



2022 Wits Mathematics Competition
Qualifying Round
Senior Secondary

Instructions

This exam consists of 20 multiple choice questions. There is one correct answer to each question. There is no penalty for incorrect answers. The mark allocation is as follows:

Questions 1-5 are each worth 3 points,
Questions 6-10 are each worth 4 points,
Questions 11-15 are each worth 5 points,
Questions 16-20 are each worth 6 points.
The total number of points available is 90.

The time limit on this exam is 75 minutes, calculators may NOT be used. A ruler and compass may be used but all other geometric aids are NOT allowed. A translation aid (such as a dictionary) from English to another language is allowed. 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 is a safe rule to apply that, when a mathematical or philosophical author writes with a misty profundity, he is talking nonsense” — Alfred North Whitehead

A. 3 point questions

1. Compute $2022 - 1234$.

- A) 777 B) 788 C) 877 D) 886 E) 920

2. Katlego used 195 digits to number the pages in her diary. How many pages did she use?

- A) 87 B) 90 C) 99 D) 101 E) 195

3. A water tank is $\frac{5}{6}$ full. When 30 litres is released the tank is $\frac{4}{5}$ full. Find the capacity of the tank in litres.

- A) 275 B) 300 C) 900 D) 1200 E) 1500

4. Bob adds up all the odd numbers from 1 to 1001 (including 1 and 1001). He then subtracts the sum of all the even numbers between 1 and 1001. What total does he end up with?

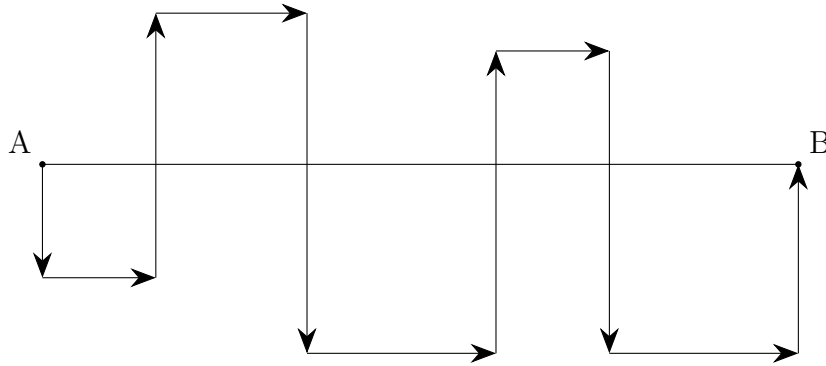
- A) 1002 B) 2004 C) 502 D) 998 E) 501

5. The product of two positive integers is equal to twice their sum. The same product is also equal to 6 times the difference between the two integers. What is the sum of the integers?

- A) 6 B) 9 C) 12 D) 15 E) 16

B. 4 point questions

6. A sequence of squares is shown, each square having a side on the line AB. A path is drawn, indicated by the arrows. The path is 96 metres long. Calculate the length AB.



- A) 18 B) 24 C) 32 D) 36 E) 48
7. 30 students wrote a mathematics exam. The average score was 50. The average score of those who passed was 60, the average score of those who failed was 45. How many students passed?
- A) 8 B) 10 C) 12 D) 16 E) 24
8. The multiplication $abc \times de = 7632$ uses each of the digits 1 to 9 exactly once. Calculate $a + b + c$.
- A) 13 B) 14 C) 15 D) 16 E) 17
9. $ABCD$ is a rectangle. Point E lies on AB such that angle $DEC = 90^\circ$. $DC = \sqrt{10}$ cm and $DE = 3$ cm. Find the area of $ABCD$.
- A) $2\sqrt{10}$ B) $\frac{3\sqrt{3}}{2}$ C) 3 D) 6 E) 12
10. A regular polygon with 6 sides has 9 diagonals. How many diagonals does a regular polygon with 10 sides have?
- A) 25 B) 28 C) 30 D) 33 E) 35

C. 5 point questions

11. Compute the product

$$\left(1 - \frac{1}{2^2}\right)\left(1 - \frac{1}{3^2}\right)\cdots\left(1 - \frac{1}{2021^2}\right)\left(1 - \frac{1}{2022^2}\right).$$

- A) $\frac{1}{2}$ B) $\frac{2023}{4044}$ C) $\frac{1011}{2022}$ D) $\frac{2021^2}{4044^2}$ E) $\frac{5}{12}$

12. How many zeroes will there be at the end of $1 \times 2 \times 3 \times 4 \times \cdots \times 39 \times 40$ when multiplied out (when all the natural numbers from 1 to 40 are multiplied together)?

- A) 6 B) 7 C) 8 D) 9 E) 11

13. Find the sum of all values of x satisfying the following simultaneous equations:

$$\begin{aligned}x^2 + 3y &= 10, \\3 + y &= \frac{10}{x}.\end{aligned}$$

- A) -3 B) -2 C) 0 D) 4 E) 5

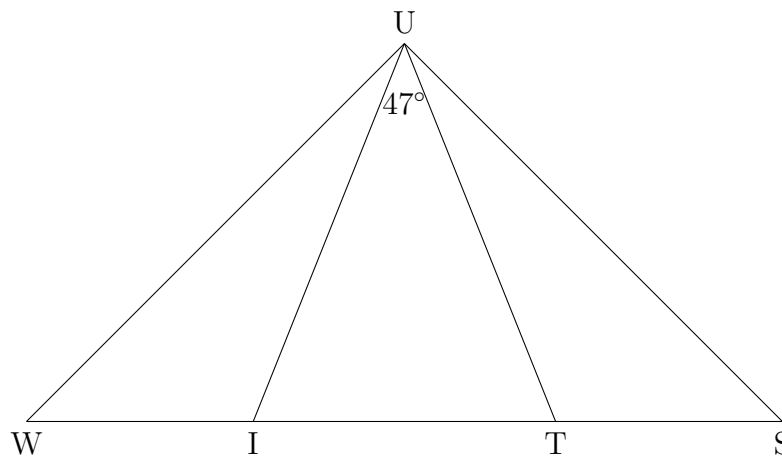
14. The sum of the digits of the integer equal to

$$777\ 777\ 777\ 777\ 777^2 - 222\ 222\ 222\ 222\ 223^2$$

is

- A) 148 B) 84 C) 74 D) 69 E) 79

15. In a triangle UWS the points I and T are placed on side WS so that $WU = WT$ and $SU = SI$. Determine \widehat{WUS} if $\widehat{IUT} = 47^\circ$.



- A) 82 B) 84 C) 86 D) 88 E) 90

