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ПИСЬМЕННАЯ РАБОТА УЧАСТНИКА
ОЛИМПИАДЫ ШКОЛЬНИКОВ СПбГУ
2018–2019

заключительный этап

Предмет (комплекс предметов) Олимпиады

СОВРЕМЕННЫЙ МЕНЕДЖЕР

Город, в котором проводится СкотеринбургДата 03.03.2019

ВАРИАНТ 1

МАТЕМАТИКА (СОВРЕМЕННЫЙ МЕНЕДЖЕР)

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

1. (6 баллов) Найдите все целочисленные решения неравенства

$$\log_{15}(x+2)^2 \geq \log_3(x-2)^2 + \log_5(x+3)$$

2. (6 баллов) Найдите котангенс наименьшего положительного корня уравнения

$$\sin(2x) \cos x = \frac{4}{3\sqrt{3}}$$

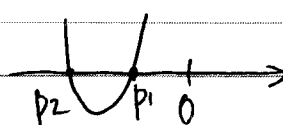
3. (6 баллов) При каком наибольшем целом
- a
- найдутся два отрицательных значения
- p
- , при которых
- $2p^2 - ap + 1 = 0$
- ?

4. (8 баллов) В трапеции диагонали равны 3 и 4, а площадь ее равна 6. Одно из оснований в четыре раза меньше другого. Найдите большее основание.

5. (8 баллов) Найдите площадь сечения единичного куба плоскостью, равноотстоящей от всех вершин куба.

Решения заданий:

3. $2p^2 - ap + 1 = 0$ /парабола, ветви направлены вверх.
• необходим отриц. знак p .



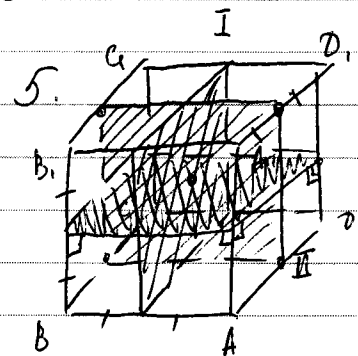
$p_2 \leq 0$ (вершина)
 $f(0) > 0$
 $D > 0$

Математика (страница для решений – 2):

$$\left. \begin{array}{l} a < 0 \\ a(-\infty, -2\sqrt{2}) \cup (2\sqrt{2}, +\infty) \end{array} \right\} \rightarrow a(-\infty, -2\sqrt{2})$$

• наиб. знач. $a = -3$ (целое), ~~минимум~~

Ответ: -3

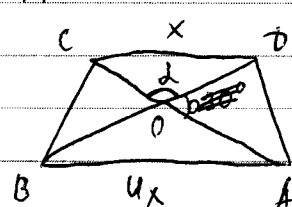


- 1) Построим необходимое сечение.
- если плоскость «равносторонняя» от всех вершин куба \rightarrow расстояние от вершин до этой плоскости должно быть равно. (т.е. плоск. равност.)
 - плоскость должна проходить через центр куба, т.е. эта точка равноудалена от всех вершин.

Возможны 2 случая, при которых искомого плоскость будет соответствовать названным условиям. (В первом из них искомым п.л. пар. двум против. грани куба и пересекает другие грани через их середины). В любом из этих случаев $S_{\text{сечения}} = 1 \cdot 1 = 1$

Ответ: 1

4.



$$1) S = \frac{1}{2} d_1 d_2 \sin \alpha$$

$$b = 12 \cdot \sin \alpha$$

$$\alpha = 30^\circ$$

$$2) \triangle BOA \sim \triangle DOC \text{ (по 2-м углам: } \angle BOA = \angle DOC \text{ или верт., } \angle ABD = \angle BDC \text{ или напр. перес.)} / \begin{array}{l} CO = \frac{3}{5}, AO = \frac{12}{5} \\ CD = \frac{1}{4}, AC = 3, BD = 4 \\ BO = \frac{16}{5}, OD = \frac{4}{5} \end{array}$$

$$3) \triangle COD: x^2 = CO^2 + OD^2 - 2 \cdot CO \cdot OD \cdot \cos \alpha$$

$$x^2 = \frac{9}{25} + \frac{16}{25} - \frac{2 \cdot 3 \cdot 4 \cos \alpha}{5 \cdot 5}$$

$$x^2 = 1 - \frac{12\sqrt{3}}{25} \quad x = \frac{\sqrt{25 - 12\sqrt{3}}}{5}$$

Ответ: $\frac{4\sqrt{25 - 12\sqrt{3}}}{5}$

Task 3

For each question 1-2, mark one letter.

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

- (A) define
(B) present
(C) handle
(D) create

2. Sustainable forest management in the Central Province of Zambia includes all of the following EXCEPT:

- (A) raising young animals
(B) breeding new varieties of trees
(C) managing colonies of useful insects
(D) growing young plants

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 Goals¹ (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 vast and diverse region of Africa is unified around two ambitious programmes for people, planet and welfare: the global Sustainable Development Goals and the continental Agenda 2063, which builds on and aims to accelerate existing continental initiatives for growth and sustainable development.

Since 1992, the Africa region has received 24% of all environmental grant financing mobilized by UNDP for 46 countries in the region. When combined with US\$8.1 billion in co-financing, this total investment of US\$9.9 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 Namibia, Integrated Forest Management Plans have been completed for 2.8 million hectares and will facilitate the use of improved agricultural, livestock, and forestry management practices in community forest areas. Managing community forests improves communities' fair and sustainable access to wood resources, firewood, poles, wild fruits, medicinal plants, etc. The National Agricultural Policy now has strategies that address forest concerns, including the protection and conservation of native plants and genetic material, agroforestry, and a strategy on sustainable utilisation of natural resources. Communities in the Central Province of Zambia are taking a lead role in sustainable forest management by: adopting local laws that encourage tree regeneration; planting 88,000 seedlings from an agro-forestry nursery to promote more diversified and sustainable land use practices; and adopting alternative income generating activities such as bee-keeping, conservation farming, small livestock rearing, and handicrafts in order to reduce pressures on forests. Mapping of historical trends of fire incidence and fire danger for the Central Province help identify areas at risk and contribute to the development of a fire incidence database at the Forestry Department Headquarters in Lusaka which form an integral part of draft fire management plans.

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

Senegal is working with Burkina Faso, Togo and Democratic Republic of Congo on the concept of an ecovillage model that combines the sustainable management of natural resources with the use of renewable and low-carbon energy sources, for multiple benefits. Healthcare management experts from Ghana, Kenya, Madagascar, Mauritius, South Africa, Uganda, Tanzania and Zambia participated in an intensive training session on advanced healthcare waste management, strengthening collaboration among country teams and promoting a broader regional effort on global green hospitals. Representatives from Burkina Faso traveled to Niger to observe the production of native bourgou grass (*Echinochloa stagnina*) for livestock feeding, and to explore options for increasing production of bourgou back home.

A new bush fire management strategy developed for the Tsodilo Enclave in Botswana has significantly reduced fire incidents and burnt area by 60%. This has led to more effective range management which helps the flow of ecosystem services that support livelihoods of local communities. The creation of five new protected areas in the Dulombi-Boe-Tchetche complex in Guinea Bissau resulted in the expansion of the National Protected Area system from 15% of the country's territory to over 26%. Record numbers of lions and elephant groups and significant increases of chimpanzee populations have been recorded in the new PAs. In South Sudan, protected areas under improved management increased from 2 million to 6 million hectares. Improved management effectiveness of these areas is helping to preserve biodiversity conservation efforts via training on identification of illegal wildlife products, investigation procedures, aerial surveillance of ecosystems and species, among other activities.

Essay:

The environmental issues are becoming more and more significant in Russia. Nowadays, the country is facing a necessity to solve the most urgent problems.

Thus, an air pollution can be considered as one of the key environmental challenges. One of the main Russian's economic spheres consists of the big industrial corporations business, which results in a tremendous amount of gases being thrown in the atmosphere annually. The problem of deforestation can be also referred to the most urgent problems, since the forests are not able to recover after their usage in production. The third main problem is an increasing number of the endangered species. Nowadays, more and more animals in Russia become extinct due to the human's activity.

There are various methods which can be used to solve these issues partly. Thus, an Integrated Forest Management program has shown the successful results in improving the forest's state in Africa by adopting local laws in the aim of tree regeneration, and promoting the alternative land use practices. These initiatives could be used in Russia as well, since they ~~are~~ definitely will not ~~be~~ change the existing

Essay (продолжение)

Russian's production state drastically. The monitoring of illegal wildlife products and protected areas creation could help to preserve biodiversity in Russia, because these methods does not require the enormously high governmental expenses.

In conclusion, there are various environmental ~~problems~~ in Russia that need to be solved.

Task 2

Explain the meaning of the term "ecosystem" from the text in about 50-100 words.

~~Ecosystem is a part of a biosphere, which contains a unique variety of plants, animals and other living beings on a certain area. An ecosystem provides a balanced communication between the creatures and can be defined as an independent component of the biosphere. Thus, eliminating one of the ecosystem's elements leads to its whole damaging.~~

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Математика (страница для решений - 3):

$$2. \ 2\sin x \cos^2 x = \frac{4}{3\sqrt{3}}$$

$$\sin x \cos^2 x = \frac{2}{3\sqrt{3}}$$

$$2\sin x (1 - \sin^2 x) - \frac{4}{3\sqrt{3}} = 0$$

$$\sin x = t, \ t \in [-1, 1]$$

$$3\sqrt{3}t - 3\sqrt{3}t^3 - 2 = 0$$

$$3\sqrt{3}t^3 - 3\sqrt{3}t + 2 = 0$$

$$\sin^3 x - \sin x + \frac{2}{3\sqrt{3}} = 0$$