Quiz # 4
Math 102-Section **06** Calculus II
9 March 2017, Thursday
Instructor: Ali Sinan Sertöz
**Solution Key**

Bilkent University

Your Name: ...............................

Student ID: ...................     Your Department: ...............................

*Show your work in detail. Correct answers without justification are never graded.*

**Q-1)** Find at what points on the surface
$$x^2 + 2y^2 + 3z^2 = 4$$

is the tangent plane parallel to the plane

$$5x + 6y + 3\sqrt{2}z = 2017.$$

(10 points)

**Answer:** The gradient vector $\nabla$ of the surface is perpendicular to the tangent plane and hence $\nabla$ must point in the same direction as a normal to the given plane. A normal to the plane is $(5, 6, 3\sqrt{2})$. Thus we must have

$$\nabla = (2x, 4y, 6z) = \lambda(5, 6, 3\sqrt{2}),$$

for some $\lambda$. To determine $\lambda$, we first note that

$$x = \frac{5}{2}\lambda, \ y = \frac{3}{2}\lambda, \ z = \frac{1}{\sqrt{2}}\lambda.$$

Putting these into the equation of the surface and simplifying we get

$$\lambda = \pm\frac{4}{7}.$$

Thus there are two points on the surface satisfying the required condition. These points are

$$\pm\left(\frac{10}{7}, \frac{6}{7}, \frac{2\sqrt{2}}{7}\right).$$

*(To make sure you can check that these points lie on the surface and that the gradient satisfies the required condition, but this is not required in the quiz.)*