AMESA
The Association for Mathematics Education of South Africa

KWAZULU NATAL PROBLEM SOLVING

MATHEMATICS CHALLENGE 2006

GRADE 11

DATE: THURSDAY 24 AUGUST 2006
DURATION: 90 MINUTES

GENERAL INFORMATION

1. Congratulations on being selected to participate in this challenge.
2. This examination paper consists of 20 questions.
3. Enter your final answer in the correct block on the ANSWER SHEET. Working details are not required.
4. Candidates that qualify to the SECOND ROUND will be required to show full working details.
5. Each question is worth 1 point. No marks are deducted for incorrect answers.
6. Calculators or other computing devices are NOT allowed.
7. Some questions have blanks. You are expected to fill in the blanks.
8. For multiple choice questions, write only the LETTER of your choice.
9. Please do not turn over until the invigilator gives you the signal

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1. Find the value of
$2004 \times 2008 - 2003 \times 2009$

A. 9 B. 8 C.6
D. 5 E. 4

2. Find the cube root of $2^{(3^6)}$

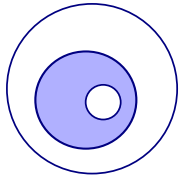
A. $2^{(3^2)}$ B. $2^{(3^6-3)}$
C. $2^{(3^3)}$ D. 2^6
E. $2^{(3^5)}$

3. If $2x = 5y - 8$ and $y = 3$, find x.

4. How many 5 - digit number plates using the digits from 0 to 9 will read the same when turned upside down as per the examples 01810 and 91016?

A. 36 B. 48 C. 72 D. 75
E. 125

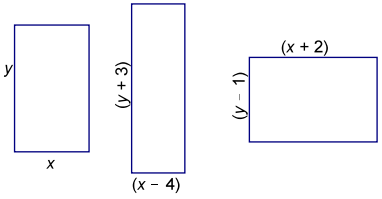
5. The radii of the three circles in the figure are in the ratio 1 : 3 : 6. Calculate the ratio of the shaded area to the area of the largest circle.



6. If $\sec^2 x = 10$, then $\cot x =$

A. $\frac{1}{3}$ B. $\frac{\sqrt{10}}{10}$ C. $\frac{2\sqrt{3}}{3}$
D. $\frac{\sqrt{2}}{10}$ E. 2

7. Each of the rectangles below has the same area, Calculate this area.



8. How many roots does the equation

$x(x^2 + 8x + 16)(4 - x) = 0$

have?

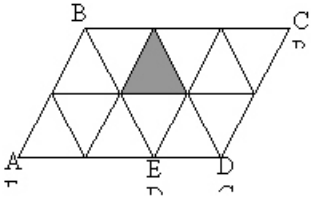
9. Lily plans to spend all of her R31 to buy different types of pens that cost R2, R3 and R4 respectively.

If she wants to buy at least 1 pen of each type, what is the maximum number of pens that she can buy?

10. Solve for x:

$x^2 - 4x + 4 = (x - 2)^2$

11. ABCD is a parallelogram that is made up of 12 identical triangles as shown. The lines in the figure are parallel to



either AB, AD or BE. How many different parallelograms are there which include the shaded triangle?

12. a, b and c are two-digit numbers.

The unit digit of a is 7, the unit digit of b is 5 and the tens digit of c is 1.

If $a \times b + c = 2006$, find the value of $a + b + c$.

13. The height of an equilateral triangle = $\sqrt{6}$ units.

Find the area of this triangle.

14. The lengths of two sides of a triangle are 2006 and 6002 units respectively.

If the length, in the same units, of the third side of this triangle is an integer, how many different triangles can exist?

15. We have four cards numbered 1, 2, 3 and 4 respectively.

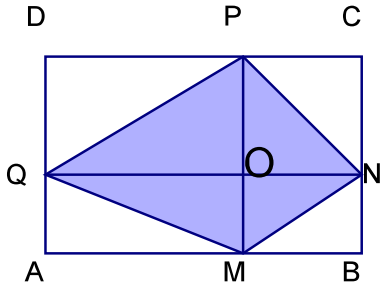
Three of the four cards are placed into the boxes as shown in the equation below.

$n = 5 + \square + \square - \square$?

How many different values of n can be obtained?

16. A class of students bought and equally distributed a certain number of notebooks. If the notebooks are distributed to girls only, each girl will receive 15 notebooks. If the notebooks are distributed to boys only, each boy will receive 10 notebooks. If the notebooks are equally distributed to everyone in the class, how many notebooks will each student receive?

17. In the following figure, AMOQ, MBNO, ONCP, QOPD and ABCD are rectangles. If the area of



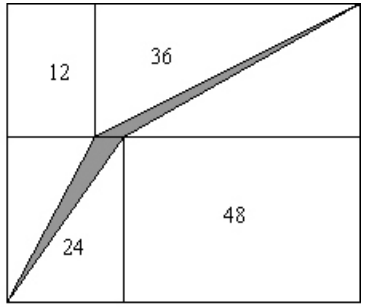
QOPD is 51 square units, the area of ONCP is 17 square units and the area of MBNO is 29 square units, find the area of the quadrilateral MNPQ.

18. There are over 50 children sitting in a circle.

They count clockwise around the circle starting from 1.

If the same child has counted 2 and 2006, what is the least number of children in the circle?

19. As shown in the figure below, the big rectangle consists of four smaller rectangles with their areas 12 cm^2, 24 cm^2, 36 cm^2 and 48 cm^2 respectively. If all the lengths, in cm, of the rectangles are integers, what is the area of the shaded region?



20. Find the units digit of the sum:
$1^{2006} + 2^{2006} + 3^{2006} + \ldots 9^{2006}$.

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