One of the following questions will serve as a problem in quiz 3:

1. What is the definition of $f_x(x, y)$?

2. Formulate the Clairaut Theorem (about mixed derivatives).

3. Write the definition of a differentiable function of two variables.

4. What is the differential of function $f(x, y)$?

5. Given surface $\vec{\mathbf{r}}(u, v)$, what is the normal vector to the tangent plane?

6. What is the equation of the tangent plane to the surface $z = f(x, y)$ at the point $P(x_0, y_0, z_0)$?

7. Given surface $z = f(x, y)$, what is the normal vector to the tangent plane?

8. Write the formula for $\dfrac{df}{dt}$ (Chain rule) for function $f(x, y)$ if $x = x(t)$, $y = y(t)$.

9. Write the formula for $\dfrac{\partial f}{\partial u}$ (Chain rule) for function $f(x, y)$ if $x = x(u, v)$, $y = y(u, v)$.

10. Write the definition of the derivative in the direction of unit vector $\vec{\mathbf{u}} = \langle a, b \rangle$ and the formula connecting the directional derivative and partial derivatives.

11. Write the definition of the gradient vector and the formula connecting the directional derivative and gradient.

12. Formulate the theorem on maximizing the directional derivative.

13. Given surface $F(x, y, z) = k$, write the formula for the tangent plane at point (x_0, y_0, z_0).

14. Given surface $F(x, y, z) = k$, what is the normal vector to the tangent plane?

15. Given function $f(x, y)$, prove that the gradient vector is perpendicular to level curves of f.

16. Formulate the second derivative test for extremum values of function $f(x, y)$.

17. Write the system of equations for the search for extremum values of function $f(x, y, z)$ under constraints $g(x, y, z) = k$ (Lagrange multipliers formula).

18. What is the formula for the volume V of the solid that lies above the region R on the xy coordinate plane and below the surface $z = f(x, y)$ if $f \geq 0$?

19 What is the average value of function $f(x, y)$ defined on a domain R?

20. Formulate the Fubini theorem on rectangle
$R = \{(x, y) |\ a \leq x \leq b,\ c \leq y \leq d\}$.