1. This corresponds to the equations $20y - 8 + x + 2y = 180$ and $20y - 8 = 2x$, which produces the solution $y = 6$ and $x = 56$ **D**

2. The area of the shaded region is $3^2*\pi = 9\pi$. The area of the whole circle is 144π, so the probability is $9\pi/144\pi = 1/16$. **B**

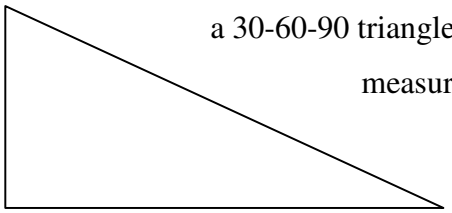
3. Angle EBC is a 90º angle bisected twice, so it is 22.5º. θ is the supplement of angle CEB. Since CEB + θ and CEB + EBC + ECB are both = 180º, then θ = EBC + ECB = 112.5º. **A**

4. The area of Pac-Man's missing sector is $¼(10^2)\pi = 25\pi$, approximately 78. To find the area of the segment, we subtract the triangle formed by a chord across his mouth, as it were. That triangle has a right angle (the central angle) and two legs with length 10, so it's area is ½(10)(10) = 50. The area of the segment is therefore $25\pi - 50$, which is approximately 28. 28 goes into 78 twice, so the answer is 2 segments. **A**

5. The best way to visualize this is to have a circle, with each of its infinitely many diameters representing the lines. If each diameter is raised above the plane of the circle, and each is raised a different height, then there are infinitely many lines in a space, no two of which are coplanar. **D**

6. Split into two identical right triangles, the area is 2(1/2)(8)(12) = 96 units **A**

7. For the lens to be 14 inches off the ground, the bottom of the camera is at a height of 12 inches. A right triangle is formed, like below, with height 12 inches and hypotenuse 24 inches. This is a 30-60-90 triangle, therefore the top angle, which is across from the longer leg, measures 60 degrees, and that is how far the leg is pulled out. **C**



8. Since AB is tangent, OB forms a right angle with AB. OB is a radius, with length 4. With that length and the given length of the other leg, $4\sqrt{3}$, use pythagorean theorem to find the hypotenuse AO has length 8. The only choices which are valid are I, III **B**

9. A heptadecagon has 17 sides. 17(14) / 2 = 119 **B**

10. The volume of the pyramid is $(1/3)(750^2)(450) = 84{,}375{,}000$ or approximately 85 million cubic feet. Since it is made of 10 million cubes, each cube has a volume of approximately 8.5 cubic feet. $2^3 = 8$, therefore to the closest foot the rocks are 2 feet tall. **B**

11. This problem is best done using the Shoelace Theorem, but first the points must be re-written in order: (0,8) (3,8) (5,-1) (1,1). The Shoelace Theorem gives the answer 53/2.

    Shoelace theorem is used as follows (once the points are in order):

    0 8

    3 8

    5 -1

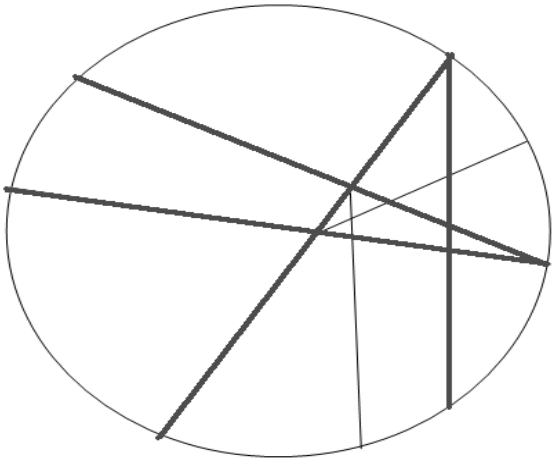
    1 1

    0 8

    multiplying across the diagonals (if you draw them, it looks kinda like shoelaces, hence the name) we add: the top-left-to-bottom-right diagonal products sum to 10, the other set of diagonals sums to 63. The area is half the absolute value of the difference of these terms, so 53/2. **D**

    Alternatively, the quadrilateral can be broken up into two triangles, such as (0,8) (3,8) (1,1) and (3,8) (1,1) (5,-1). In that case, the triangles have areas 21/2 and 16 respectively. Still **D**

12. **A** can be true, though it does not have to be. **C** is equivalent to **A** in this case. **D** is true of all convex polygons. **B** can be true, looks similar to a regular pentagon but with two sides pushed inwards. **E**

13.  The 4 lines in this figure in bold red are chords. **D**

14. Harvey's wheel has radius $20/\pi$ cm, so the circumference is 40cm. If Harvey runs at 720 rungs per minutes, since there are 36 rungs on the wheel this is equivalent to 20 circumferences, =

800cm/minute. 800/60=40/3 cm/second. **B**

15. **C**, the Pythagorean Theorem. The squares on each side of the triangle represent the sides 3, 4 and 5 units each being squared, and one can count that $3^2+4^2 = 5^2$

16. The distance between the two points is $\sqrt{((11-8)^2 + (2+4)^2)} = \sqrt{(9+36)} = \sqrt{45}$. Since area = πr^2, the area of this circle is 45π. **C**

17. Radius of $4/\pi$ feet means that circumference is 8 feet. When the barrel is rolled 18 feet, 18/8 = 2 ¼ rotations. The marking on the barrel had started on the ground, and is now ¼ of the way around, so it is on the diameter parallel to the ground. The marking is at the same height as the center of the circle, so it is one radius = $4/\pi$ feet above the ground. **B**

18. Angles A and B must be supplementary, and the same with angles D and J, and F and H. Angles B and C could be supplementary if they are both right angles; they are necessarily congruent but are not necessarily supplementary. **D**

19. By Brahmagupta's Theorem, $A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$, where s is the semiperimeter and a,b,c,d are the sides. Therefore, $A = \sqrt{(13-9)(13-4)(13-7)(13-6)} = \sqrt{9*4*6*7} = 6\sqrt{42}$ **D**

20. The circumcenter is the center of the circle which is circumscribed around the triangle; that is, a circle on which each vertex of the triangle lies. **C**

21. ABC is a 30-60-90 triangle, with angle C being 30°. Since we know this, and that BD forms a right angle with AC, we know that BCD is also a 30-60-90 triangle. BC has a length of $8\sqrt{3}$, so by the 30-60-90 shortcut we can find the lengths of the other two sides. BD = $4\sqrt{3}$, and DC = 12. Area = ½(base)(height) = $½(4\sqrt{3})(12) = 24\sqrt{3}$ **B**

22. By Power of a Point (or Two Chord Power Theorem): 4*3 = 6*s, therefore s = 2 **B**

23. The most efficient way to pack the smaller circles into the larger is to place one in the center and six more around it, so that each of the six is externally tangent to three other small circles (including the central one) and internally tangent to the large circle. With a total of seven small circles, the area covered by small circles is $7(5^2)\pi = 175\pi$. The area of the large circle is $15^2\pi = 225\pi$. $175\pi/225\pi = 7/9$, which is approximately 77%. Since the questions asks for percent not covered by a small circle, the answer is 22%. **A**

24. A Pythagorean Triple is a set of integers (a,b,c) such that the sum of the squares of two of the integers equals the squares of the third. A Primitive Pythagorean Triple is a Pythagorean Triple in which no two members of the set share a common factor. By these rules, the Primitive Pythagorean Triples among these choices are: (5,12,13) (9,40,41) (61,60,11) (4,3,5) and (u^2-v^2,

u^2+v^2, 2uv). **C**

25. The small side of the triangle is 1 unit. Since we know the hexagon is regular, each of it's angles is 120°. The lower right angle of the triangle is a supplement to an interior angle of the hexagon, so its measure is 60° and the triangle is 30-60-90. This tells us that the hypotenuse of the triangle, and therefore the side of the hexagon, 2 units. A regular hexagon is 6 equilateral triangles, so the area is = $6(2^2\sqrt{3})/4 = 6\sqrt{3}$. $\sqrt{3}$ = approximately 1.7, so the area is about 10.2 **B**

26. A ray is formed from the point of tangency to point A, or to point B. An annulus is the area between the two concentric circles. There are two right triangles; the right angles of these triangles are shown by the intersection of a radius and a tangent line. There is no trapezoid in the figure. **B**

27. A quadrilateral which is both rhombus and kite is called a lozenge. All rectangles are examples of cyclic quadrilaterals. If a quadrilateral has an angle measuring 183° then it is concave; the question did not specify that WXYZ was a convex quadrilateral, so this is acceptable. By definition, trapezoids have *exactly one* pair of parallel sides, and rectangles have *exactly two* pairs of parallel sides, therefore a quadrilateral cannot be both. **D**

28. Circumference of 18π means that diameter is 18, so radius is 9. Surface area of a sphere is = $4\pi r^2$ = 324π. 75% covered by water means that 25% is land, so 25% of $324\pi = 81\pi$ will be painted green. **C**

29. We can determine that the height of the vertical walls is 25 feet because the width is 30ft, implying that the radius of the semicircles is 15ft, and for the total height to be 40ft then the vertical part must be 25ft. There are 6 sections of the barn to be painted red: the broad sides are 25ft x 100ft each, the front and back are 30ft x 25ft each, each with a 15ft radius semicircle above. There is one part painted grey: the roof is a curved rectangle 100ft long and 15π ft wide. Using 3.14 for π, the grey area is approximately 4710 ft^2. The red area is $2(25)(100) + 2(25)(30) + 2(\frac{1}{2})(15^2\pi) = 6500 + 225\pi$; again using 3.14 the area to be painted red is approximately 7206 ft^2. Since each gallon covers 600 ft^2 and Aneesh must buy enough paint, he will need 8 gallons of grey and 13 gallons of red (just barely needing the 13th gallon). He will spend 13($4.08) = $52.04 on red paint, and 8($3.44) = $27.52 on grey paint. His total is $79.56, so assuming he pays exact change he needs only 1 penny. **B**

30. Theo's tank has a total volume of $(1/3)(24)(12^2)\pi = 1152\pi$ cm^3. Currently, there is $(1/3)(18)(9^2)\pi = 486\pi$ cm^3, so the space remaining for ice is $1152-486 = 666\pi cm^3$. Each "ice cube" is a sphere with radius 3/2 cm, volume = $(4/3)(3/2)^3\pi = 9\pi/2$ cm^3. 666π divided by the volume of each ice = 148, so to the nearest 10 is 150. **C**