THE HARMONY SOUTH AFRICAN MATHEMATICS OLYMPIAD

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

FIRST ROUND 2003
JUNIOR SECTION: GRADES 8 AND 9
18 MARCH 2003
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 answer 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 answer on the sheet provided.
8. Start when the invigilator tells you to.
   You have 60 minutes to complete the question paper.
9. Answers and solutions are 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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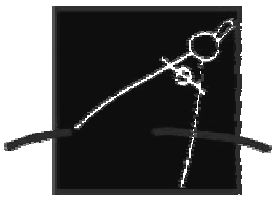

PRACTICE EXAMPLES

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. The value of $1{,}1 \times 10$ is

A) 1 B) 11 C) 1,1 D) 11,1 E) 110

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2. $4^3 \div 2^2$ is equal to

A) 2 B) 3 C) 4 D) 16 E) 32

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3. **Did you know?** In the decimal number system (base 10) ten different digits, 0 to 9, are used to write all the numbers. In the binary number system (base 2) two different digits are used, i.e. 0 and 1.

Which one of the following numbers is not a valid number in the octal number system (base 8)?

A) 128 B) 127 C) 126 D) 125 E) 124

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4. At a recent Athletics Championship Sipho broke the old record of 11,01 seconds for the 100 metre race by 0,04 seconds.
The new record for the race in seconds is

A) 10,01 B) 10,04 C) 10,61 D) 11,05 E) 10,97

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5. What is the units digit of 4^{2003}?

A) 0 B) 2 C) 4 D) 6 E) 8

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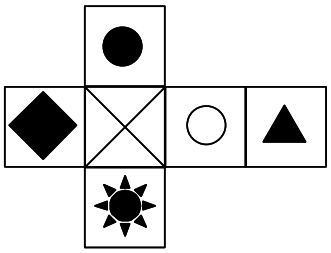
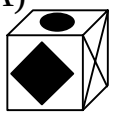
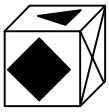
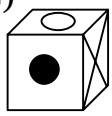
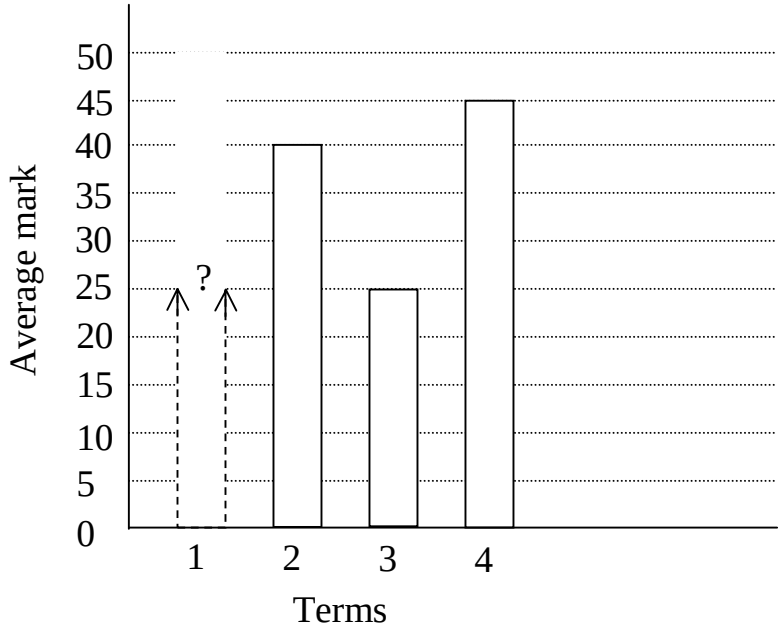
6. The following net is given:



Which one of the following cubes cannot be folded from this net?

A) 
B) 
C) 
D) 
E) 

7. Susan's average mark for the four terms (numbered 1 to 4 on the horizontal axis) of 2002 was 70%. The mark for each term is out of 50 and carries the same weight when calculating the average. Use the graph to determine what her percentage was for the first term of 2002.



A) equal to or more than 70%
B) equal to or less than 20%
C) between 20% and 30%
D) between 40% and 50%
E) between 50% and 70%

8. If $20x - 25$ is expressed in the form $a(4x + b)$,
then the value of $a + b$ is

A) -20 B) -10 C) 0 D) 10 E) 20

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9. **Did you know?** In a magic square the sum of the numbers in every horizontal row, vertical column and diagonal are all the same.

In this magic square,
the row total is equal to 15.

x		6
	5	1

The value of x is

A) 1 B) 2 C) 3 D) 5 E) 8

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10. How many numbers between 800 and 1000 are divisible by both 7 and 8?

A) 2 B) 3 C) 4 D) 5 E) 6

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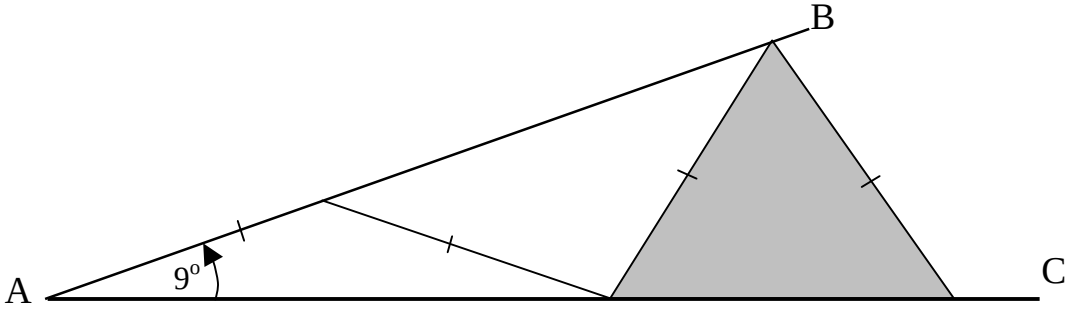
11. Isosceles triangles have been drawn between AB and AC with $\hat{BAC} = 9^\circ$.



What is the size of the largest angle in the shaded triangle?

A) 72° B) 81° C) 90° D) 126° E) 144°

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12. $\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\left(1-\frac{1}{5}\right) \quad . \quad . \quad . \quad \left(1-\frac{1}{2003}\right)$ is equal to

A) $\frac{1}{2003}$ B) $\frac{2}{2003}$ C) $\frac{202}{2003}$ D) $\frac{24}{2003}$ E) $\frac{2002}{2003}$

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13. Nomava visits a shop with one 20c coin and ten 50c coins. The shopkeeper can offer change but has only two 20c coins and nine R1 coins. She buys one item and receives the correct change. Which one of the following is a possible price for this item?

A) R4,60 B) R5,40 C) R1,40 D) R4,40 E) R5,10

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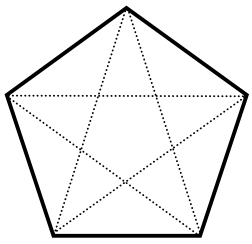
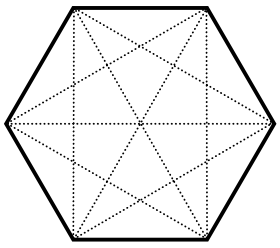
14. **Did you know?**

i) A regular polygon with five sides (pentagon) has five diagonals, indicated by the dotted lines.



ii) A regular polygon with six sides (hexagon) has nine diagonals, indicated by the dotted lines.



The number of diagonals that can be drawn in a regular polygon with twenty sides (icosagon), is

A) 190 B) 180 C) 170 D) 380 E) 19

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15. **Did you know?**

Formula for speed: $\text{average speed} = \dfrac{\text{total distance}}{\text{total time}}$

The distance from Sipho's home to Harmony Gold mine is 120 km.
Sipho travels at 60 km/h from his home to the mine.
He is in a hurry to get back to his home in the afternoon, and travels at 120 km/h.
What is his average speed for the journey there and back in km/h?

A) 110 B) 100 C) 95 D) 90 E) 80

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16. A store sold 213 bicycles during the year 2002. For the first few months they sold 20 bicycles per month, then for some months they sold 16 bicycles per month and in the remaining month(s) they sold 25 bicycles per month. For how many months did they sell only 16 bicycles per month?

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

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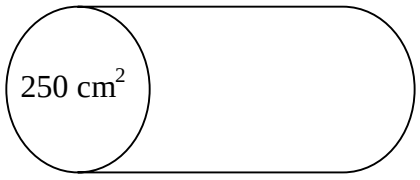
17. **Did you know?**
1 litre is the same as 1000 cm^3.

The area of the cross-section of a pipe is 250 cm^2. Water flows through the pipe at a rate of 3 litres per second.



The speed at which the water flows through the pipe in cm/s is

A) 15 B) 1,2 C) 8 D) 6 E) 12

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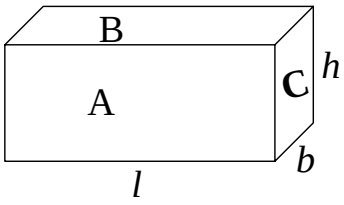
18. The areas of the faces of the rectangular box are A, B and C.



If the volume of the box is V,
then $A \times B \times C$ is equal to

A) V B) $2V^2$ C) V^2 D) $\sqrt{V}$ E) $\sqrt[3]{V}$

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19. In the formula $M = \dfrac{10n}{1+2n}$, n is any positive integer.

If n increases (gets bigger and bigger), M will

A) decrease
B) increase
C) stay the same
D) first increase and then decrease
E) first decrease and then increase

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20. A meal made with four eggs and 60 g cheese contains 560 calories.
Another meal made with six eggs and 20 g cheese also contains 560 calories.
How many calories does one (1) egg contain?

A) 60 B) 70 C) 80 D) 90 E) 100

THE END

Formula and Information Sheet

1.1 The natural numbers are 1; 2; 3; 4; 5; …

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

1.3 The integers are …, –4; –3; –2; –1; 0; 1; 2; 3; 4; 5; …

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

3.1 Exponential notation:

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

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

$a \times a \times a \times a \times \ldots \times a = a^n$ (n factors of a)

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

3.2 Factorial notation:

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

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

4 Area of a:

4.1	rectangle is:	length x width = lw length x breadth = lb
4.2	square is:	side x side = s^2
4.3	rhombus is:	$\frac{1}{2}$(product of diagonals)
4.4	trapezium is:	$\frac{1}{2}$(sum of parallel sides) × height
4.5	circle is:	πr^2 (r = radius)

5 Surface area of a:

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

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

6 Perimeter of a:

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

6.2 square is: $4s$

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

8. Volume of a:

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: $\pi r^2 h$

9.1 Volume of a right prism is: area of cross-section x height
or area of base x height

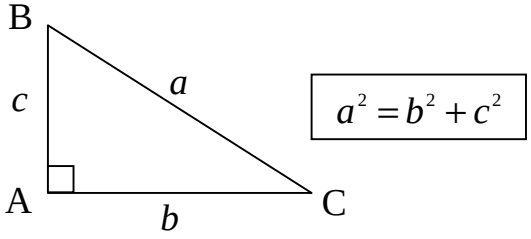
9.2 Surface area of a right prism is: perimeter of base x h + 2 x area of base

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

11. Distance is: speed x time (d = s x t)

12 Pythagoras:

ΔABC is a right-angled triangle



$a^2 = b^2 + c^2$

13. Conversions:
1 cm^3 = 1 ml ; 1000 cm^3 = 1 l
1000 m = 1 km ; 1000 g = 1 kg ; 100 cm = 1 m

ANSWER POSITIONS: JUNIOR FIRST ROUND 2003

PRACTICE EXAMPLES	POSITION
1	C
2	D

NUMBER	POSITION
1	B
2	D
3	A
4	E
5	C
6	B
7	E
8	C
9	B
10	B
11	D
12	A
13	A
14	C
15	E
16	D
17	E
18	C
19	B
20	C

DISTRIBUTION	
A	3
B	5
C	5
D	3
E	4
TOTAL	**20**