



2

2809

70

**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

.....

ВАРИАНТ 5

МАТЕМАТИКА (СОВРЕМЕННЫЙ МЕНЕДЖЕР)

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

1. (6 баллов) Найдите сумму корней уравнения

$$(x+1)(x+2)(x+3)(x+4) = 24$$

2. (6 баллов) Сколько корней имеет уравнение $\cos(\pi/(x+2)) = \sin(\pi x)$ на промежутке $[0; 10]$?

3. (6 баллов) Найдите наибольшее значение функции

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

4. (8 баллов) В параллелограмме одна из диагоналей равна боковой стороне и равна 4, а другая диагональ является биссектрисой двух углов параллелограмма. Найдите его площадь.

5. (8 баллов) В кубе $ABCD A'B'C'D'$ точка P лежит на ребре $B'C'$ и при этом $B'P:PC' = 1:2$. Через точки B , D и P проведена плоскость. В каком отношении она делит объем куба?

Решения заданий:

1. ~~Найти сумму корней уравнения~~ При перемножении многочленов 4
получим, ~~получим~~ по числу, произведение равно 24.
При этом показатели степеней равны на 1
(т.к. первое слагаемое каждого множителя одинаково -
а второе образует арифм. прогрессию с разностью 1).
Возможное решение:

Математика (страница для решений - 2):

$$(0+1) \cdot (0+2) \cdot (0+3) \cdot (0+4) = 24, \quad x=0$$

~~Другие решения невозможны, т.к. при увеличении x какой-то фактор будет уменьшаться.~~

При уменьшении x так, что $x \in [-4; 0)$, один из множителей будет равен нулю, и какой-то фактор также будет равен 0.

Второе возможное решение:

$$(-5+1) \cdot (-5+2) \cdot (-5+3) \cdot (-5+4) = 24, \quad x=-5$$

Другие решения невозможны, т.к. при $x > 0$ произведение будет больше 24 (увеличиваются множители - увелич. произв-е), при $x < -5$ - аналогично.

Ответ: -5.

$$2. \cos\left(\frac{\pi}{x+2}\right) = \sin(\pi x) \quad \textcircled{*} \quad x \neq -2$$

$$\cos\left(\frac{\pi}{x+2}\right) = \cos\left(\pi x + \frac{\pi}{2}\right)$$

$$\frac{\pi}{x+2} = \pi x - \frac{\pi}{2}$$

$$\pi = (\pi x - \frac{\pi}{2})(x+2)$$

$$2\pi - x^2\pi - 2\pi x + \frac{\pi}{2} = 0 \quad | : \pi$$

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

$$-2x^2 - 3x + 4 = 0$$

$$x_{1,2} = \frac{3 \pm \sqrt{41}}{-4}$$

$$\frac{3 - \sqrt{41}}{-4} \in [0; 10]; \quad \frac{3 + \sqrt{41}}{-4} < 0, \quad \text{не принадлежит } [0; 10]$$

Ответ: 1 корень.

8. Дано: $ABCPA'B'C'D'$ - куб; $B'P: P'C = 1:2$;

Найти:

В каком углу и т. (PBD) лежит отрезок

Task 3

For each question 1-2, mark one letter.

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

- (A) started
- (B) agreed
- (C) completed
- (D) outlined

2. According to paragraph 7, sustainable development measures taken in Sri Lanka and Philippines resulted in the following EXCEPT:

- (A) people are given better security
- (B) people earn more money than they used to
- (C) trading zones for groceries appeared
- (D) newly produced cars give off less fumes

*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.

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 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.

The Kokoda Trail, Papua New Guinea's most famous tourist site, is now protected by the government's Conservation and Environment Protection Agency. Preserving the unique biodiversity along the 100km corridor is vital, as the number of visitors to the country is rising. The trail brings the equivalent of over US\$1 million annually to the country. Tourism Development Area (TDA) management plans developed and **launched** in Samoa identify sensitive tourism locations, provide alternative destinations, and provide recommendations for climate change adaptation action on the ground. More than 75% of tourism operators in targeted TDAs have already invested in and implemented sustainable adaptation measures.

Over 1,300 home gardens using climate-adaptive agriculture and water management practices have been planted in the North Western province of Sri Lanka, supplying an average of 20,000 kg of fruits and vegetables monthly to eight newly established regional farmers markets. The annual income of participating families has increased by 34% and the distance between a farmer and a consumer has been reduced thereby lowering emissions from the transportation of produce. Over 5,400 small-scale farmers in Mindanao in the Philippines are getting compensation for climate risks through weather-indexed based

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

Detailed risk maps were developed for 15 mountainous provinces in Vietnam to assist local governments with making informed decisions on risk reduction measures, help in managing climate change impact, prioritizing investments for infrastructure upgrades, including the timing of such investments. In Timor Leste, climate sensitive rural infrastructure activities – including new and restored water supply systems (reservoirs, irrigation systems) – are bringing clean water to rural communities that experience frequent droughts. Farmers and residents have received training on soil bioengineering and management practices concerning rainwater collection.

In Tonga, the Fanga'uta Lagoon Environmental Management Plan was approved by the Cabinet. Efforts to improve long-term sustainability of the lagoon include development of a full monitoring system for the area of land from which water flows into the lagoon to improve water quality and *mangrove* (type of a tropical tree found near water) conservation work. China and the Republic of Korea border the Yellow Sea Large Marine Ecosystem (YSLME) are working together to foster long-term sustainable institutional, policy and financial arrangements for effective management of the area which covers 400,000 km². A special YSLME Commission was set up to coordinate and strengthen legal mechanisms for governing the YSLME which tens of millions of residents rely on.

The East Godavari River Estuarine Ecosystem holds the second largest area of *mangroves* along the east coast of India and is rich in floral and faunal diversity. It generates significant ecological and economic benefits such as shoreline protection, livelihood provision and services to reduce the effect of global warming by protecting forests that absorb large amounts of carbon dioxide. This area is being protected via significant reforms including sustainable fishing and aquaculture regulations integrated into the Andhra Pradesh Marine Fisheries Act and specific protections for marine and coastal biodiversity in the Wildlife Act. These protect water and land ecosystems including manmade landscapes and native biodiversity from risks associated with non-native species.

Essay:

Nowadays almost all ~~area~~ regions of the world ~~are~~ face environmental challenges. Russian Federation is probably one of the most under-the-risk countries, ~~as~~ because of its large territory and different climate zones.

The most urgent environmental problem in Russia is water and air pollution. ~~The~~ Most developed regions suffer from it, and in some cities, such as Volokolamsk and Moscow, the level of toxic fumes is ~~in~~ several times higher than that considered safe. The ~~problem is~~ ^{problem is} severe of the problem is reluctance of factory owners* to spend money on water ^{and} ^{garbage} cleaning ~~sanitation~~ systems.

Another environmental challenge of Russia is the disappearance of ~~the~~ unique ^{ecosystems} ~~ecosystems~~, especially in the Far East ^{region} where lots of endangered species live. The area is preserved by government, but ~~there~~ this measure ~~is not~~ is not ^{enough} ~~various~~ to protect rare species from extinction. Soil degradation and the disappearance of forests also

impact ~~has~~ heavily on Russia's environment, ~~the main reason of this issue is that there are~~ ~~wastelands~~ leading to problems with agriculture and creating wastelands ~~which cannot be used~~.

~~The protection of large breeding unique birds and~~ ~~wastelands requires special laws~~ ~~have been made~~.

The measures taken by Tunga and Papua New Guinea's governments, which protect ~~areas~~ areas rich in floral and faunal diversity, would work in Russia as well. Restricting fighting with illegal hunters and restricting the number of visitors would help to ~~protect~~ preserve the ~~regions~~ unique ~~regions~~ ^{ecosystems} of the Far East and Baikal lake.

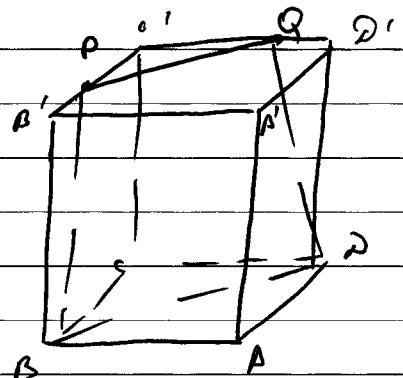
However, ~~improving the situation~~ ~~is~~ improving water quality and restoring forest and agricultural land is more difficult. Initiatives presented in the text cannot deal with this problem, as ~~the~~ ^{its} source ~~is~~ ^{is} people's indifference to ~~ecological~~ ~~problems~~ environmental issues. ~~The problem of~~ Restrictions would not work here, ~~as~~ and the government would have to take more complicated measures in order to solve the problem.

To conclude, Russia faces ~~as~~ three main ~~challenges~~ environmental challenges, and only one of them can be solved by initiatives ~~mentioned~~ mentioned in the text.

Task 2 Explain the meaning of the term "gender equality" from the text in about 50-100 words.

~~The term "gender equality" means that men and women have the same rights and opportunities. It means that men and women should have the same opportunities to choose their way of life and profession, and equal treatment of men and women in all spheres of life. The lack of gender equality is a common trait of developing countries, where women often do not have political rights or other rights, or are traditionally considered men's property.~~

The term "gender equality" means equal rights for men and women, the possibility for ~~the~~ ~~people~~ ~~of~~ ~~both~~ ~~genders~~ ~~to~~ ~~choose~~ ~~their~~ ~~way~~ ~~of~~ ~~life~~ ~~and~~ ~~profession~~, and equal treatment of men and women in all spheres of life. The lack of gender equality is a common trait of developing countries, where women often ~~do~~ ~~not~~ ~~have~~ ~~political~~ ~~rights~~ ~~or~~ ~~other~~ ~~rights~~, or are traditionally considered ~~the~~ men's property.



Роспуск сечения куба м. (PBD)

$$\frac{B'P}{PC'} = \frac{1}{2}$$

Пусть точка Q ∈ C'D'

PQ ∥ BD, т.е. нахождение точки

$$\text{Значит, } \frac{C'Q}{QD'} = \frac{2}{1}$$

$$S_{PC'Q} = \frac{2}{3} \cdot \frac{2}{3} S_{B'C'D'} = \frac{4}{9} S_{B'C'D'}$$

Решение: BCDPC'Q - усеч. пирамида

$$V = \frac{1}{3} (S_{BCD} - S_{PC'Q}) \cdot \frac{h}{2} \quad ; \quad V = \frac{1}{3} \cdot \frac{5}{9} S_{BCD} \cdot \frac{h}{2}$$

$$S_{BCD} = \frac{a^2}{2} \quad ; \quad h = a \quad ; \quad V = \frac{5}{27} \cdot \frac{a^3}{4} = \frac{5a^3}{108}$$

$$V_{BCD B'C'D'} = \frac{1}{2} V_{куба} = \frac{a^3}{2}$$

$$V_{B'A'DQD'D} = \frac{a^3}{2} - \frac{5a^3}{108} = \frac{49a^3}{108}$$

$$V_{B'A'DA'D'} + V_{B'A'DQD'D} = \frac{a^3}{2} + \frac{49a^3}{108} = \frac{103a^3}{108}$$

Ответ:

$$\frac{V_{BCDPC'Q}}{V_{куб.}} = \frac{5}{103}$$

$$\text{Ответ: } \frac{5}{103}$$

