# SOUTH AFRICAN MATHEMATICS OLYMPIAD

*Organised by the*
**SOUTH AFRICAN MATHEMATICS FOUNDATION**

## 2013 FIRST ROUND
## SENIOR SECTION: GRADES 10, 11 AND 12

**14 March 2013** **Time: 60 minutes** **Number of questions: 20**

**Instructions**

1. *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.*
2. *Scoring rules:*
   2.1. *Each correct answer is worth 5 marks.*
   2.2. *There is no penalty for an incorrect answer or any unanswered question.*
3. *You must use an HB pencil. Scrap paper, a ruler and an eraser are permitted.* ***Calculators and geometry instruments are not permitted.***
4. *Figures are not necessarily drawn to scale.*
5. *Indicate your answers on the sheet provided.*
6. *Start when the invigilator tells you to do so.*
7. *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***

PRIVATE BAG X173, PRETORIA, 0001
TEL: (012) 392-9323 E-mail: ellie@samf.ac.za

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

# PRACTICE EXAMPLES

**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 value of $1 + \dfrac{1}{3 + \dfrac{1}{2}}$ is

(A) $\dfrac{6}{5}$ (B) $\dfrac{7}{6}$ (C) $\dfrac{9}{2}$ (D) $\dfrac{6}{7}$ (E) $\dfrac{9}{7}$

**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.** $\dfrac{\sqrt{49}}{49}$ equals

(A) 1 (B) 7 (C) $\dfrac{1}{7}$ (D) 49 (E) $\dfrac{1}{9}$

**2.** Which two of the shapes below can be joined to form a rectangle?
(No gaps or overlapping allowed.)

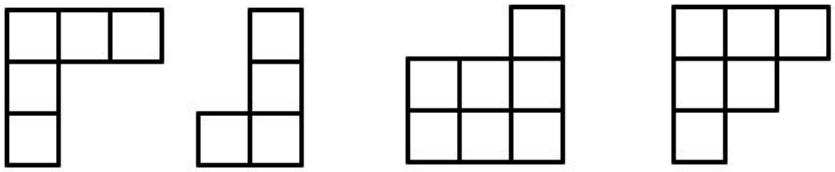
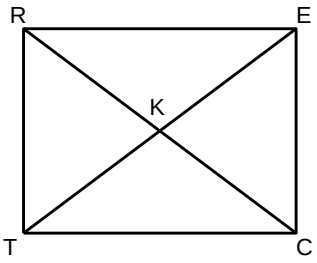


Fig. 1 Fig. 2 Fig. 3 Fig. 4

(A) 1 and 2 (B) 1 and 3 (C) 1 and 4 (D) 2 and 3 (E) 2 and 4

**3.** The diagonals of rectangle RECT intersect at K.
If RE = 4 and EC = 3, then RK =




(A) 2 (B) 2.5 (C) 3 (D) 3.5 (E) 4

**4.** $2013^2 - 1$ equals

(A) $2012 \times 2014$ (B) $2012 \times 2013$ (C) $2013 \times 2014$
(D) $2012 \times 2012$ (E) $2000 \times 2013$

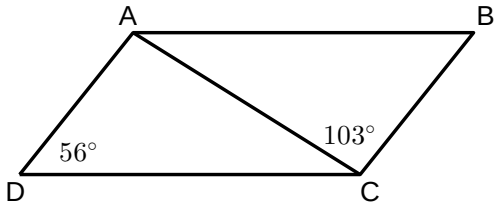
**5.** The largest number in the following list is

(A) $\dfrac{3}{2^3}$ (B) $\dfrac{1}{4}$ (C) $0.2^3$ (D) $\dfrac{7}{16}$ (E) 0.625

**6.** Barbie's bag is half full with 30 tennis balls in it. If she takes half of the balls from Ken's bag, then her bag is two-thirds full. The original number of tennis balls in Ken's bag was

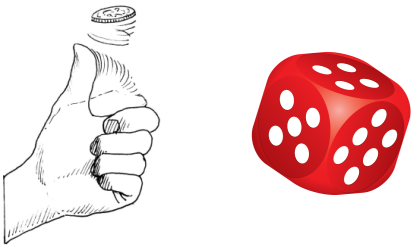
(A) 10 (B) 20 (C) 30 (D) 40 (E) 60

**7.** If ABCD is a parallelogram, then angle ACD is equal to



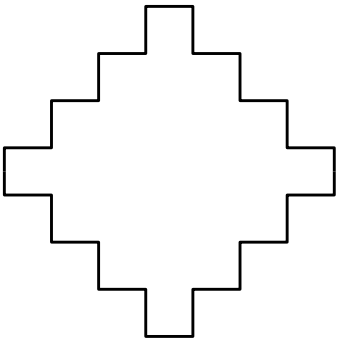

(A) 56° (B) 34° (C) 21° (D) 42° (E) 28°

**8.** A coin and a die are thrown simultaneously. The probability of getting a tail and a 6 is



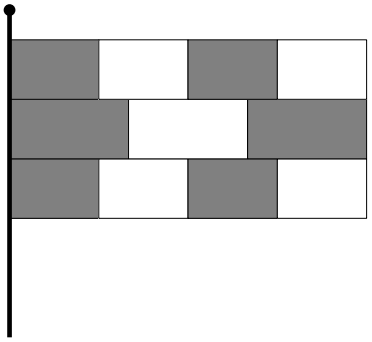
(A) $\frac{1}{8}$ (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $\frac{1}{12}$ (E) $\frac{1}{6}$

**9.** All 28 sides of the polygon are equal in length with adjacent sides perpendicular. If the perimeter of the polygon is 56 cm, then its area is



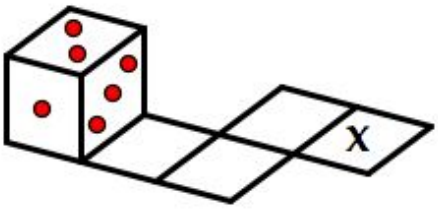
(A) 64 $\text{cm}^2$ (B) 81 $\text{cm}^2$ (C) 100 $\text{cm}^2$ (D) 121 $\text{cm}^2$ (E) 144 $\text{cm}^2$

**10.** A flag is made up of three strips of equal width. Each strip is divided into equal parts with alternating dark and light colours, as shown. The fraction of the flag that is dark in colour is



(A) $\frac{5}{9}$ (B) $\frac{5}{8}$ (C) $\frac{6}{11}$ (D) $\frac{7}{11}$ (E) $\frac{3}{5}$

**11.** On a die the numbers on opposite faces add up to 7. The die in the diagram is rolled edge over edge along the path until it rests on the square labeled $X$. In that position, the number on top is




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

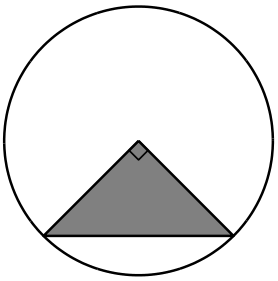
**12.** Children at a school fun day had to guess the number of marbles in a jar. Prizes were awarded on how close the guesses were. The first prize went to Emily who guessed 125 marbles, second prize to Cassandra who guessed 140, third prize to Sigrid who guessed 142, and fourth prize to Rina who guessed 121. The actual number of marbles in the jar was

(A) 129 (B) 130 (C) 131 (D) 132 (E) 133

**13.** If $m$ and $n$ are positive integers and $n^2 = 756\,m$, then the smallest possible value of $m$ is

(A) 3 (B) 7 (C) 9 (D) 15 (E) 21

**14.** The two perpendicular sides of a right-angled triangle form radii of a circle, as shown. The ratio of the area of the triangle to the area of the circle is

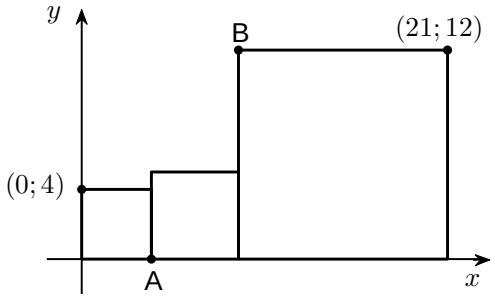


(A) $2 : \pi$ (B) $2 : 3\pi$ (C) $1 : \pi$ (D) $1 : 2\pi$ (E) $1 : 3\pi$

**15.** Two empty containers P and Q have the same volume. Water flows into P at a rate of $4\,\ell$ per minute, and into Q at a rate of $6\,\ell$ per minute. After a certain time container P can still take another $60\,\ell$ but Q has overflowed by $10\,\ell$. The volume of each container is

(A) $50\ell$ (B) $90\ell$ (C) $140\ell$ (D) $200\ell$ (E) $210\ell$

**16.** Three squares are aligned along the $x$-axis, with coordinates as shown. The shortest distance between the points A and B is




(A) 13 (B) 16 (C) 21 (D) 9 (E) 12

**17.** The operation $\diamondsuit$ is defined by $x \diamondsuit y = 4x - 3y + xy$, for all real $x$ and $y$. The number of solutions of the equation $x \diamondsuit x = 12$ is

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

**18.** The 24-digit integer 111111111111111111111111 is divided by 1111. The number of zeros in the quotient is

(A) 8 (B) 9 (C) 12 (D) 14 (E) 15

**19.** If $2a + b = c$, $a + b + c = 2d$ and $a + b + c + d = 18$ for positive integers $a$, $b$, $c$ and $d$, then the value of $c$ is

(A) 2 (B) 3 (C) 5 (D) 6 (E) 7

**20.** The number of possible pairs of integers $(x, y)$ such that $(x + 2y)^2 + (2x + 5y - \frac{1}{2})^2 \leq 2$ is

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