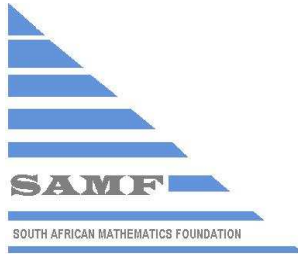




SOUTH AFRICAN MATHEMATICS OLYMPIAD



Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2009 FIRST ROUND SENIOR SECTION: GRADES 10, 11 AND 12

18 March 2009

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:
 - 3.1. Each correct answer is worth 5 marks.
 - 3.2. There is no penalty for an incorrect answer or any unanswered question.
4. You must use an HB pencil. Rough paper, a ruler and an eraser are permitted.
Calculators and geometry instruments are not permitted.
5. Diagrams are not necessarily drawn to scale.
6. Indicate your answers on the sheet provided.
7. Start when the invigilator tells you to do so. You have 60 minutes to complete the question paper.
8. Answers and solutions will be available at 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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Organisations involved: AMESA, SA Mathematical Society,
SA Akademie vir Wetenskap en Kuns



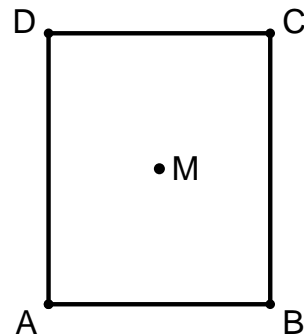
PRACTICE EXAMPLES

1. If biltong costs R16 for every 80 grams, then the cost per kilogram is
- (A) R80 (B) R20 (C) R50 (D) R200 (E) R160
2. The value of $1 + \frac{1}{3 + \frac{1}{2}}$ is
- (A) $\frac{6}{5}$ (B) $\frac{7}{6}$ (C) $\frac{9}{2}$ (D) $\frac{6}{7}$ (E) $\frac{9}{7}$
3. The tens digit of the product $1 \times 2 \times 3 \times \cdots \times 98 \times 99$ is
- (A) 0 (B) 1 (C) 2 (D) 4 (E) 9

PLEASE DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

1. As a decimal number 6.28% is equal to
(A) 0.0628 (B) 0.628 (C) 6.28 (D) 62.8 (E) 628
2. The number of degrees in four and a half revolutions is
(A) 405 (B) 510 (C) 810 (D) 1440 (E) 1620
3. A tap drips at the rate of one drop of water every second. It takes 4000 such drops to fill a 330 ml can. The number of litres of water wasted in one day by this dripping tap is approximately
(A) 4 (B) 7 (C) 14 (D) 28 (E) 48
4. The total mass of three identical yellow balls and four identical red balls is 420 g. The mass of one yellow ball is 80 g. What is the mass of one red ball?
(A) 35 g (B) 45 g (C) 60 g (D) 65 g (E) 80 g
5. The price of an item in a shop is reduced from R79.99 to R63.99. The percentage reduction is approximately
(A) 16 (B) 20 (C) 30 (D) 64 (E) 80

6. The diagram shows a rectangle $ABCD$ with centre M . If A has coordinates $(15; 15)$ and M has coordinates $(33; 37)$ the coordinates of C are



- (A) $(51; 59)$ (B) $(51; 58)$ (C) $(52; 48)$ (D) $(52; 52)$ (E) $(53; 58)$

12. Four people are standing in front of a treasure chest. Each makes a statement. One statement is false, the other three are true.

Ann: "I do not have the key and Cal does not have the key."

Ben: "I do not have the key and Ann does not have the key."

Cal: "I do not have the key and Ben does not have the key."

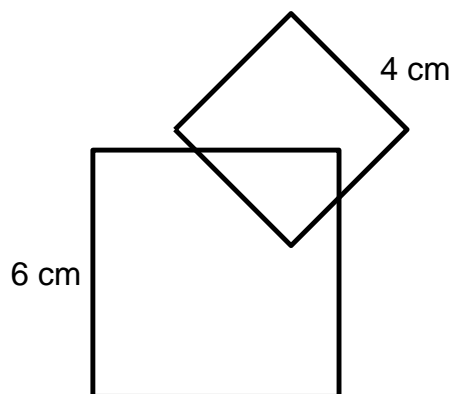
Don: "I do not have the key and Ann does not have the key."

Who has the key?

- (A) Ann (B) Ben (C) Cal (D) Don (E) none of them has the key
13. A number is written using the digits 1, 2, 3, 4, 5 once each and in any order. The probability that the number starts with 1 and ends with 5 is

- (A) $\frac{1}{10}$ (B) $\frac{1}{12}$ (C) $\frac{1}{15}$ (D) $\frac{1}{20}$ (E) $\frac{1}{5}$

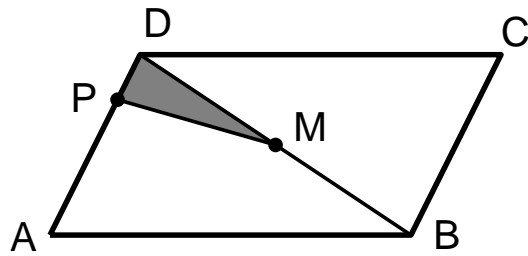
14. Two squares overlap as shown in the diagram. The difference, in cm^2 , between the non-overlapping areas is



- (A) 2 (B) 5 (C) 10 (D) 20 (E) not enough information given
15. The value of $\sqrt{8 + 3\sqrt{7}} - \sqrt{8 - 3\sqrt{7}}$ is

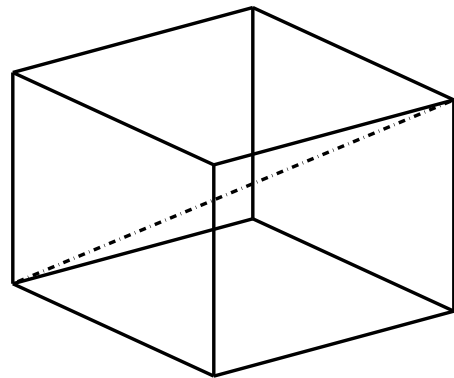
- (A) 4 (B) $3\sqrt{2}$ (C) $\sqrt{6\sqrt{7}}$ (D) $\sqrt{14}$ (E) 14

16. In parallelogram $ABCD$, M is the midpoint of diagonal BD , and P is a point on AD such that $AD = 4PD$. If the area of the quadrilateral $ABMP$ is 35, then the area of the triangle PMD (shaded) is



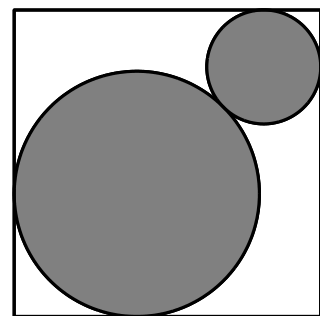
- (A) 4 (B) 5 (C) 6 (D) 7 (E) 9

17. The sum of the lengths of all twelve edges of a solid rectangular block is 20 cm. The distance from one corner to the furthest corner is 4 cm. The total surface area of the block, in cm^2 , is



- (A) 9 (B) 16 (C) 18 (D) 20 (E) 24

18. Two circles are inscribed in a square of side 1 as shown in the diagram. The sum of the two radii is



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

19. The sum of a number of positive integers is 20. (Integers may be repeated.)
The largest product that can be formed by these integers is

(A) 100 (B) 1024 (C) 1215 (D) 1458 (E) 2048

20. Given that

$$\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots = \frac{\pi^2}{6},$$

compute the value of

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots$$

(A) $\frac{\pi^2}{8}$ (B) $\frac{\pi^2}{9}$ (C) $\frac{\pi^2}{10}$ (D) $\frac{\pi^2}{12}$ (E) $\frac{\pi^2}{16}$

The Mathematical Talent Search is a free correspondence based problem solving course for high school learners, presented by the SAMF. All you have to do to get started is to complete an application form and to solve four questions. The application form and questions are available on

www.samf.ac.za/MathTalentSearch