      C) Wednesday  
D) Thursday      E) Friday
- 

3. In a magic square the sum of the numbers in each row, in each diagonal and in each column are equal.  
In this magic square the value of  $x$  is:

9	14	
	10	$x$
	6	

- A) 7      B) 8      C) 11      D) 12      E) 13
- 

4. If half of a number is 30, then three-quarters of that number is:

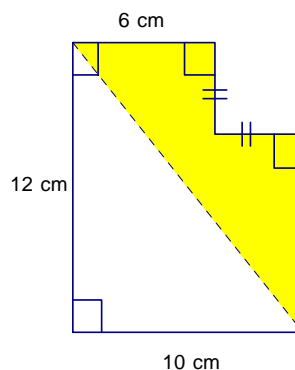
- A) 39      B) 40      C) 42      D) 45      E) 48
- 

5. The sum of the digits of the following product is:

$$999 \times 555$$

- A) 9      B) 18      C) 27      D) 36      E) 45
- 

6. In the given figure the area of the shaded region, in  $\text{cm}^2$ , is



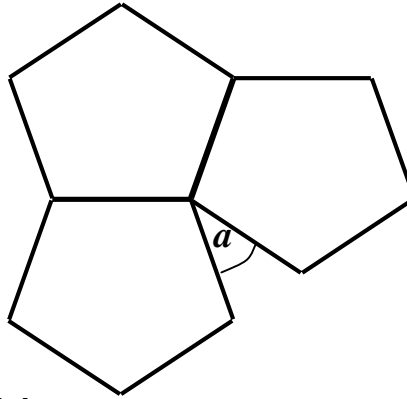
- A) 40      B) 44      C) 50      D) 54      E) 60
-

7. Three positive integers have a sum of 28. The greatest possible product that these integers can have is:

A) 720      B) 756      C) 792      D) 810      E) 852

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8. Jack was trying to tessellate regular pentagons. He managed the following figure.



The size of angle 'a' is:

A)  $36^\circ$       B)  $30^\circ$       C)  $24^\circ$       D)  $18^\circ$       E)  $12^\circ$

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9. In what follows,  $\square$  and  $\triangle$  are different numbers.

When 503 is divided by  $\square$  the remainder is 20.

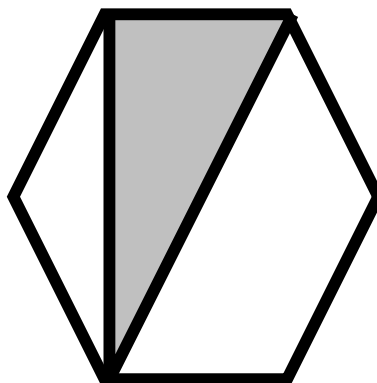
When 503 is divided by  $\triangle$  the remainder is 20.

When 493 is divided by  $\square \times \triangle$  the remainder is :

A) 3      B) 7      C) 10      D) 20      E) 21

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10. If the area of the shaded region of the regular hexagon in the diagram below is  $36 \text{ cm}^2$ , the area of the whole hexagon in  $\text{cm}^2$  is:



A) 90      B) 108      C) 117      D) 126      E) 144

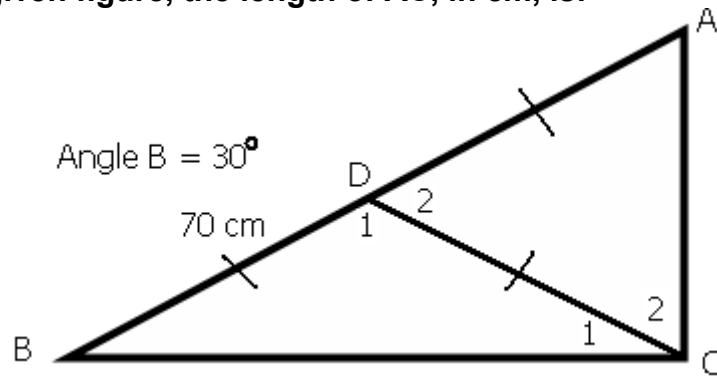
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11. The distance on a map between Harmony town and Sterling is 24 cm. The actual distance between these two towns is 360km. The scale of the map is:

A) 1 : 1 500 000    B) 1 : 150 000    C) 1 : 15 000  
D) 1 : 1 500    E) 1 : 150

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12. In the given figure, the length of AC, in cm, is:



A) 35    B) 50    C) 60    D) 70    E) 90

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13. In a certain code S A T ; S E T and T E N are written as 1 5 4 ; 3 1 4 ; 3 2 1 respectively. The codes are not necessary in the order of the letters. Using the same code in the correct order, how would the word S E N T be represented?

A) 3 4 2 1    B) 3 4 5 1    C) 1 2 3 4    D) 4 1 2 3    E) 4 3 2 1

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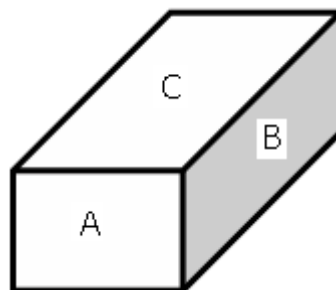
14. The following information is given for a box with integer valued dimensions:

Area of face A is  $24 \text{ cm}^2$

Area of face B is  $40 \text{ cm}^2$

The volume of the prism is  $240 \text{ cm}^3$ .

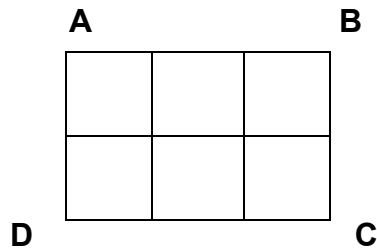
Find the area of face C in  $\text{cm}^2$ .



A) 40    B) 48    C) 60    D) 72    E) 80

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15. In the adjacent figure six squares make up the rectangle ABCD. The perimeters of all six squares were added to give 72 cm. The area of ABCD, in  $\text{cm}^2$ , is:



- A) 54      B) 48      C) 36      D) 30)      E) 24**

- 16. In the following addition problem, each of the letters  $a$  ;  $b$  and  $c$  stands for a digit.**

$$\begin{array}{r} \phantom{+} \quad a \quad b \quad c \\ + \quad a \quad c \quad b \\ \hline \phantom{+} \quad c \quad 4 \quad a \end{array}$$

The value of  $a + b + c$  is:

- A) 20      B) 19      C) 18      D) 17      E) 16**

- 17.**

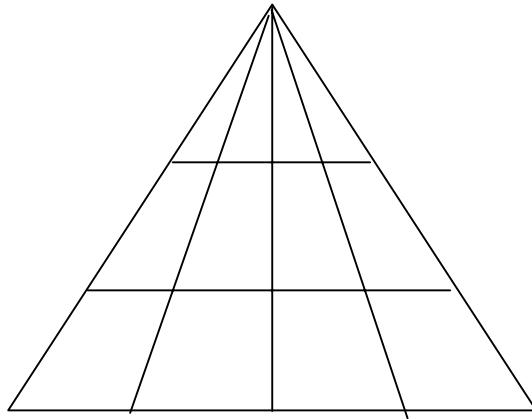


**x and y are the digits of a two digit number. x is greater than y by 3. When this two digit number is divided by the sum of its digits the quotient is 7 with a remainder of 3.**

**The sum of the digits of this two digit number is:**

- A) 1      B) 3      C) 5      D) 7      E) 9**

18. The number of all possible triangles in the given figure is:



- A) 34      B) 30      C) 26      D) 24      E) 20

19. If you continue the given number pattern, in what row and in what position in that row will the number 320 be?

1					----- row 1
2	3				----- row 2
4	5	6			----- row 3
7	8	9	10		----- row 4

The answers are given in the order of row ; position.

- A) 18 ; 15      B) 20 ; 20      C) 27 ; 25  
D) 24 ; 20      E) 25 ; 20

20. A lady, her brother, her son and her daughter (all related by birth) played volleyball.

The worst player's twin (who is one of the four players) and the best player are of opposite sex.

The worst player and the best player are of the same age.

Who cannot be the worst player(s)?

- A) brother only      B) daughter only  
C) son and daughter only      D) lady and daughter only  
E) lady only

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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:

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

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

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

( $a$  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

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**4.1** triangle is:  $\frac{1}{2} \times (\text{base} \times \text{height}) = \frac{1}{2}(b.h)$

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**4.2** rectangle is:  $\text{length} \times \text{width} = lw$   
 $\text{length} \times \text{breadth} = lb$

---

square is:  $\text{side} \times \text{side} = s^2$

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**4.3**

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

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

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**4.6** 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:  $2lb + 2lh + 2bh$  ( $h$  = 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  $2l + 2w$  ( $w$  = 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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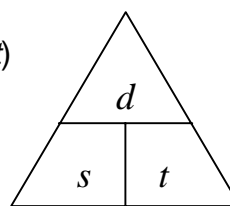
**10.** Sum of the interior angles of a polygon is:  $180^\circ(n - 2)$  [ $n$  = number of sides]

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

Speed = distance  $\div$  time ( $s = \frac{d}{t}$ )

Time = distance  $\div$  speed ( $t = \frac{d}{s}$ )



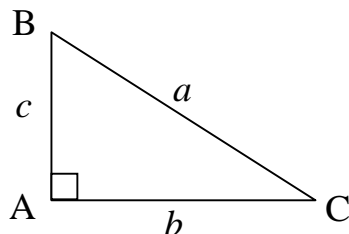
$$d = s \times t$$

$$s = \frac{d}{t}$$

$$t = \frac{d}{s}$$

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**12** Pythagoras:



If  $\triangle ABC$  is a right-angled triangle, then  $a^2 = b^2 + c^2$

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**13.** Conversions:

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

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

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