Section 1: Multiple choice (15 minutes)

1. In three dimensions, what is the set of all points for which x=0?

   (a) the origin
   (b) a line parallel to the axis
   (c) the yz-plane
   (d) a plane containing the x-axis
   (e) the x-axis

2. The intersection of a plane with a right circular cylinder could be which of the following? I. a circle. II. Parallel lines. III. Intersecting lines

   (a) I only
   (b) II only
   (c) II only
   (d) I and II only
   (e) I, II, and III

3. The length of the radius of a circle is one-half the length of an arc of the circle. How large is the central angle that intercepts that arc?

   (a) $60°$
   (b) $120°$
   (c) 1^R
   (d) 2^R
   (e) π^R

4. A cylinder has a base radius of 2 and a height of 9. To the nearest whole number, by how much does the lateral area exceed the sum of the areas of the two bases?

   (a) 101
   (b) 96
   (c) 88
   (d) 81
   (e) 75

5. A sphere is inscribed in a cube. The ratio of the volume of the sphere to the volume of the cube is

   (a) 0.79:1
   (b) 1:2
   (c) 0.52:1
   (d) 1:3.1
   (e) 0.24:1

6. A sphere has a surface area of 36π. Its volume is

   (a) 84
   (b) 113
   (c) 201
   (d) 339
   (e) 905

7. The volume of a right circular cylinder is the same numerical value as its total surface area. Find the smallest integral value for the radius of the cylinder.

   (a) 1
   (b) 2
   (c) 3
   (d) 4
   (e) This value can not be determined.

8. The region in the first quadrant bounded by the line $3x + 2y = 7$ and the coordinate axes is rotated about the x-axis. What is the volume of the resulting solid?

   (a) 8
   (b) 20
   (c) 30
   (d) 90
   (e) 120

9. The distance between two points in space, $(x, -1, -1)$ and $(3, -3, 1)$ is 3. Find the possible values of x.

   (a) 1 or 2
   (b) 2 or 3
   (c) -2 or 3
   (d) 2 or 4
   (e) -2 or -4

Section 2: Free Response (10 minutes)

1. The length, width, and height of a right prism are 9, 4, and 2, respectively. What is the length of the longest segment whose endpoints are vertices of the prism?

2. If the volume of a right circular cone is to be reduced by 15% by reducing its height by 5% , by what percent must the radius of the base be reduced?

3. If the segment of the line y=-2x+2 that lies in quadrant I is rotated about the y-axis, a cone is formed. What is the volume of the cone?