

MATH 32A DISCUSSION

JED YANG

1. INTRODUCTION

Lecture 1

- Instructor: Steve Butler.
- Location: BUNCHE 1209B.

Sections 3C and 3D

- Email: <mailto:jedyang@ucla.edu>.
- Office: MS 6617A.
- Office hours: TR 13:00–13:30.
- Discussion Location: MS 6229.
- Website: <http://www.math.ucla.edu/~jedyang/32a.3.10s/>.
- SMC: Mar. 31–Jun. 3, M–R 10:00–15:00, MS 3974, M 14:00–15:00.

2. ADMINISTRATION

- HW due Fridays in lecture, can turn in early to me, and I will hand back in section.
- Textbook: Stewart, Multivariable Calculus, 6e, 2008.
- Confirm office hour.

3. 3-D COORDINATES

3.1. **Exercise 13.1.8.** Find the lengths of the sides of the triangle PQR , where $P(2, -1, 0)$, $Q(4, 1, 1)$, $R(4, -5, 4)$. Is it a right triangle? Is it an isosceles triangle?

Solution. $|PQ|^2 = 2^2 + 2^2 + 1^2 = 9$, $|QR|^2 = 0^2 + 6^2 + 3^2 = 45$, $|PR|^2 = 2^2 + 4^2 + 4^2 = 36$. Obviously not isosceles, but is right triangle since $9 + 36 = 45$. \square

3.2. **Exercise 13.1.11.** Find an equation of the sphere with centre $(1, -4, 3)$ and radius 5. What is the intersection of this sphere with the xz -plane?

Solution. The equation is $(x - 1)^2 + (y + 4)^2 + (z - 3)^2 = 5^2$. If we set $y = 0$, we get $(x - 1)^2 + (z - 3)^2 = 3^2$, a circle in the xz -plane. \square

3.3. **Exercise 13.1.14.** Find an equation of the sphere that passes through the point $(4, 3, -1)$ and has centre $(3, 8, 1)$.

Solution. We can think of $(x - 3)^2 + (y - 8)^2 + (z - 1)^2 = (4 - 3)^2 + (3 - 8)^2 + (-1 - 1)^2$ as the equation of the sphere on the left and calculating the radius on the right, or plugging the point it ought to pass through to the same equation. \square

3.4. **Exercise 13.1.28.** Describe in words the region of \mathbb{R}^3 represented by the equation $z^2 = 1$.

Solution. Notice $z^2 = 1$ means $z = \pm 1$, so we have two planes parallel to the xy -plane. \square

3.5. Exercise 13.1.38. Consider the points P such that the distance from P to $A(-1, 5, 3)$ is twice the distance from P to $B(6, 2, -2)$. Show that the set of all such points is a sphere, and find its centre and radius.

Solution. We have $|PA| = 2|PB|$, squaring, we get $|PA|^2 = 4|PB|^2$. So we want to simplify $(x+1)^2 + (y-5)^2 + (z-3)^2 = 4[(x-6)^2 + (y-2)^2 + (z+2)^2]$. Expanding and collecting terms, we get $3x^2 - 50x + 3y^2 - 6y + 3z^2 + 22z + 141 = 0$. Dividing by 3 then completing the squares, we get $(x - 25/3)^2 + (y - 1)^2 + (z + 11/3)^2 = 332/9$, a circle of radius $\frac{2}{3}\sqrt{83}$. \square