Dick Schaff Math Superbowl XLII
Level 3: Geometry Huddle

Directions:
1. Select the most correct answer for each question and mark it on your Scantron™ form.
2. You may use 3.14 for π.
3. N.O.T. stands for "None of These."

Problems 1 – 3 refer to the statement, "If you took part in the math contest, then you visited the planetarium."

1. Which of the following is the inverse of this statement:

a) If you didn't take part in the math contest, then you didn't visit the planetarium.
b) If you visited the planetarium, then you took part in the math contest.
c) If you didn't visit the planetarium, then you didn't take part in the math contest.
d) You took part in the math contest and you didn't visit the planetarium.
e) N.O.T.

2. Which of the following is the contrapositive of this statement:

a) If you didn't take part in the math contest, then you didn't visit the planetarium.
b) If you visited the planetarium, then you took part in the math contest.
c) If you didn't visit the planetarium, then you didn't take part in the math contest.
d) You took part in the math contest and you didn't visit the planetarium.
e) N.O.T.

3. Which of the following is the converse of this statement:

a) If you didn't take part in the math contest, then you didn't visit the planetarium.
b) If you visited the planetarium, then you took part in the math contest.
c) If you didn't visit the planetarium, then you didn't take part in the math contest.
d) You took part in the math contest and you didn't visit the planetarium.
e) N.O.T.

4. A hut is shaped like a circular cylinder with a radius of five feet and a height of eight feet. What is the volume of this hut?

a) 628 sq.ft. b) 628 cu.ft. c) 1004.8 sq.ft. d) 1004.8 cu.ft. e) N.O.T.

5. The hut from problem #4 has a thatched roof shaped like a circular cone with a radius of five feet and a height of three feet. What is the volume of this cone?

a) 78.5 cu.ft. b) 235.5 cu.ft. c) 706.5 cu.ft. d) 863.5 cu.ft. e) N.O.T.

6. A triangle has side lengths 13, 20, and 21. What is the area of this triangle?

a) 126 sq.units b) 130 sq.units c) 136.5 sq.units d) 210 sq.units e) N.O.T.

7. A Mobius strip is made by taking a rectangle of length L units and joining the ends. What is the length of the edge of this Mobius strip?

a) ½ L units b) L units c) 2L units d) 4 L units e) N.O.T.

8. A square is inscribed within a circle. What is the ratio of the area of the square to the area of the circle?

a) 1 : 3.14 b) 2 : 3.14 c) 3 : 3.14 d) 5 : 6.28 e) N.O.T.

9. Consider the statement "not-A or not-B." What is the negation of this statement?

a) A or B b) A and B c) If A then B d) A iff B e) N.O.T.

10. A triangle has interior angles that measure 2x degrees, 3x degrees, and 5x degrees. What is the measure of the largest of these three angles?

a) 18° b) 36° c) 50^{0} d) 100^{0} e) N.O.T.

11. Let A and B be the endpoints of the diameter of a circle, and C be a third point on that circle. What is the measure of angle ACB?

a) $< 90^{\circ}$ b) 90° c) $> 90^{\circ}$ d) Any of these e) N.O.T.

12. Let A → B, B → C, and C → D. If D is true, what else MUST be true?

a) A b) B c) C d) All of these e) N.O.T.

13. Let angle A and angle B be complements, and let angle B and angle C be supplements. Which of the following MUST be true?

a) Angle A and angle C are complements.
b) Angle A and angle C are supplements.
c) The measure of angle A is 90° more than the measure of angle C.
d) The measure of angle C is 90° more than the measure of angle A.
e) N.O.T.

14. An annulus is the ring-shaped area between two concentric circles.
An annulus has an inner radius of 5 mm and an outer radius of 15 mm. What is the area of this annulus?

a) 31.4 mm^2 b) 314 mm^2 c) 628 mm^2 d) 785 mm^2 e) N.O.T.

15. A coin is a shaped like a thin disk with a circular hole cut out of the center. The coin is 2 mm thick, with a diameter of 30 mm. The hole in the center has a diameter of 10 mm. What is the volume of this coin?

a) 1256 mm^3 b) 1413 mm^3 c) 1570 mm^3 d) 5024 mm^3 e) N.O.T.

16. Consider triangle ABC. Let D be the midpoint of AB and let E be the midpoint of AC. Which of the following must be true?

a) Triangle ADE is congruent to triangle ABC.
b) Triangle ADE has one half of the area of triangle ABC.
c) Triangle ADE has one third of the area of triangle ABC.
d) Triangle ADE has one fourth of the perimeter of triangle ABC.
e) N.O.T.

17. Consider triangle ABC. Let D be the midpoint of AB and let E be the midpoint of AC. Find the ratio of the area of triangle ADE to trapezoid BDEC.

a) 1:1 b) 1:2 c) 1:3 d) 1:4 e) N.O.T.

18. What is the sum of the measures of the interior angles of a 2015-sided polygon?

a) 180° b) 2015° c) 362,340° d) 362,700° e) N.O.T.

19. Apples are piled in a tetrahedral pyramid. The top layer has one apple, the next layer down has three apples, they layer below that has six apples, and so on. The pile has ten layers. How many apples are in this pile?

a) 55 b) 220 c) 230 d) 250 e) N.O.T.

20. How many vertices (corners) does a regular octahedron have?

a) 4 b) 6 c) 8 d) 12 e) N.O.T.

21. A bag of bark mulch covers 500 square feet. How many full bags would you need to buy to completely cover a rectangular plot of land 60 feet long and 40 feet wide?

a) 4 b) 5 c) 6 d) 48 e) N.O.T.

22. A rectangular solid has edge lengths 3, 4, and 12. What is the distance between opposite corners?

a) 14 b) 15 c) 17 d) 21 e) N.O.T.

23. Let A, B, and C be three distinct, non-collinear points. Which of the following MUST be true?

a) The measure of angle ABC is greater than the measure of angle ACB.
b) The length of line segment AB is greater than the length of line segment BC.
c) The measure of angle ABC is less than the sum of the measures of angles ACB and BAC.
d) The length of line segment AB is less than the sum of the lengths of line segments AC and BC.
e) N.O.T.

24. Let A, B, and C be three distinct points. Which of the following MAY be true?

a) The measure of angle ABC is twice the measure of angle ACB.
b) The length of line segment AB is twice the length of line segment BC.
c) The length of line segment AB is equal to the sum of the lengths of line segments AC and BC.
d) All of these.
e) N.O.T.

25. Let A → B. If A or C is true, what else MUST be true?

a) B and C b) B or C c) B → C d) not-B e) N.O.T.

26. Let circle A have radius length a, and let circle B have radius length b. Circles A and B touch exactly once. Which of the following CAN NOT be the distance between the centers of circles A and B?

a) 0 b) $a - b$ c) $a + b$ d) $2a$ e) N.O.T.

27. What is the measure of an interior angle of a regular dodecagon?

a) 144° b) 150° c) 180° d) 1800° e) N.O.T.

28. A gigantic space station is built in the shape of a hemisphere with a radius of 6 km (they could only afford to build half of it). What is the volume of this station?

a) 1.1304×10^{11} m^3
b) 2.2608×10^{11} m^3
c) 4.5216×10^{11} m^3
d) 9.0432×10^{11} m^3
e) N.O.T.