TASHKENT UNIVERSITY OF TECHNOLOGY | CONSTRUCTOR TALENT SCHOOL

Selection Examination to "ToshTech" technical university in MATHEMATICS

Notes on the Sample Examination

Applicants should keep in mind that the tasks included in the sample examination do not cover all content elements that will be assessed in the actual versions of the Selection Examination. The list of content topics is provided in the Selection Examination specification document.

The sample examination is intended to give any applicant and the wider public an idea of the structure of the Selection Examination, the number of tasks, their format, and the overall level of difficulty of the examination.

> **ATTENTION**
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> The sample examination contains several example tasks for some positions of the Selection Examination. In the actual examination, only one task will be presented for each position.

Sample Examination, 2026

Part 1

> **Answers to Tasks 1–10**
>
> Complete the given task and write your answer on Answer Sheet No. 1 to the right of the corresponding task number. Units of measurement are not required.

1. In triangle ABC, angle C is equal to 90°, CH is an altitude, $AB = 49$, $\sin\alpha = \frac{5}{7}$. Find BH.

OR

1. The sides of a parallelogram are 9 and 15. The altitude drawn to the shorter side is 10.
Find the altitude drawn to the longer side of the parallelogram.

OR

1. The acute angle of a rhombus is 30°. The radius of the circle inscribed in the rhombus is 18.
Find the side length of the rhombus.

2. The base of the regular quadrilateral prism $ABCDA_1B_1C_1D_1$ is a square with side length 2. The height of the prism is $2\sqrt{7}$.
Find the cosine of angle B_1AC.

OR

2. In the cube $ABCDA_1B_1C_1D_1$, find the distance from point A to plane BCD_1 if the edge length of the cube is $\sqrt{3}$.

OR

2. The height of a right circular cylinder is 4 times the radius of its base. A plane that has exactly one point in common with the circumference of the cylinder's base intersects the cylinder at an angle of 45° to the base and divides the cylinder into two parts. Find the ratio of the volumes of these two parts.

3. $ABCD$ is a rhombus with side length 4 and angle A equal to 30°. Find the dot product of vectors AC and BD.

OR

3. The lengths of vectors $\vec{a}$ and $\vec{b}$ are 3 and $3\sqrt{2}$ respectively, and the angle between them is $45°$.
Find the length of the vector $\overrightarrow{a-b}$.

OR

3. Find angle A of the triangle with vertices $A(-1, \sqrt{3})$, $B(1, -\sqrt{3})$, $C(\frac{1}{2}, \sqrt{3})$.

4. A bank deposit increases by 10% each month. By what percentage will it increase compared to its original value after 3 months?

OR

4. A cucumber contains 90% water. After a day in the sun, evaporation causes its mass to decrease by half. What percentage of water does the cucumber contain now?

OR

4. To make candied orange peel, fresh oranges and sugar are taken in a mass ratio of 6:7. During drying, the mass of the oranges is reduced by half. How many grams of oranges are needed to obtain 1000 g of candied peel?

5. Simplify the expression:

$$\left(\sqrt{x} - \frac{\sqrt{xy} + y}{\sqrt{x} + \sqrt{y}}\right) \cdot \left(\frac{\sqrt{x}}{\sqrt{x} + \sqrt{y}} + \frac{\sqrt{y}}{\sqrt{x} - \sqrt{y}} + \frac{2\sqrt{xy}}{x - y}\right).$$

OR

5. Simplify the expression:

$$36^{\log_6 5} + 10^{1 - \lg 2} - 3^{\log_3 36}.$$

OR

5. Simplify the expression

$$\frac{\operatorname{tg}\alpha}{1 + \operatorname{tg}\alpha} + \frac{\operatorname{tg}(\alpha + \pi)}{1 - \operatorname{tg}\alpha}.$$

6. Find the value of the expression:

$$\frac{12}{\sin^2 37° + \sin^2 127°}.$$

OR

6. The expression

$$6\sqrt[5]{3^5 x^{45}} \cdot \sqrt[8]{2^8 x}$$

is equivalent to ax^b, where a and b are positive constants and $x > 1$.
What is the value of $a + b$?

7. Solve the equation.

$$\sqrt{x + 17} = 3 - x$$

OR

7. Solve the inequality.

$$2\log_2(x-2) > \log_2(3x-2)$$

OR

7. Solve the equation.

$$2^{\left|\frac{x}{2}+1\right|-2} = 4\sqrt{2}$$

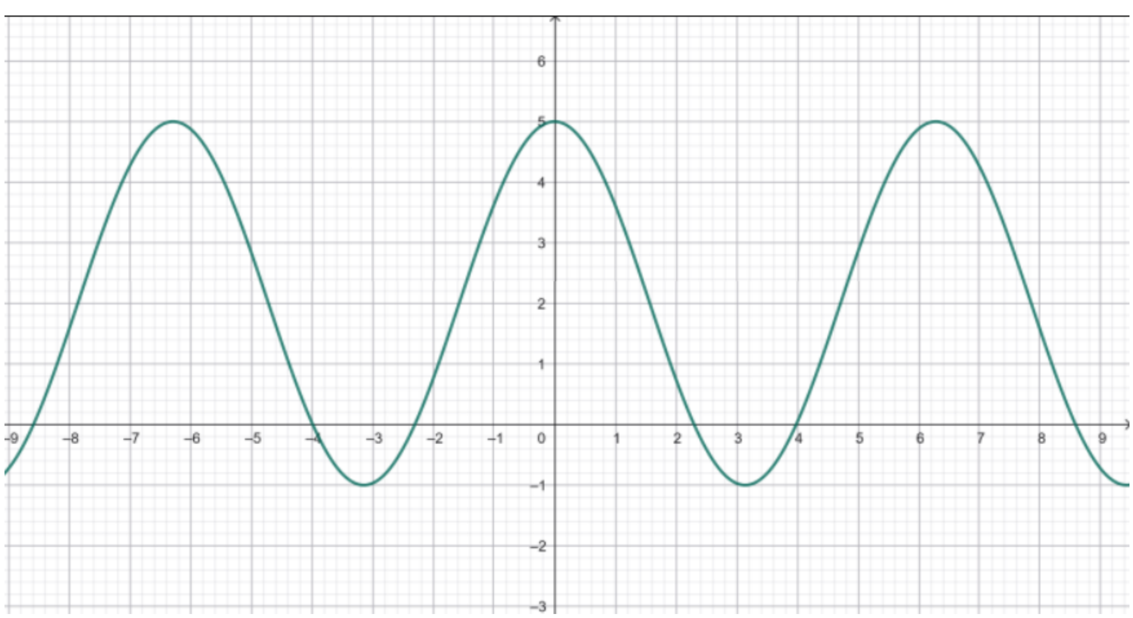
8. Solve the system of equations:

$$\begin{cases} x - y - 5z = 0, \\ 3x - 2y - 14z = 2, \\ 2x - y - 8z = 1. \end{cases}$$

OR

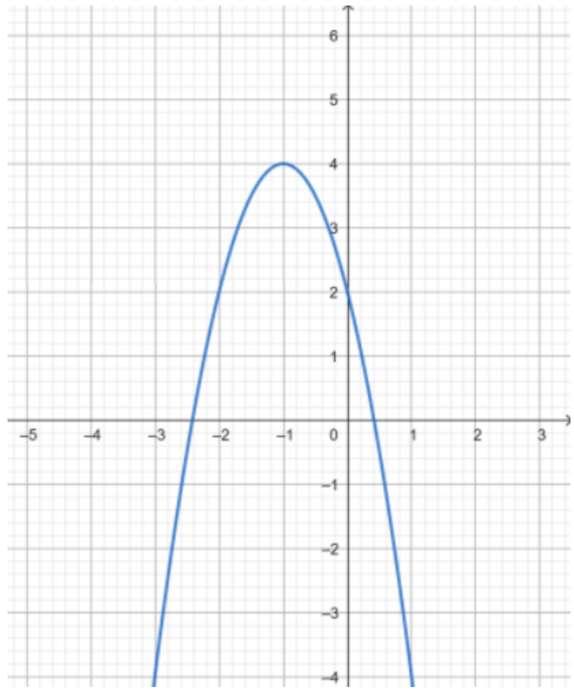
8. Alice and Bob discovered that if they add the house numbers where they live, the result is 113, and if they subtract twice Alice's house number from Bob's house number, the result is 74. What is Bob's house number?

9. The graph of the function $f(x) = a\cos x + b$ is shown below. Find a.



OR

9. Find the equation of the given parabola. Write it in the form $y = a(x-b)^2 + c$.



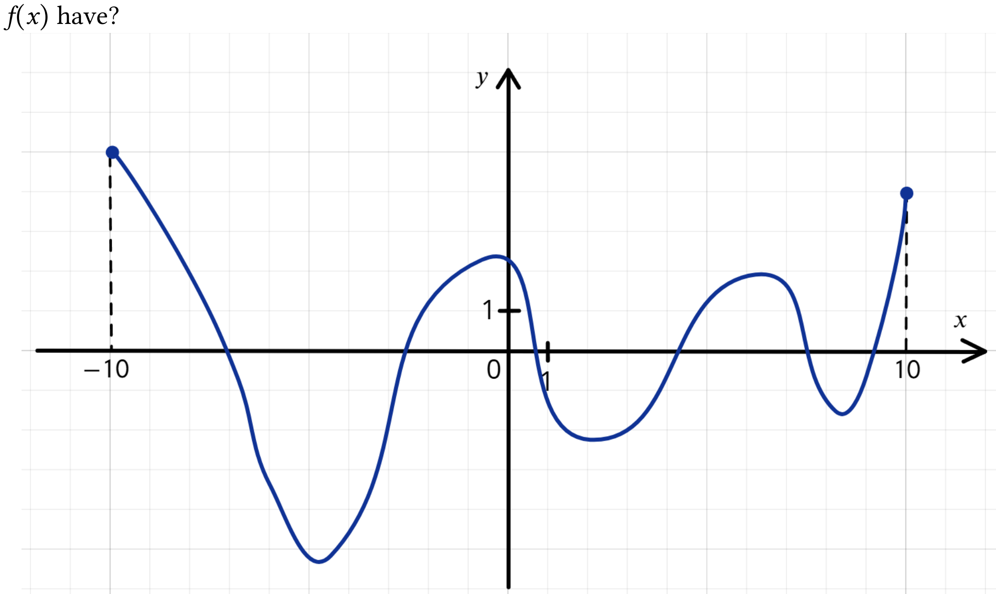
10. Bob was boiling water in a pot in his kitchen, but his smart electric stove recently caught a virus, so it heated unevenly. Fortunately, it saved some data, from which Bob concluded that the water temperature as a function of time was $f(x) = (x-10)^3/100 + 25$.

Determine after how much time Bob removed the pot from the stove. At what time t_0 was the heating rate maximal?

In your answer, write the value of t_0.

OR

10. The graph of the derivative $f'(x)$ of a function $f(x)$ defined on the interval $[-10, 10]$ is given. How many local maxima does the function $f(x)$ have?



Part 2

ATTENTION

Use Answer Sheets No. 2 to write your solutions and answers to Tasks 11–14. Write your solution as completely and in as much detail as possible. Remember that even if you are unable to solve the problem completely, you may still receive partial credit for significant progress according to the marking criteria.

11. The depth of the water in a harbor is modeled by

$$h(t) = 3 + 2\sin\left(\frac{\pi t}{6}\right),$$

where t is the time in hours after midnight, $0 \le t \le 24$.

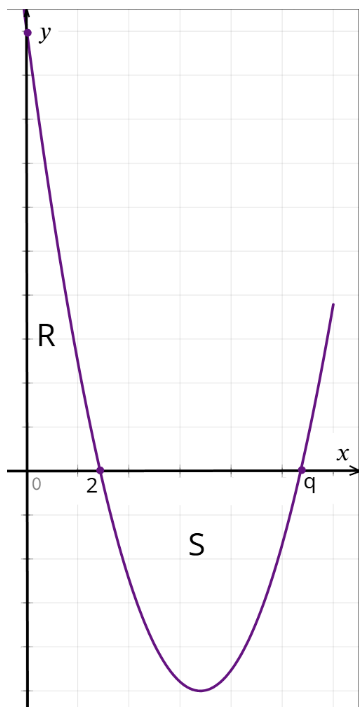
(a) Find the times between midnight and noon when the depth is exactly 4 m.

(b) Determine the rate of change of depth at $t = 2$ hours.

(c) At what times in the first 12 hours does the depth reach its maximum and minimum? Give the corresponding depths.

(d) A boat requires at least 4 m of water to sail safely. For how many hours between $t = 0$ and $t = 12$ can the boat be in the harbor?

12. The quadratic function shown passes through $(2, 0)$ and $(q, 0)$, where $q > 2$. What is the value of q such that the area of region R equals the area of region S?



13. Solve the system of equations:

$$\begin{cases} 5\sin x - 2y + z = 0, \\ 3\cos x + 11y + z = 0, \\ e^{\sin x} = 1. \end{cases}$$

14. Two cyclists are moving at constant speeds along mutually perpendicular roads toward the intersection of those roads. One of them is traveling at 40 km/h and is 5 km from the intersection, while the other is traveling at 30 km/h and is 3 km from the intersection. After how many minutes will the distance between the cyclists be minimal? What will this minimum distance be?