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**ПИСЬМЕННАЯ РАБОТА УЧАСТНИКА  
ОЛИМПИАДЫ ШКОЛЬНИКОВ СПбГУ  
2018–2019**

заключительный этап

Предмет (комплекс предметов) Олимпиады

СОВРЕМЕННЫЙ МЕНЕДЖЕР

Город, в котором проводится Санкт-Петербург

Дата 16.03.2019

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**ВАРИАНТ 6**

**МАТЕМАТИКА (СОВРЕМЕННЫЙ МЕНЕДЖЕР)**

*Для каждой из сформулированных задач приведите полное ее решение и запишите ответ.*

1. (6 баллов) Найдите сумму корней уравнения

$$(4x^2 + 8x + 3)(x^2 + 3x + 2) = 6$$

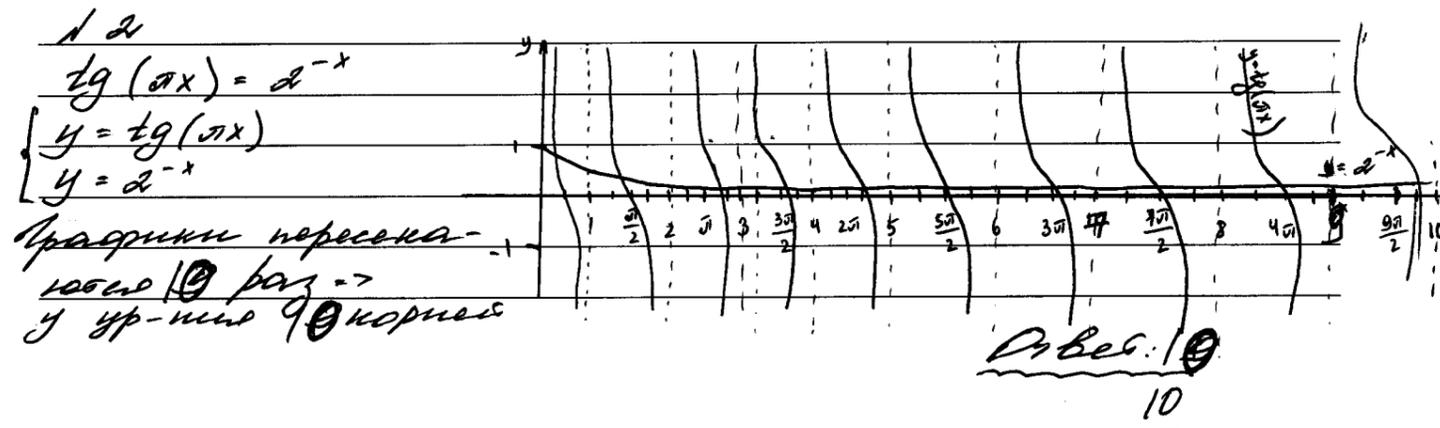
2. (6 баллов) Сколько корней имеет уравнение  $\operatorname{tg}(\pi x) = 2^{-x}$  на промежутке  $(0; 10)$ ?

3. (6 баллов) Найдите наибольшее значение функции

$$f(x, y) = \frac{x \ln y + y \ln x}{x^2 + y^2}$$

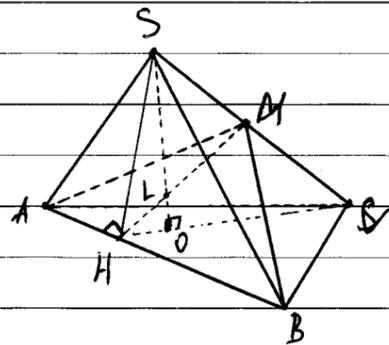
4. (8 баллов) В выпуклом четырехугольнике последовательно соединены середины сторон. Образовавшийся «серединный» четырехугольник является ромбом, в котором стороны и одна из диагоналей равны 3. Найдите площадь искомого четырехугольника.
5. (8 баллов) В правильной треугольной пирамиде  $ABCD$  через точки  $A$ ,  $B$  и середину ребра  $CS$  проведена плоскость. В каком отношении она делит высоту пирамиды?

Решения заданий:



Математика (страница для решений - 2):

N 5



Дано:

$SABC$  - правильная пирамида

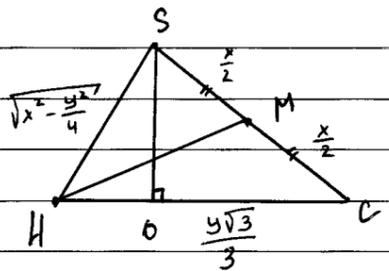
$SM : MC = 1 : 1$

$SO$  - высота

$SL : LO = ?$

Решение:

$\triangle SHC$



$AS = SB = SC = x$

$AB = BC = AC = y$

$\triangle ASB:$   
 $SH = \sqrt{x^2 - \frac{y^2}{4}}$

$\triangle ABC:$   
 $CH = \frac{y\sqrt{3}}{2}$

$\triangle ACB:$   
( $\cdot$ )  $O$  - пересечение  
медиан, т.к.  $\triangle$  равно-  
сторонний (также верш и  
средн. перпендик.)

$CO : OH = 2 : 1$   
 $CO = \frac{y\sqrt{3}}{2} \cdot \frac{2}{3} = \frac{y\sqrt{3}}{3}$

$SO = \sqrt{x^2 - \frac{y^2}{3}}$

Task 3

For each question 1-2, mark one letter.

1. In the text, the word in bold 'customary' is closest in meaning to:

- (A) experimental
- (B) client-oriented
- (C) trial
- (D) traditional

2. According to paragraph 7, Vietnam and Timor Leste have shared the information about all of the following EXCEPT:

- (A) adopting climate adjusting solutions in economic sphere
- (B) examining areas needing special care in changing climate conditions
- (C) planning basic systems and services in the countryside
- (D) adopting climate adjusting solutions in agricultural sphere

## АНГЛИЙСКИЙ ЯЗЫК И ОБЩЕСТВОЗНАНИЕ (СОВРЕМЕННЫЙ МЕНЕДЖЕР)

## Task 1

In this integrated task, you should read the text on the topic of environmental issues and answer the essay question. You have about 30 minutes to read and analyse the text and 40 minutes to plan, write, and revise your essay. Write your essay in 200–250 words in an appropriate style. Use your own words as far as possible.

- Identify at least three key environmental challenges that Russia faces today and give your arguments for each of them.
- Using the information from the text, explain if the initiatives presented in the text could be used in Russia to protect and improve the environment.

From Afghanistan to Zimbabwe, 141 countries made significant progress in 2017 to tackle the most urgent environmental challenges facing humanity and our planet, inspiring us to seek out new and more innovative solutions.

The 2030 Agenda for Sustainable Development provides our vision for this work – connecting people and welfare with the planet; development with environment – and signals that our response to these complex and inter-connected challenges must do the same.

In this 10th annual performance report of the United Nations Development Programme (UNDP), we show how investments in the Sustainable Development Goals<sup>1</sup> (SDGs) – on affordable and clean energy, climate action, life below water, and life on land – accelerate the achievement of other goals aimed at ending poverty, achieving zero hunger, achieving gender equality, reducing inequalities, and building strong institutions.

The Asia and the Pacific region is home to more than half of the world's population and faces a range of development challenges. These are often worsened by natural disasters which strain efforts to sustain economic growth and work to improve environmental sustainability.

Since 1992, the Asia and Pacific region has received over 28% of all environmental grant financing mobilized by UNDP for 37 countries in the region. When combined with close to US\$7 billion in co-financing, this total investment of US\$9 billion over the past 25 years has made significant progress in addressing the root causes of environmental degradation, and has built capacity to recover and strengthened livelihoods across the region.

In Nepal, a lift irrigation system for the Chepang and Magar communities uses electricity from micro hydro pumps to transfer clean water 100m uphill, saving residents the 90 minute trip needed to fetch the water by foot. The water is used for drinking and irrigation on land that had previously only been rain fed. Because of the support from the micro hydro pump, income has gone up tenfold in the community. At the national level, the Government of Nepal approved the Renewable Energy Subsidy Policy and the Renewable Subsidy Delivery Mechanism. Malaysia has reduced GHG emissions from the building sector almost twice the targeted amount. The biggest contributor of the reduced greenhouse gas (GHG) emissions from the building sector is from the Energy Performance Contract Financing Scheme which provides financing support to energy service companies. This enables the uptake of energy efficient technologies and the growth of the building renovation market.

Lessons from autonomous power supply systems and rural electrification models in Nepal were shared with the State Council of Science, Technology and Environment in India for an autonomous power supply initiative in Meghalaya. Tonga and Fiji organized a study tour to compare and contrast the challenges and benefits of establishing locally managed marine areas (LMMAs) and to develop a

<sup>1</sup> Sustainable Development Goals – a plan of action to end poverty, protect the planet and guarantee the global well-being of people

structure for LMMA's in Nauru. A delegation from Timor Leste traveled to Bangladesh, which supports the world's largest single tract of mangrove (type of a tropical tree found near water) forest, to learn about and share experiences on community based management of mangrove ecosystems. Vietnam and Timor Leste have exchanged knowledge and experience on promoting climate-adaptive infrastructure, which includes, among others: sensitivity assessments, mapping of essential rural infrastructure, integration of climate change adaptation into policies and designs of rural roads, irrigation and river embankments, and low-cost bio-engineering using locally-available resources. Sri Lanka and China have discussed the applicability of technology transfer from China for facilities to produce fertilizer out of ash waste, biomass heaters for the tea industry, and activated carbon based product manufacturing in Sri Lanka.

Native groups in Myanmar are involved in strengthening the sustainability of protected areas by identifying their customary land use practices and being involved in zoning processes. In addition, community guardians have been identified and trained to participate in protected area management. Selected native youth have been employed as community guards in protected areas. In Laos, native communities in targeted areas have been involved in prioritizing development interventions for increasing climate change adaptation and in land use planning at the village level, e.g. through their local knowledge, and in developing management plans for ecosystem areas.

## Essay:

With development of new technologies, many countries all around the world have to face environmental problems, and Russia is not an exception.

There are many issues to be solved in this country, one of them being enormous waste of energy. This happens because people don't think that by leaving the light or TV turned on they use energy that comes from resources that can not be easily renewed. If this tendency continues, our children will not be able to use what we have now due to it being completely wasted. Moreover, Russia is situated in many climate zones with each of them requiring special characteristics from materials that are being used in building of infrastructure. In spite of this fact, the same materials and technologies are used all around the country, even if they don't suit ~~region~~ climate of the region. That is why renovation can ~~be~~ be needed more often than expected ~~which~~ which means that more money and resources are being spent. Additionally, there is a problem connected with people's activities which is air pollution. Due to lack of regulations of usage of cars and of work of factories in Russia, both of this factors produce toxic waste which is thrown into the atmosphere for us to breath it in. Not only is it harmful for the environment, but also for the people's health.

## Essay (продолжение)

Many ways of coping with environmental issues are suggested around the world, but not all of them can be used anywhere. Some are specialised for the countries with special weather conditions or the danger of natural disaster and thus can't be used in Russia due to the fact that disasters happen too rarely to worry about them and the country being too big and too unique. However, some ideas connected only with the special part of the life such as agriculture or with climate-adaptive technologies.

There are too many problems to be solved in our world, and while some technologies are highly beneficial anywhere, others ~~can~~ can be harmful or just useless if used somewhere, ~~not~~ where it was not thought to be used.

## Task 2

Explain the meaning of the term "energy efficient technologies" from the text in about 50-100 words.

The term "energy efficient technologies" is used to name methods of doing something ~~with~~ with saving as much energy as possible. For example, if ~~building~~ producing a bottle of lemonade required work of three machines and now there was invented one which could do it itself, the second one can be called "energy sufficient", or, in other words, more productive.

## Математика (страница для решений - 3):

N1

$$(4x^2 + 8x + 3)(x^2 + 3x + 2) = 6$$

$$4x^4 + 8x^3 + 3x^2 + 12x^3 + 24x^2 + 9x + 8x^2 + 16x + 6 - 6 = 0$$

$$4x^4 + 20x^3 + 35x^2 + 25x = 0$$

$$x(4x^3 + 20x^2 + 35x + 25) = 0$$

$$x = 0 \quad 4x^3 + 20x^2 + 35x + 25 = 0$$

N2

