1. **B**. There are 7 hexagonal numbers between 000-100: 1, 6, 15, 28, 45, 66, 91.
2. **D**. There are 7 possible triangles. (6,6,6), (5,5,8), (5,6,7), (4,6,8), (4,7,7), (3,7,8), (2,8,8).
3. **B**. This is the definition of a circumradius.
4. **D**. The formula to solve for the circumradius is abc/4A. a=51 yds, b=24 yds, c=45 yds. Circumradius is 25.5 yds = 76.5 ft.
5. **B**. 5 mph = 26400 ft/hr = 440 ft/min = 22/3 ft/sec. In 309/44 sec, they all travel (309/44)\*(22/3) = 103/2 ft. The circumradius then becomes 153/2 – 103/2 =25 ft. Area of the circle = 625pi sqft.
6. **C**. The smallest distance forms two similar triangles with the side length 5 corresponding to the side length 30. Since the horizontal difference of the points is 28, we have the systems of equations x+y = 28, x/5=y/30. x = 4, y = 24. Using the pythagorean theorem, the hypotenuse of the two triangles is sqrt41 and 6sqrt41, total distance = 7sqrt41.
7. **B**. The area of the 4 semicircles is 8π, one semicircle is 2π, diameter is 4. Using pythagorean theorem, AD = 2sqrt7, and AB = 10sqrt7 - 3. Using pythagorean theorem, EB = sqrt707
8. **C**. Use angle bisector theorem. x + y = 14, x/20 = y/8. x = 10, y = 4. 10\*4 = 40.
9. **D**. Forms a right triangle with side lengths 5sqrt3 and 10, angle of tan(5sqrt3/10) = 30**°** and using pythagorean theorem distance is 10sqrt3
10. **C**. Guess and check each answer, and by using Heron’s formula, see that only 37 works as the missing side length.
11. **D**. The orthocenter is the point of concurrency of the three perpendicular bisectors of a triangle.
12. **A**. Shaggy starts moving at 12:00AM, so between 12:00AM and 12:02AM, he runs for two minutes or 120 seconds for 20 feet per second. That means (120\*20) is 2400 feet that he has run North. Divide by 3 to get the number of yards he ran North by 12:02AM (800 yards). Scooby starts running East 1 minute and thirty seconds after midnight (which means he starts running at 12:01:30), so he only runs for thirty seconds at 40 feet per second by 12:02AM. That means he travels (30\*40) gives 1200 feet. Again dividing by three, we get 400 yards. Since Shaggy was running North and Scooby was running East from the same point, a right triangle is formed by Scooby’s path, Shaggy’s path, and an imaginary line that you make that connects Shaggy and Scooby’s location at 12:02. The length of that line in yards is the answer to this problem. Use Pythagorean theorem to get the answer of sqrt800000, which simplifies to A. 400sqrt5 yards.
13. **D**. Use Euler’s formula: F + V – E = 2. F + 20 -30 = 2. F= 12. The polyhedron with 12 faces, as the prefix dodeca- implies, is the dodecahedron.
14. **C**. The length of the median to the hypotenuse on any right triangle is equal to half the length of the hypotenuse so the answer is (13/2) or 6.5.
15. **B**. Volume of a cone: V = 1/3(pir^2)(h). Volume drained: 1/3(pi(6)^2)(18) - 1/3(pi(1)^2)(3) = 215pi cm^3. Drains at 5 cm^3/min. 215pi/5 = 43pi mins = 43/60pi hrs.
16. **C**. Shoelace theorem.
17. **D**. Draw a chord of length 4. Imagine putting you pencil on its midpoint and sliding the chord around the circle. Your pencil will draw a circle.
18. **C**. First you need to use the formula for the number of diagonals of a n-gon. That formula is ((n(n-3))/2. If you use that formula on a nonagon, which has 9 sides, you get 27 diagonals. Next, find x, which is 59+(the sixth triangular number). The sixth triangular number can be found using the formula n(n+1)/2. 6(6+1)/2 gives us the sixth triangular number: 21. Adding 21+59 gives us x, or angle B, which is 80°. Since a triangle has total 180°, to find the number of degrees of angle C, you need to subtract: 180°-51°-80°= 49°. Angle C is 49°, so its complementary angle is 41° since they add up to 90°. Now subtract 27 from 41 to get 14. The 14th letter of the alphabet is N. Neha stole the Smarties!
19. **E**. The formula for the area of an equilateral triangle is (s2(sqrt3))/4. If you set that equal to 4sqrt3, then s, the side length of one side, will equal 4, which is none of the choices, so you choose NOTA.
20. **A**. Use the formula distance = (sqrt((X2– X1)2+ (Y2– Y1)2+ (Z2– Z1)2)). The answer is 13, the amount of books in Euclid’s Elements.
21. **E**. The answer is 352, using the formula (½(s2 + s + 2)), where s is the number of chords.
22. **D**. The formula for the area of a regular hexagon with side legnth a is [3(a2)sqrt(3)]/2. Equate it to 840, solve for side length, and multiply by 60.
23. **A**. Use the angle bisector theorem, dividing the down side to 7-x and x, and solving for x. Then find AD.
24. **E.** Triangle BCD is not necessarily an equilateral triangle. There is not enough information to calculate the area of the sector. A is not necessarily the center of the circle.
25. **B**. Given statement (if p then q) Only the contrapositive: (~q ~p) must be true. The converse: (q p) and inverse: (~p ~q) are not necessarily true.
26. **D**. The area of an ellipse is Radius1×radius2×π. The big ellipse is 5×4×π = 20π. The small ellipse is 2.5×2×π = 5π. The area in between is 20π - 5π = **15π**
27. **C**. Heron’s Formula sqrt((s)(s-a)(s-b)(s-c)) = sqrt(1575/16) simplifies to **15sqrt(7)/4**
28. **B**. The side opposite of the largest angle is the largest side. Since triangle ABD longest side is the same as the shortest length BDC, BDC is the larger triangle. The largest side in BDC is **BC**.
29. **C**. GHC = 153. Supplement = 180**°**-153**°** = 27**°**. Complement = 90-27 = 63°
30. **B**. Exterior angle = supplement of interior. The sum of all the exterior angles of any regular polygon is 360. Exterior angle of a decagon (10 sided) is 360**°**/10 = 36**°**. The complement of 36**°** = 90**°**-36**°** = **54°**