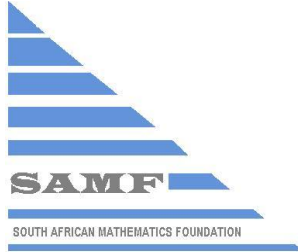




SOUTH AFRICAN MATHEMATICS OLYMPIAD



Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2011 FIRST ROUND SENIOR SECTION: GRADES 10, 11 AND 12

16 March 2011 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. Rough work 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.***

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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 $1 + \frac{1}{3 + \frac{1}{2}}$ is

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

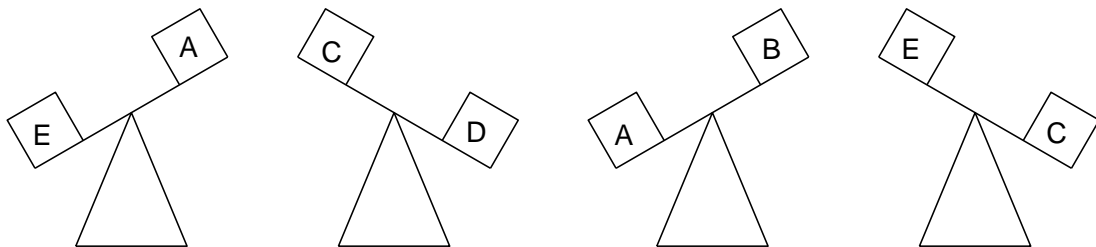
3. The tens digit of the product $1 \times 2 \times 3 \times \cdots \times 98 \times 99$ is

- (A) 0 (B) 1 (C) 2 (D) 4 (E) 9

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1. $0.125 + \frac{3}{4}$ equals
- (A) 0.1 (B) 0.875 (C) 1 (D) $\frac{5}{8}$ (E) $1\frac{1}{4}$
2. $1\,000\,000 \div 100$ gives the same result as $100\,000 \div \dots$
- (A) 0.1 (B) 1 (C) 10 (D) 100 (E) 1000
3. If a cube has surface area 54 cm^2 , then its volume is
- (A) 9 cm^3 (B) 27 cm^3 (C) 36 cm^3 (D) 64 cm^3 (E) 81 cm^3
4. In a box of coloured balls $\frac{1}{3}$ are red, $\frac{1}{4}$ are blue, $\frac{1}{6}$ are green and the remaining balls are yellow. The smallest number of balls that could be in the box is
- (A) 6 (B) 12 (C) 13 (D) 24 (E) 36

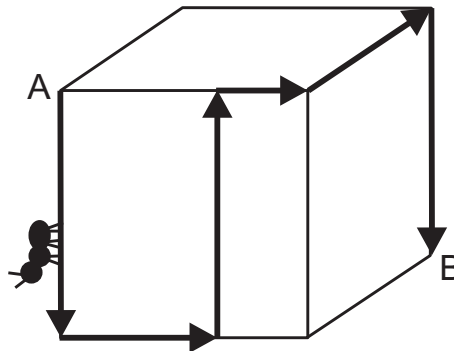
5. The boxes **A**, **B**, **C**, **D**, **E** are put on a balance beam as shown in the figure:



If the boxes are then arranged from the lightest to the heaviest, the one in the middle is

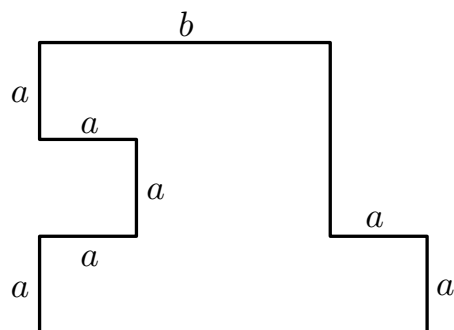
- (A) **A** (B) **B** (C) **C** (D) **D** (E) **E**
6. For how many integers between 500 and 900 is the sum of the ones digit and the hundreds digit equal to the square of the tens digit?
- (A) 4 (B) 6 (C) 7 (D) 8 (E) 9

7. The edges of a cube are 12 cm long. An ant moves on the cube surface from point A to point B along the path shown. The length of the ant's path is



- (A) 60 cm (B) 50 cm (C) 48 cm (D) 40 cm (E) 35 cm

8. The diagram shows the floor plan of a room. Adjacent walls are perpendicular to each other. Letters a and b represent the lengths of some of the walls. The area of the room is



- (A) $3ab - a^2$ (B) $2a^2 + 3ab$ (C) $3a^2b$ (D) $3ab - 2a^2$ (E) $3ab$
9. A coin is flipped three times. The probability that it will land heads up exactly once is
- (A) $\frac{3}{8}$ (B) $\frac{1}{8}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$ (E) $\frac{2}{3}$
10. From a group of four children two are chosen and weighed. This is repeated for all possible pairs. The masses for each pair are recorded as 85, 92, 95, 97, 100 and 107, all in kg. The total mass of the four children is
- (A) 189 kg (B) 190 kg (C) 192 kg (D) 194 kg (E) 195 kg
11. If M is the product of the first 100 prime numbers, then the last digit of M is
- (A) 0 (B) 1 (C) 4 (D) 8 (E) 9

12. The difference between the largest 5-digit number with no repeated digits and the smallest 5-digit number with no repeated digits is

- (A) 89321 (B) 88531 (C) 86421 (D) 97531 (E) 96425

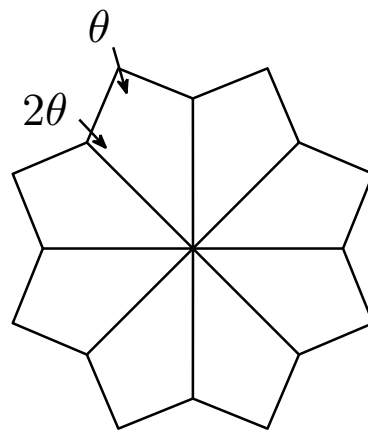
13. The length of rectangle S is 10 percent longer than the length of rectangle R , and the width of rectangle S is 10 percent shorter than the width of rectangle R . The area of rectangle S is

- (A) 10 percent greater than the area of rectangle R
(B) 1 percent greater than the area of rectangle R
(C) equal to the area of rectangle R
(D) 1 percent less than the area of rectangle R
(E) 10 percent less than the area of rectangle R

14. Seven cards in a pile are numbered from 1 to 7. One card is drawn. The units digit of the sum of the numbers on the remaining cards is 7. The number on the drawn card is

- (A) 1 (B) 3 (C) 5 (D) 6 (E) 7

15. If eight identical kites form a shape as shown, then angle θ equals

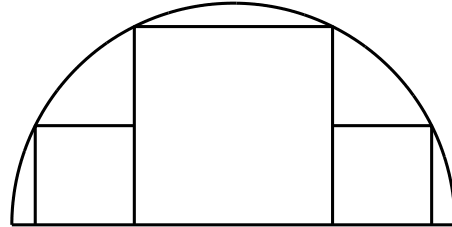


- (A) 45° (B) 52° (C) 60° (D) 63° (E) 70°

16. $\sqrt{4 - 2\sqrt{3}}$ equals

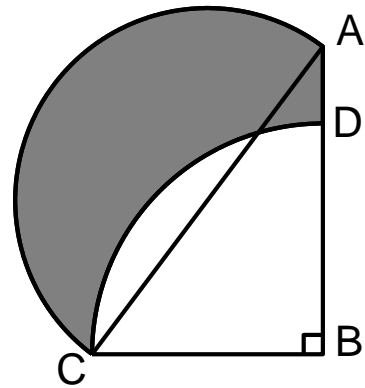
- (A) $1 - \sqrt{3}$ (B) $\sqrt{3} - 1$ (C) $2 - \sqrt{3}$ (D) $\sqrt{3} - 2$ (E) $\frac{\sqrt{3}}{2}$

17. Two small squares and a large square are inscribed in a semicircle as shown. If the side length of both small squares is 2, then the area of the semicircle is



- (A) 8π (B) 9π (C) 10π (D) 12π (E) 16π

18. ABC is a right-angled triangle with $BC = 6$ and $AB = 8$. A semicircle with AC as diameter and a quarter circle with BC as radius are drawn. Rounded to the nearest integer, the area of the shaded region is



- (A) 31 (B) 32 (C) 34 (D) 35 (E) 41

19. Two cars start at the same time from towns A and B, and travel with constant but different speeds towards each other. They pass each other 70 km from town A, and continue to the opposite town, where they turn around without stopping. The cars pass each other again 40 km from town B. The distance between the two towns is

- (A) 165 km (B) 170 km (C) 175 km (D) 180 km (E) 185 km

20. How many times does the digit 1 occur in the result of

$$1 + 11 + 111 + 1111 + \cdots + \underbrace{111 \dots 111}_{2011 \text{ digits}} ?$$

- (A) 201 (B) 210 (C) 214 (D) 220 (E) 226