2019 Wits Mathematics Competition
Qualifying Round
Grades 10, 11 and 12

Instructions

This exam consists of 15 multiple choice questions. There is one correct answer to each question. There is no penalty for incorrect answers. The first 5 questions are each worth 3 points, the next 5 questions are each worth 4 points and the last 5 questions are each worth 5. The total number of points available is 60. The time limit on this exam is 75 minutes, calculators and geometric implements may NOT be used. If you are using the computer friendly answer sheet you should fill it in in BLACK pen (other colours do not scan well). Time may be given for filling in name, school and other personal details.

"It's like asking why is Ludwig van Beethoven's Ninth Symphony beautiful. If you don't see why, someone can't tell you. I know numbers are beautiful. If they aren't beautiful, nothing is". — Paul Erdos

Name and Surname: _____
School _____
Division: **Senior High School**
Grade _____
E-mail _____

Circle your answers below					
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E

A. 3 point questions

1. Nkosi played soccer with some friends. They started at 5:20 pm and finished at 6:05 pm. How long was their game?
   A. 1 hour and 35 minutes
   B. 45 minutes
   C. 1 hour and 45 minutes
   D. 1 hour
   E. 35 minutes

2. By what percentage does the area of a square increase if its perimeter increases by 25%?
   A. 20%
   B. 25%
   C. $36,25\%$
   D. $56,25\%$
   E. $71,25\%$

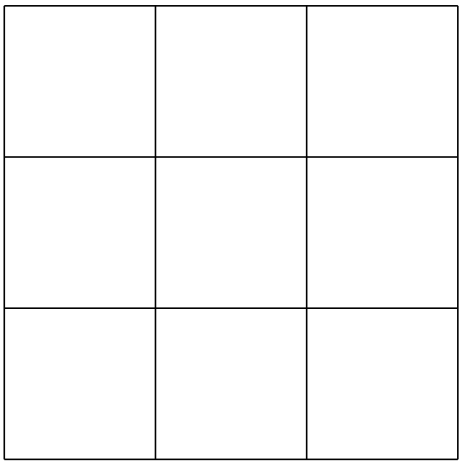
3. Find the value of $0,2019 - 0,02019$.
   A. $0,18181$
   B. $0,18171$
   C. $0,199881$
   D. 0
   E. $1,801$

4. Some students in a Grade twelve class line up. Thabo is 10^{th} from the front and 12^{th} from the back. How many students are in the class?
   A. 10
   B. 12
   C. 20
   D. 21
   E. 22

5. Which number is closest to $0,000246 \times 7982413$?
   A. 2
   B. 20
   C. 200
   D. 2000
   E. 20000

B. 4 point questions

6. How many rectangles are there in the following picture? Include rectangles of all sizes.



   A. 25
   B. 30
   C. 36
   D. 42
   E. 90

7. Find the 83^{rd} term in the sequence, 1,2,2,3,3,3,4,4,4,4,5,5,5,5,5,6,6,...

   Here the number 1 is repeated once, 2 twice, 3 three times. Later 10 is repeated ten times, 11 eleven times, and so on.

   A. 10
   B. 11
   C. 12
   D. 13
   E. 14

8. Find $726 \times 32 + 726 \times 68$.

   A. 72804
   B. 72920
   C. 72856
   D. 72600
   E. 79400

9. Find the sum of the roots of the polynomial $x^3 - 6x^2 + 11x - 6$.

   A. 4

   B. 6

   C. 8

   D. 10

   E. 12

10. There are 14 people at a party. Every pair of people shakes hands exactly once. How many handshakes occur?

    A. 7

    B. 14

    C. 22

    D. 53

    E. 91

C. 5 point questions

11. Consider $S = 9 + 99 + 999 + 9999 + ... + 99...99$ where the last number has 2019 digits. Find the sum of the digits of S.

    A. 2033

    B. 2034

    C. 4254

    D. 4255

    E. 9102

12. Compute:

$$\frac{1}{\sqrt{2}+\sqrt{1}} + \frac{1}{\sqrt{3}+\sqrt{2}} + \frac{1}{\sqrt{4}+\sqrt{3}} + ... + \frac{1}{\sqrt{25}+\sqrt{24}}$$

    A. 4

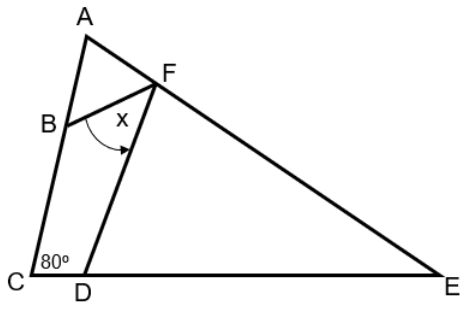
    B. 7

    C. 11

    D. 12

    E. 18

13. In ΔACE below, F lies on AE, D lies on CE and B lies on AC. $AF = AB$ and $EF = ED$. $\angle ACE = 80^o$. Calculate the angle marked x.



A. 35^o

B. 40^o

C. 45^o

D. 50^o

E. 55^o

14. This exam consists of three sections, each with five questions. The questions in these sections are worth respectively three, four and five points. What is the fifth highest score it is possible to achieve?

A. 54

B. 55

C. 56

D. 59

E. 60

15. Find the last digit of $2^{2019} + 3^{2019} + 5^{2019}$.

A. 0

B. 2

C. 4

D. 5

E. 9