1. The vertical distance from Little Mermaid’s head to the top of the castle is

feet. The horizontal distance is 5 feet, so by Pythagorean Theorem, the distance from the top of the castle to the top of Little Mermaid’s head is = 41 feet. **A**

2. Since the ratio of density to volume is 3 to 1, the beard’s volume is = 18. Using the formula for volume of a cone, = 18, and plugging in , solving for height gives **B**

3. Let = the age of the Little Mermaid (the youngest daughter) in years. Since she was born five years after her youngest sister, the age of her youngest sister is . The age of her other sisters are .

. **E**

4. Volume of each pearl = = 36

. **B**

5. The area bound by the four circles is the area of the square formed by connecting

their centers subtracted by the area of four quarter circles.

- (4)= 64 - 16 square feet. From this, a = 64 and b = -16.

**D**

6. The volume of the frustum is the difference in the volumes of two rectangular pyramids. By similar triangles, the height of the entire pyramid is 24 feet, and the width of the smaller base is 12 feet. The volume of a pyramid is ((where *b* represents the area of its base, so the volume of the frustum is

(( -((= 3648 cubic feet. 75% 3648 cubic feet = 2736 cubic feet. The ship submerges after 1/3 of 2736 = 912 cubic feet is filled with water. **A**

7. Let x and y represent the legs of the right triangle, and z represent the hypotenuse. and z=20, so . By the Pythagorean theorem, . Squaring 8 gives Subtracting gives , but we are looking for , the area of the triangle. Dividing by four yields 96. **B**

8. Let *h* = the height of the tree after struck by lightning. The tree forms a right triangle with the ground with legs of *h* feet and 15 feet, and a hypotenuse of length 75 – *h* feet. Using Pythagorean, = . Solving for *h* yields 36 feet. **C**

9. The top face should not be counted, so **C**

10. Volume = **A**

11. Measure of interior angle = = = 140 degrees. **B**

12. An icosahedron consists of 20 triangular faces. There are 20 / 2 = 30 edges since the sides of each triangle were all counted twice.

By Euler’s, edges. **D**

13. Euler’s line contains all of the following points except the incenter. **D**

14. This is simply the converse of the statement - **C**

15. 6x + 12x – 18 = 180. x =11 degrees. The smaller angle is 66 degrees. The supplement of the complement of 66 is (180-(90-66)) = 156 degrees. **A**

16. **D**

17. The rotation forms two cones, each with radius and height 3. Volume = (2)(3) = 54. **B**

18. Formula for volume of tetrahedron: .

= cubic inches. **A**

19. Let *x* = the length shortened the fold on the side with length 11. By inspection, the triangle on top is a right triangle with legs of length *x* and 8, and hypotenuse of length . By Pythagorean,

The base of the shaded triangle is , and its height is simply 8. The area of the shaded region is

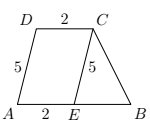
. **C**

20. The radius of the semicircle is 2, so the height of the rectangle is 9 – 2 = 7. The area of the figure is 7 = 28 + 2square inches. and, so . **C**

21) The figure consists of two cylinders, one with a diameter 2 cm and height of 2 cm and another with diameter 6 cm and height of 9 cm. By superimposing the base of the smaller cylinder onto the base of the larger cylinder, the “hole” of the larger cylinder is filled. Hence the surface area is simply the surface area of the larger cylinder added by the lateral area of the smaller cylinder. **B**

22. Applying Law of Cosines, we have . . **D**

23. Let E be the point on AB so that CE is parallel to AD.



Since AE is parallel to CD, quadrilateral AECD is a parallelogram. Hence, AE = CD = 2 and CE = AD = 5. Also, ∠AEC = ∠ADC = 2∠B. Since ∠AEC is exterior to triangle BCE, ∠BCE = ∠AEC − ∠CBE = 2∠B − ∠B = ∠B. Therefore, triangle BCE is isosceles, and BE = CE = 5, so AB = AE + BE = 2 + 5 = 7. **A**

24. and , hence . We see is a right triangle with leg lengths 3 and 4 and a hypotenuse of 5. . . **A**

25. The only regular polygons that tessellate with each other are squares, triangles, and hexagons. Hexagons have the most sides (6) **B**

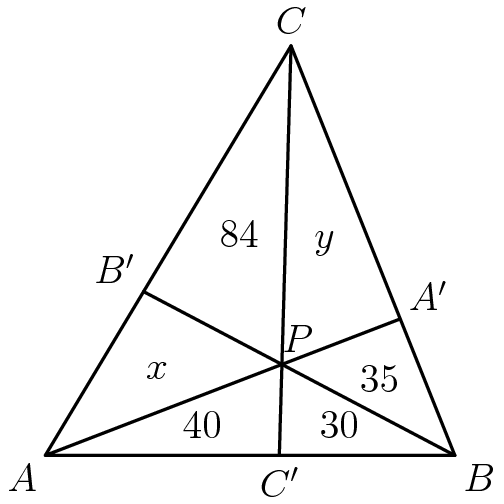
26. Common external tangent: =

Common internal tangent: = . Adding the two together yields + . **A**

27. Let *a*, *b*, and *c* denote the radii of circle A, B, and C, respectively.

Adding these three equations yields , .

Subtracting yields *b* = 5. The diameter is two times the radius = 10. **C**

28. (D) *ACC’ and* share an altitude, so

This simplifies to

also share a common altitude, so

. This simplifies to

Solving these system of equations yields

, so the area of

= 315 **D**

29. The answer choices consist of 4 of 5 of Euclid’s Postulates. All of these are true. **E**

30. By Ptolemy’s Theorem,

**C**