TAKE-HOME CLASS QUIZ: DUE WEDNESDAY JANUARY 16: THREE DIMENSIONS

MATH 195, SECTION 59 (VIPUL NAIK)

Your name (print clearly in capital letters): ____

THIS IS A TAKE-HOME CLASS QUIZ, BUT I WILL GIVE YOU ABOUT 5 MINUTES TO REVIEW YOUR ANSWERS IN CLASS AND DISCUSS WITH OTHER STUDENTS.

YOU ARE ALLOWED TO DISCUSS ONLY QUESTIONS THAT BEGIN WITH A (*) OR (**). PLEASE ATTEMPT ALL OTHER QUESTIONS BY YOURSELF. EVEN FOR THE QUESTIONS YOU DISCUSS, PLEASE FINALLY ENTER ONLY THE ANSWER OPTION YOU ARE PERSONALLY MOST CONVINCED ABOUT – DON'T ENGAGE IN GROUPTHINK.

(1) (*) Consider the subset of $\mathbb{R}^3$ given by the condition $(x^2 + y^2 - 1)(y^2 + z^2 - 1)(x^2 + z^2 - 1) = 0$. What kind of subset is this? *Last time:* 12/24 *correct*
  (A) It is a sphere centered at the origin and of radius 1.
  (B) It is the union of three circles, each centered at the origin and of radius 1, and lying in the xy-plane, yz-plane, and xz-plane respectively.
  (C) It is the union of three cylinders, each of radius 1, about the x-axis, y-axis, and z-axis respectively.
  (D) It is the intersection of three circles, each centered at the origin and of radius 1, and lying in the xy-plane, yz-plane, and xz-plane respectively.
  (E) It is the intersection of three cylinders, each of radius 1, about the x-axis, y-axis, and z-axis respectively.

  Your answer: ____________________________

(2) Given two distinct points A and B in three-dimensional space, what is the nature of the set of possibilities for a third point C such that AC and BC have equal length (i.e., C is equidistant from A and B)? *Didn't appear last time*
  (A) Sphere
  (B) Plane
  (C) Circle
  (D) Line
  (E) Two points

  Your answer: ____________________________

(3) Given two distinct points A and B in three-dimensional space, what is the nature of the set of possibilities for a third point C such that the triangle ABC is a right triangle with AB as its hypotenuse? *Last time:* 15/24 *correct*
  (A) Sphere (minus two points)
  (B) Plane
  (C) Circle (minus two points)
  (D) Line
  (E) Square

  Your answer: ____________________________

(4) Given two distinct points A and B in three-dimensional space, what is the nature of the set of possibilities for a third point C such that the triangle ABC is a right isosceles triangle with AB as its hypotenuse? *Didn't appear last time.*

(A) Sphere
(B) Plane
(C) Circle
(D) Line
(E) Square

Your answer: ____________________________

(5) Given two distinct points A and B in three-dimensional space, what is the nature of the set of possibilities for a third point C such that the triangle ABC is equilateral? *Last year:* 23/24 *correct.*

(A) Sphere
(B) Plane
(C) Circle
(D) Line
(E) Two points

Your answer: ____________________________

(6) Given two distinct points A and B in three-dimensional space, what is the nature of the set of possibilities for a third point C such that $|AC|/|BC| = \lambda$ for λ a fixed positive real number not equal to 1? *Didn't appear last time.*

(A) Sphere
(B) Plane
(C) Circle
(D) Line
(E) Square

Your answer: ____________________________

(7) Consider the parametric curve in three dimensions given by the coordinate description $t \mapsto (\cos t, \sin t, \cos(2t))$, with $t \in \mathbb{R}$. We can consider the *projections* of this curve onto the xy-plane, yz-plane, and xz-plane, which are basically what we get by dropping perpendiculars from the curve to these planes. What is the correct description of the curves obtained by doing the three projections? *Last time:* 17/24 *correct*

(A) The projections on the xy-plane and yz-plane are both parts of parabolas, and the projection on the xz-plane is a circle.
(B) The projections on the xy-plane and yz-plane are both circles, and the projection on the xz-plane is a part of a parabola.
(C) The projection on the xy-plane is a circle, and the projections on the yz-plane and xz-plane are both parts of parabolas.
(D) The projection on the xy-plane is a part of a parabola, the projection on the xz-plane and yz-plane are both circles.
(E) All the three projections are circles.

Your answer: ____________________________