



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

SECOND ROUND 2003 JUNIOR SECTION: GRADES 8 AND 9 20 MAY 2003 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 :

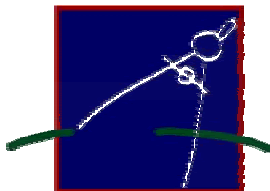
For each correct answer	in Part A:	4 marks
	in Part B:	5 marks
	in Part C:	6 marks
For each wrong answer:		-1 mark
For no answer:		0 marks
4. You must use an HB pencil.
Rough paper, a ruler and a rubber are permitted.
Calculators and geometry instruments are not permitted.
5. Diagrams are not necessarily 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 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

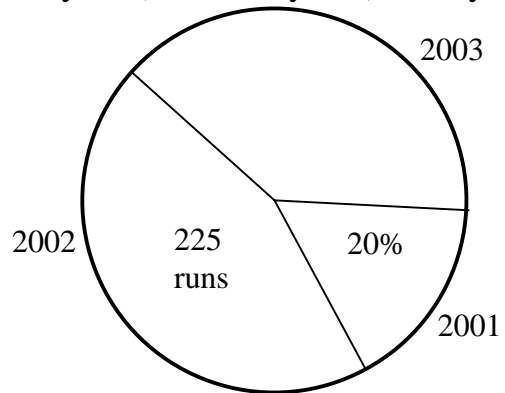
- A) $\frac{1}{15}$ B) $\frac{3}{11}$ C) $\frac{21}{50}$ D) $\frac{8}{15}$ E) $9\frac{4}{5}$

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PART A: (Each correct answer is worth 4 marks)

1. Two consecutive natural numbers add up to 2003.
The smaller of these two numbers is
A) 1001 B) 1002 C) 1003 D) 1004 E) 1000
2. I recently returned from a trip. Today is Friday. I returned four days
before the day after tomorrow.
On which day did I return?
A) Monday B) Tuesday C) Wednesday D) Thursday E) Friday

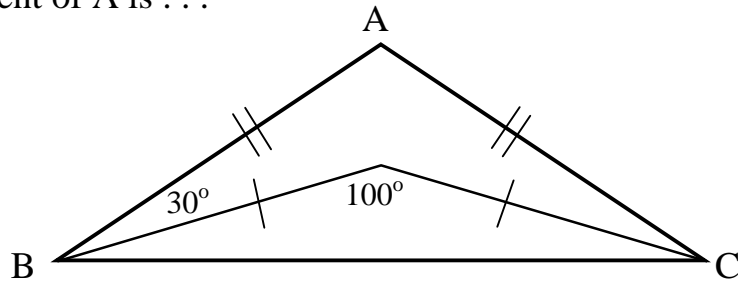
3. The pie chart shows the breakdown
of the 500 runs scored by one of the
South African batsmen over the
last three years.



- The percentage of runs in 2003 is
A) 45 % B) 20 % C) 15 % D) 65 % E) 35 %
4. Consider the following pattern:
- | | | | | |
|----------------------|---|---|---|---|
| 1 st row: | 1 | | | |
| 2 nd row: | 1 | 3 | | |
| 3 rd row: | 1 | 3 | 5 | |
| 4 th row: | . | . | . | . |
- The difference between the sums of the numbers in the 9th and 10th
rows is
A) 17 B) 18 C) 19 D) 21 E) 22
5. Which one of the following is an odd number?
A) $2001^2 + 3$
B) $2002^2 + 10$
C) $2003^2 + 7$
D) $2004^2 + 1$
E) $2005^2 + 9$

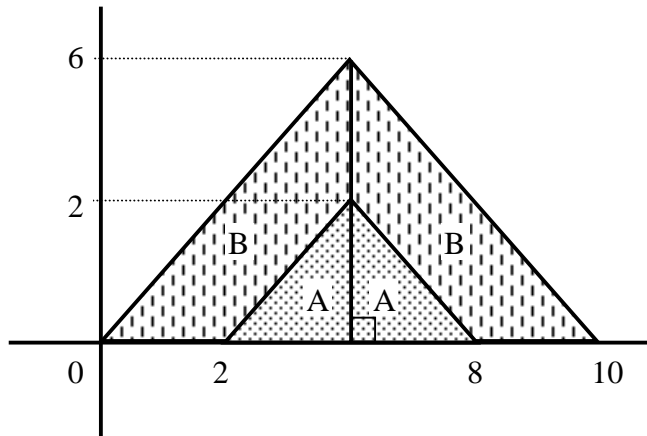
PART B: (Each correct answer is worth 5 marks)

6. The measurement of \hat{A} is . . .



- A) 30° B) 40° C) 50° D) 60° E) 70°
7. A supermarket always prices its goods at ‘so many Rands and ninety-nine cents’. If a shopper who has bought different items has to pay R41,71, how many items did she buy?
- A) 41 B) 39 C) 30 D) 19 E) 29
8. If a and b are integers, and $a \otimes b = \frac{b^2}{a} - \frac{b}{a}$, then $3 \otimes 6$ is equal to
- A) 12 B) 4 C) 6 D) 8 E) 10
9. The regions marked A are equal in area, and the regions marked B are equal in area.

The ratio of $\frac{\text{area A}}{\text{area B}}$ is

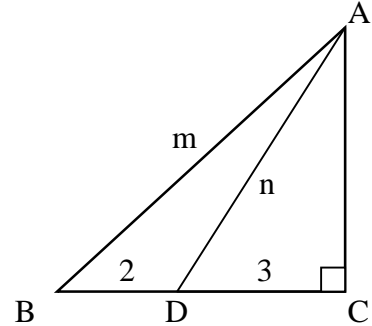


- A) $\frac{1}{5}$ B) $\frac{1}{4}$ C) $\frac{1}{3}$ D) $\frac{1}{2}$ E) $\frac{1}{1}$

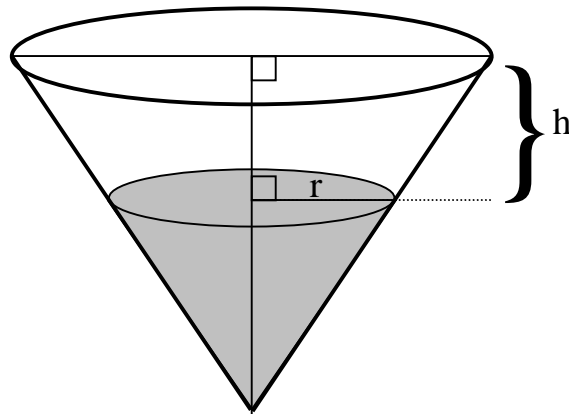
10. If $x + y = 4$, $y + z = 7$ and $x + z = 5$ the value of $(x + y + z)^2$ is
- A) 36 B) 64 C) 100 D) 144 E) 256

11. $\triangle ABC$ has D on BC such that $BD = 2$ and $DC = 3$.

If $AB = m$ and $AD = n$
then the value of $m^2 - n^2$ is



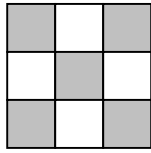
- A) 4 B) 9 C) 16 D) 25 E) 36
12. If $1 \times 2 \times 3 \times \dots \times 199 \times 200$ is calculated, then the number of zeros at the end of the product is
- A) 42 B) 43 C) 46 D) 49 E) 52
13. A tank that is in the form of an inverted cone contains a liquid. The height h , in metres, of the space above the liquid is given by the formula $h = 21 - \frac{7}{2}r$ where r is the radius of the liquid surface, in metres.



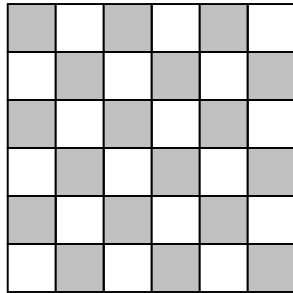
The circumference of the top of the tank, in metres is

- A) 9π B) 12π C) 15π D) 18π E) 21π

14. In this diagram, there is a total of 14 squares of all sizes.



What is the total number of squares of all sizes on the board below?



- A) 49 B) 63 C) 77 D) 91 E) 105
15. The fraction $\frac{53}{17}$ can be expressed as $3 + \frac{1}{x + \frac{1}{y}}$.
- If x and y are integers the value of $x + y$ is
- A) 8 B) 9 C) 10 D) 11 E) 12

PART C: (Each correct answer is worth 6 marks)

16. Two numbers are in the ratio $2 : 3$. When 4 is added to each number the ratio changes to $5 : 7$.
The sum of the two original numbers is
- A) 20 B) 25 C) 30 D) 35 E) 40
17. A local council consists of 4 female members and 3 male members.
The number of different 3-member committees consisting of 2 female members and 1 male member which can be formed by the council is
- A) 18 B) 15 C) 12 D) 9 E) 6

18. Lee gave Petrus a 10 metre lead in a 100 metre race and Lee was beaten by four metres.
What lead should Lee give Petrus in order that both finish the race together, if their respective speeds stayed the same in both races?
- A) 5,75 m B) 5,9 m C) 6,1 m D) 6,25 m E) 6,5 m
19. In the addition problem $TSR + PSR + RSP$, Themba substitutes the four letters with the four digits 2, 7, 5, and 3, in any order. Different letters stand for different digits. The largest value of the sum $TSR + PSR + RSP$ is
- A) 1579 B) 1499 C) 1571 D) 1701 E) 1537
20. Colleen, Jakes, Hendrik, Vishnu and Tandeka play a game of cops and robbers. The robbers' statements are always false while the cops' statements are always true.
- a) Colleen says that Jakes is a cop.
 - b) Hendrik says that Vishnu is a robber
 - c) Tandeka says that Colleen is not a robber
 - d) Jakes says that Hendrik is not a cop.
 - e) Vishnu says that Tandeka and Colleen play on different sides.

How many robbers are there?

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



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:

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

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

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

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

3.2 Factorial notation:

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

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

4 Area of a

4.1 rectangle is: length \times width = lw

$$\text{length} \times \text{breadth} = lb$$

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

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

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

4.5 circle is: πr^2 (r = radius)

5 Surface area of a:

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

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 $2l + 2w$ ($w = \text{width}$)

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 perpendicular height
or area of base x perpendicular height

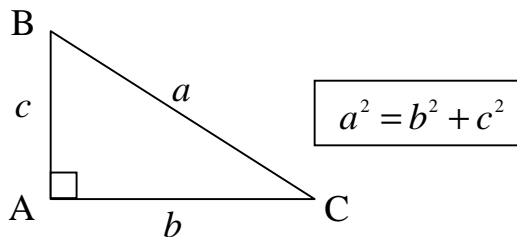
9.2 Surface area of a right prism is: perimeter of base x h + 2 x area of base

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

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

12 Pythagoras:

$\triangle ABC$ is a right-angled triangle



13. Conversions:

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

ANSWER POSITIONS:**JUNIOR SECOND ROUND 2003**

PRACTICE EXAMPLES	POSITION
1	C
2	D

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

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