LAB_02_1. BRANCHING

Class work:

1. Three real numbers are given. Choose from them those that belong to the interval (1,3).

2. Given real numbers x, y (not equal). Replace the smaller of these two numbers with their half sum, and the larger with their double product.

3. Three real numbers are given. Square those of them whose values are non-negative.

4. If the sum of three pairwise distinct numbers x , y , z is less than one, then replace the smallest of these three numbers with a half-sum of the other two; otherwise, replace the smaller of x and y with half the sum of the two remaining values.

Variants:

1. Real numbers a , b , c , d are given . If a ≤ b ≤ c ≤ d , then replace each number with the largest of them; if a > b > c > d , then leave the numbers unchanged, otherwise all numbers are replaced by their squares.

2. Real numbers x, y are given. If x and y are negative, then replace each solution with its modulus; if only one of them is negative, then increase both values by 0.5; if both values are non-negative and neither of them belongs to the segment [0.5, 2.0], then both values are reduced by 10 times; in other cases, x and y are left unchanged.

3. Real positive x , y , z are given . Find out if there is a triangle with side lengths x , y , z . If the triangle exists, then answer whether it is acute-angled.

4. Real numbers a, b, c are given (a is not equal to zero). Find out if the equation $ax^2 + bx+c= 0$ has real roots. If there are real roots, then find them. Otherwise, the response should be a message that there are no valid roots.

5. A real number h is given . Find out if the equation $ax^2 + bx+c=0$ has real roots, if

$$a = \sqrt{\frac{|\sin 8h|+17}{(1-\sin 4h\cos(h^2+18))^2}},$$
$$b = 1-\sqrt{\frac{3}{3+|\operatorname{tg} ah^2-\sin ah|}},$$
$$c = ah^2\sin bh + bh^3\cos ah.$$

If real roots exist, then find them. Otherwise, the response should be a message that there are no real roots.

6. Given real numbers a_1, c_1, c_1, a_2, c_2, c_2. Find out if it is true that $|\,|a_1b_2 - a_2b_1|\,| \geq 0.0001$, and if true, then find a solution to the system of linear equations

$$a_1x + b_1y + c_1 = 0,$$
$$a_2x + b_2y + c_2 = 0$$

(when the written inequality is satisfied, the system is certainly consistent and has a unique solution).

7. Given real numbers a , b , c (a ≠ 0). Fully explore the biquadratic equation $ax^4 + bx^2 + c =0$, i.e. if there are no valid roots, then a message to that effect should be returned, otherwise two or four roots should be returned.

8. Given real numbers a , b , c , d , s , t , u (s , t are not simultaneously equal to zero). It is known that the points (a , b) and (c , d) do not lie on the line t given by the equation sx + ty + u =0. The straight line t splits the coordinate plane into two half-planes. Find out if it is true that the points (a, b) and (c , d) belong to different half-planes.

9. Given real numbers a , b , c , d , e , f , g , h . It is also known that the points (e, f) and (g , h) are distinct. It is also known that the points (a , b) and (c , d) do not lie on the line l passing through the points (e , f) and (g , h). The straight line l divides the coordinate plane into two half-planes. Find out if the points (a , b) and (c , d) belong to the same half-plane.

10. Real numbers x_1 , x_2 , x_3 , y_1 , y_2 , y_3 are given . Does the origin belong to a triangle with vertices (x_1 , y_1), (x_2 , y_2), (x_3 , y_3)?

11. Real positive numbers a, b , c, d are given . Find out if a rectangle with sides a , b can fit inside a rectangle with sides c , d so that each of the sides of one rectangle is parallel or perpendicular to each side of the rectangle.

12. Real positive numbers a , b , c , x , y are given . Find out if the brick will go through the edges a , b , c into a rectangular hole with sides x and y. Pushing a brick into a hole is allowed only so that each of its edges is parallel or perpendicular to each side of the hole.

13. Given a real number a. Calculate F (a) if

$$f(x)=\begin{cases} x^2 & \text{при } -2\leqslant x<2, \\ 4 & \text{в противном случае;} \end{cases}$$

14. Given a real number a. Calculate F (a) if

$$f(x)=\begin{cases} x^2+4x+5 & \text{при } x\leqslant 2, \\ \dfrac{1}{x^2+4x+5} & \text{в противном случае;} \end{cases}$$

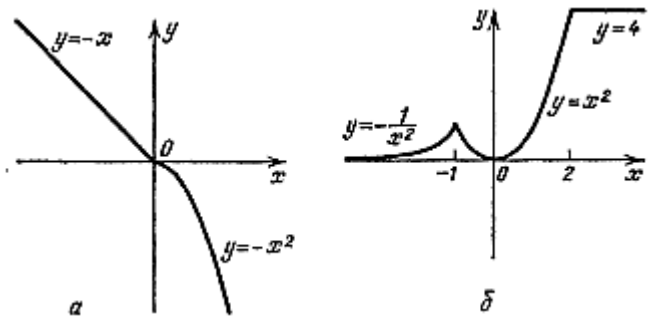
15. Given a real number a. Calculate F (a) if

$$f(x)=\begin{cases} 0 & \text{при } x\leqslant 0, \\ x & \text{при } 0<x\leqslant 1, \\ x^4 & \text{в остальных случаях;} \end{cases}$$

16. Given a real number a. Calculate F (a) if

$$f(x)=\begin{cases} 0 & \text{при } x\leqslant 0, \\ x^2-x & \text{при } 0<x\leqslant 1, \\ x^2-\sin \pi x^2 & \text{в остальных случаях.} \end{cases}$$

17. Given a real number a. For functions F (x) whose graphs are given by , compute F (a).



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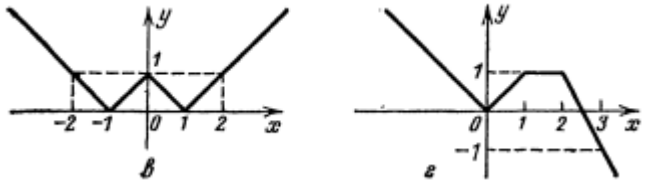
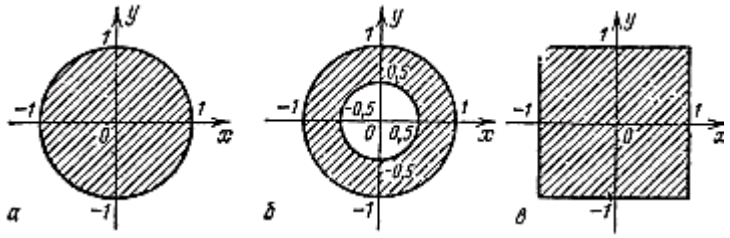


19. Real x and y are given. Determine if a point with x, y coordinates belongs to the shaded part of the plane.



20. Real x and y are given. Determine if a point with x, y coordinates belongs to the shaded part of the plane.