



# THE HARMONY SOUTH AFRICAN MATHEMATICS OLYMPIAD

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Organised by the SOUTH AFRICAN MATHEMATICS FOUNDATION.  
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## FIRST ROUND 2006 JUNIOR SECTION: GRADES 8 AND 9 23 MARCH 2006 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 [www.samf.ac.za](http://www.samf.ac.za)

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

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

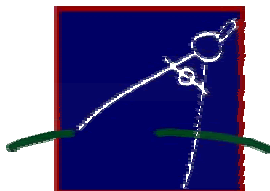
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PRIVATE BAG X173, PRETORIA, 0001. TEL: (012) 392-9323

E-mail: [ellie@samf.ac.za](mailto:ellie@samf.ac.za)

Organisations involved: AMESA, SA Mathematical Society, SA Akademie vir Wetenskap en  
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1.  $6 \times 111 - 3 \times 111$  is equal to:

- (A) 222    (B) 333    (C) 444    (D) 555    (E) 666
- 

2. If the fractions are arranged from lowest to highest then the middle fraction is:

$$\frac{1}{3}; 31\%; \frac{3}{10}; 0,313; 0,303$$

- (A)  $\frac{1}{3}$     (B) 0,313    (C)  $\frac{3}{10}$     (D) 31%    (E) 0,303
- 

3. "Diamond Stores" gives its customers four points for every R75 spent.

Sipho earned 36 points.

How much did Sipho spend at Diamond Stores?

- (A) R375    (B) R450    (C) R525    (D) R600    (E) R675
- 

4. The number  $\frac{1}{2} \times \frac{1}{2} \div \frac{1}{3}$  is equal to:

- (A)  $\frac{1}{2}$     (B) 1    (C) 2    (D)  $\frac{1}{4}$     (E)  $\frac{3}{4}$
- 

5. A three-digit number is divisible by 8, 12 and 30. The smallest possible number is:

- (A) 108    (B) 120    (C) 240    (D) 360    (E) 480
- 

6. The hundreds digit of the product  $7777 \times 9999$  is:

- (A) 2    (B) 3    (C) 4    (D) 5    (E) 6
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7. Each child of the Robertson family has at least three sisters and at least one brother.

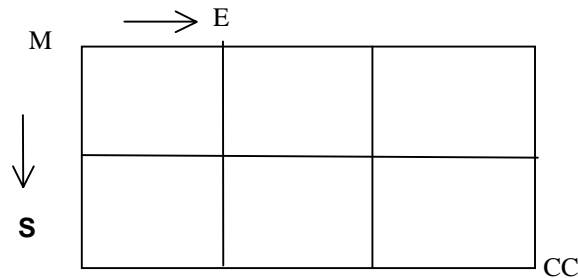
The minimum number of children in this family is:

- (A) 4    (B) 5    (C) 6    (D) 7    (E) 8
-

8. The number of whole numbers that lie between  $4^2$  and  $4^3$  is:  
(A) 45 (B) 46 (C) 47 (D) 48 (E) 49
- 

9. A watch keeps exact time, but it has only an hour hand. When the hour hand is  $\frac{2}{5}$  of the distance between the 4 and the 5, the correct time is:  
(A) 04:10 (B) 04:20 (C) 04:22 (D) 04:24 (E) 04:26
- 

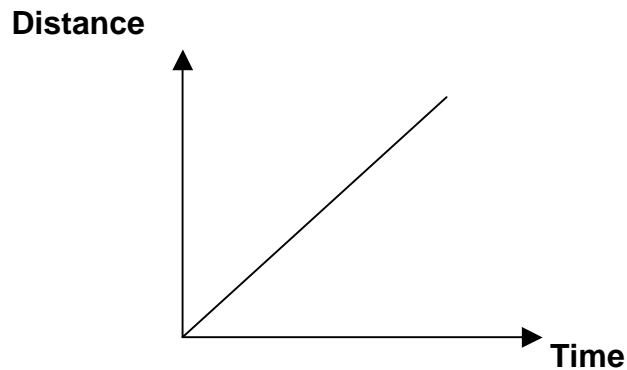
10. A protest march goes through town from the mall (M) to the community centre (CC).



If the march can only travel east or south, then the number of different possible routes is:

- (A) 6 (B) 10 (C) 4 (D) 8 (E) 9
- 
11. If the number  $12^2 \times 4 \times 3$  is written in the form  $n^3$ , where  $n$  is a natural number, then  $n$  is:  
(A) 12 (B) 24 (C) 36 (D) 48 (E) 60
- 
12. A bag contains six white beads, eight black beads and two green beads.  
A lady draws beads out of the bag without looking at them and without putting them back.  
What is the least number of beads that she must take out of the bag to ensure that she has taken out three beads of the same colour?  
(A) 3 (B) 5 (C) 7 (D) 9 (E) 11
-

13. The graph below represents the motion of a car. The graph shows us that the car is:

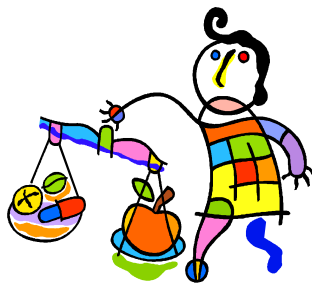


- (A) accelerating (B) standing still  
(C) travelling north-east (D) travelling uphill  
(E) travelling at a constant speed
- 

14. The product of two consecutive whole numbers is  $p$ . The square of the larger number minus the smaller number is:

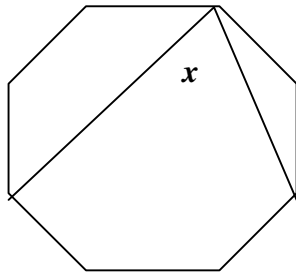
- (A)  $\frac{p}{2}$  (B)  $p-1$  (C)  $p^2$  (D)  $p+1$  (E)  $2p+1$
- 

15. A vendor has an equal arm balance and four weights that she uses to weigh her fruit. The weights are 1kg, 2k, 4kg and 8kg. If the weights are only placed on one end of the balance and the fruit is placed on the other end, how many different weight combinations can she use?



- (A) 15 (B) 13 (C) 11 (D) 9 (E) 7
-

16. In the given regular octagon, the size of angle  $x$  in degrees, is:



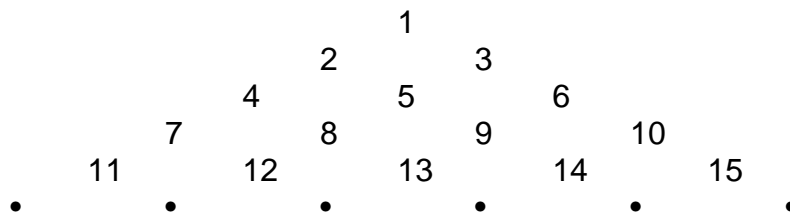
- (A)  $22\frac{1}{2}$  (B) 45 (C)  $67\frac{1}{2}$  (D) 90 (E)  $112\frac{1}{2}$
- 

17. Find the value of:

$$\frac{1}{1 \times 2} - \frac{1}{2 \times 3} + \frac{1}{3 \times 4} - \frac{1}{4 \times 5} + \dots - \frac{1}{49 \times 50}$$

- (A) 0 (B)  $\frac{1}{49}$  (C)  $\frac{1}{51}$  (D)  $\frac{1}{40}$  (E)  $\frac{1}{50}$
- 

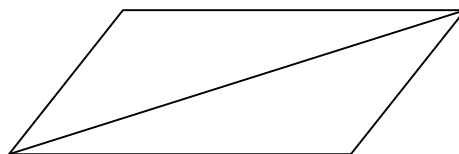
18. Consider the following triangular arrangement of numbers.



The middle number of the 51<sup>st</sup> row is:

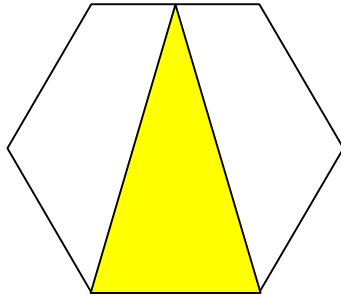
- (A) 1352 (B) 1301 (C) 1251 (D) 1275 (E) 1326
- 

19. 42 equal sized matchsticks are used to make the figure below. The figure is a parallelogram, which includes the longer diagonal. In how many different ways can you make matching figures using all 42 matchsticks?



- (A) 4 (B) 6 (C) 10 (D) 12 (E) 14
-

20. The area of the shaded triangle, written as a fraction of the regular hexagon is:



- (A)  $\frac{1}{6}$       (B)  $\frac{1}{5}$       (C)  $\frac{1}{4}$       (D)  $\frac{1}{3}$       (E)  $\frac{1}{2}$
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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: length  $\times$  width =  $lw$   
length  $\times$  breadth =  $lb$

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4.3 square is: side  $\times$  side =  $s^2$

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

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4.5 trapezium is:  $\frac{1}{2} \times$  (sum of parallel sides)  $\times$  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:  $2 \times$  length  $+ 2 \times$  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:  $s \times s \times s = s^3$

---

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

---

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]

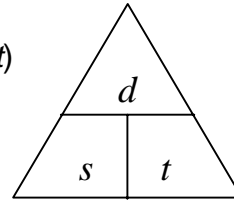
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11. Distance = speed  $\times$  time  
Speed = distance  $\div$  time  
Time = distance  $\div$  speed

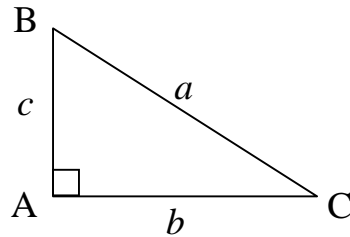
$$(d = s \times t)$$
$$(s = \frac{d}{t})$$
$$(t = \frac{d}{s})$$



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

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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:

$$1 \text{ cm}^3 = 1 \text{ ml} ; \quad 1000 \text{ cm}^3 = 1 \text{ l}$$
$$1000 \text{ m} = 1 \text{ km} ; \quad 1000 \text{ g} = 1 \text{ kg} ; \quad 100 \text{ cm} = 1 \text{ m}$$

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