CLASS QUIZ: NOVEMBER 16: VOLUME

MATH 152, SECTION 55 (VIPUL NAIK)

Your name (print clearly in capital letters): ____

(1) Oblique cylinder:Right cylinder:: *Last year:* 14/16 *correct*
   (A) Rectangle:Square
   (B) Parallelogram:Rectangle
   (C) Disk:Circle
   (D) Triangle:Rectangle
   (E) Triangle:Square

   Your answer: ____________________________

(2) Right circular cone:Right circular cylinder:: *Last year:* 13/16 *correct*
   (A) Triangle:Square
   (B) Rectangle:Square
   (C) Isosceles triangle:Equilateral triangle
   (D) Isosceles triangle:Rectangle
   (E) Isosceles triangle:Square

   Your answer: ____________________________

(3) Circular disk:Circle:: *Last year:* 8/16 *correct*
   (A) Hollow cylinder:Solid cylinder
   (B) Solid cylinder:Hollow cylinder
   (C) Cube:Cuboid (cuboid is a term for rectangular prism)
   (D) Cube:Square
   (E) Cube:Sphere

   Your answer: ____________________________

(4) Circular disk:Line segment:: *Last year:* 14/16 *correct*
   (A) Solid sphere:Circular disk
   (B) Circle:Rectangle
   (C) Sphere:Cube
   (D) Cube:Right circular cylinder
   (E) Square:Triangle

   Your answer: ____________________________

(5) Suppose a filled triangle ABC in the plane is revolved about the side AB. Which of the following best describes the solid of revolution thus obtained if both the angles A and B are acute (ignoring issues of boundary inclusion/exclusion)? *Last year:* 13/16 *correct*

(A) It is a right circular cone.
(B) It is the union of two right circular cones sharing a common disk as base.
(C) It is the set difference of two right circular cones sharing a common disk as base.
(D) It is the union of two right circular cones sharing a common vertex.
(E) It is the set difference of two right circular cones sharing a common vertex.

Your answer: ____________________________

(6) Suppose a filled triangle ABC in the plane is revolved about the side AB. Which of the following best describes the solid of revolution thus obtained if the angle A is obtuse (ignoring issues of boundary inclusion/exclusion)? *Last year:* 9/16 *correct*

(A) It is a right circular cone.
(B) It is the union of two right circular cones sharing a common disk as base.
(C) It is the set difference of two right circular cones sharing a common disk as base.
(D) It is the union of two right circular cones sharing a common vertex.
(E) It is the set difference of two right circular cones sharing a common vertex.

Your answer: ____________________________

(7) What is the volume of the solid of revolution obtained by revolving the filled triangle ABC about the side AB, if the length of the base AB is b and the height corresponding to this base is h? *Last year:* 10/16 *correct*

(A) $(1/6)\pi b^{3/2}h^{3/2}$
(B) $(1/3)\pi b^2 h$
(C) $(1/3)\pi b h^2$
(D) $(2/3)\pi b^2 h$
(E) $(2/3)\pi b h^2$

Your answer: ____________________________

For the next two questions, suppose Ω is a region in a plane Π and ℓ is a line on Π such that Ω lies completely on one side of ℓ (in particular, it does not intersect ℓ). Let Γ be the solid of revolution obtained by revolving Ω about ℓ. Suppose further that the intersection of Ω with any line perpendicular to ℓ is either empty or a point or a line segment.

(8) (*) What is the intersection of Γ with Π (your answer should be always true)? *Last year:* 6/16 *correct*

(A) It is precisely Ω.
(B) It is the union of Ω and a translate of Ω along a direction perpendicular to ℓ.
(C) It is the union of Ω and the reflection of Ω about ℓ.
(D) It is either empty or a rectangle whose dimensions depend on Ω.
(E) It is either empty or a circle or an annulus whose inner and outer radius depend on Ω.

Your answer: ____________________________

(9) What is the intersection of Γ with a plane perpendicular to ℓ (your answer should be always true)? *Last year:* 9/16 *correct*

(A) It is precisely Ω.
(B) It is the union of Ω and a translate of Ω along a direction perpendicular to ℓ.
(C) It is the union of Ω and the reflection of Ω about ℓ.
(D) It is either empty or a rectangle whose dimensions depend on Ω.
(E) It is either empty or a circle or an annulus whose inner and outer radius depend on Ω.

Your answer: ____________________________

(10) (*) Consider a fixed equilateral triangle ABC. Now consider, for any point D outside the plane of ABC, the solid tetrahedron $ABCD$. This is the solid bounded by the triangles ABC, BCD, ACD, and ABD. The volume of this solid depends on D. What specific information about D completely determines the volume? *Last year:* 7/16 *correct*

(A) The perpendicular distance from D to the plane of the triangle ABC.
(B) The minimum of the distances from D to points in the filled triangle ABC.
(C) The location of the point E in the plane of triangle ABC that is the foot of the perpendicular from D to ABC.
(D) The distance from D to the center of ABC (here, you can take the center as any of the notions of center since ABC is equilateral).
(E) None of the above.

Your answer: ____________________________

(11) (**) For $r > 0$, consider the region $\Omega_r(a)$ bounded by the x-axis, the curve $y = x^{-r}$, and the lines $x = 1$ and $x = a$ with $a > 1$. Let $V_r(a)$ be the volume of the region obtained by revolving $\Omega_r(a)$ about the x-axis. What is the precise set of values of r for which $\lim_{a\to\infty} V_r(a)$ is finite? *Last year:* 3/16 *correct*

(A) All $r > 0$
(B) $r > 1/2$
(C) $r > 1$
(D) $r > 2$
(E) No value of r

Your answer: ____________________________