1. **A.** Since b buildings can be constructed in c minutes, one building can be constructed in $\frac{c}{b}$ minutes. Thus, d buildings can be constructed in $\frac{dc}{b}$ minutes.

2. **B.** The closest and farthest points from the sun (focus), as well as the sun itself, lie on a line. This line is the major axis of the ellipse, and has length 260 + 140=400. Additionally, the eccentricity is given as 0.28 which equals $\frac{7}{25}$. Since $\frac{c}{a} = \frac{7}{25}$ and a=200, $c = 56$. Then, using $a^2 = b^2 + c^2$, $200^2 = b^2 + 56^2$. Recognizing the 7-24-25 triple (or subtracting) yields b as 192. Since the question asks for the length of the entire minor axis, 2b, the answer is 384.

3. **D.** Let r be the radius of the original circle. The circumference of the original circle is $2\pi r$. Once folded, the circumference is πr. The second fold gives a circumference of $\frac{\pi r}{2}$. However, since a flap is opened (thus doubling the circumference), the cone shape has a circumference of πr. This means that the radius of the cone is $\frac{r}{2}$. Additionally, the slant height of the cone is equal to the original radius. Thus, a right triangle is formed with hypotenuse r and one leg length $\frac{r}{2}$. This is a 30-60-90 right triangle, and half the bottom angle is then 30, making θ = 60.

4. **B.** If the gambler wins, he has $\frac{3}{2}$ of his previous amount. If he loses, he has $\frac{1}{2}$ of his previous amount. Since he won and lost the same amount of times, his amount of money, M, is modeled by $M = x\left(\frac{3}{2}\right)^n\left(\frac{1}{2}\right)^n = x\left(\frac{3}{4}\right)^n$. Since $\frac{3}{4} < 1$, the gambler lost money.

5. **B.** Let x, the total amount of M&M's, equal $50 + 10k$, where k is a nonnegative integer. Then the number of blue M&M's is $45 + 7k$. Since at least 80% of the M&M's must be blue, $\frac{45+7k}{50+10k} \geq \frac{8}{10}$. Cross multiplying and simplification yields $5 \geq k$. Since the question asks for the maximum, plug in five to yield 50+(10)(5)=100.

6. **E. (40)** The constant 10 can be ignored until the end. Thus, the sum is $\frac{2}{2} + \frac{4}{4} + \frac{6}{8} + \frac{8}{16}$.... Call this S. Consider another sum, 2S, which is $2 + \frac{4}{2} + \frac{6}{4} + \cdots$. Subtract these two sums:$2S - S = 2 + \left(\frac{4}{2} - \frac{2}{2}\right) + \left(\frac{6}{4} - \frac{4}{4}\right)$.... This becomes $S = 2 + 1 + \frac{1}{2}$.... This is an infinite geometric series, so the sum is $\frac{2}{1-.5} = 4$. Multiply by the 10 to yield 40.

7. **C.** Use the half-life equation $A = A_o\left(\frac{1}{2}\right)^{\frac{t}{h}}$ and thus $\frac{1}{1000} = \left(\frac{1}{2}\right)^{\frac{t}{7.1\,x\,10^8}}$. Since we are looking for an approx. value, we can say $\frac{1}{1000} = 2^{-10}$, so $2^{-10} = 2^{-\frac{t}{7.1\,x\,10^8}}$. And, $10 = \frac{t}{7.1\,x\,10^8}$ and $t = 7.1\,x\,10^9$

8. **C.** The positions at the table are indistinguishable, so take one of the teachers, say the male one, to start. The female teacher then has two choices for her position, to the left or to the right of the male teacher. Next, a male student must sit next to the female teacher, and there are 4 ways to do this. A female student must sit next to this male student, and there are 4 choices for this as well. Continuing around the table leaves 3 choices for a male, 3 choices for a female, 2 choices for a male, 2 choices for a female, and the last positions will only have one choice. Thus, the total number of choices is 2 x 4 x 4 x 3 x 3 x 2 x 2 x 1 x 1= 1152.

9. **C.** Total permutations = $\frac{9!}{2!2!}$. Treat U and I as one letter, UI. Since this could also be IU, we have to remember to multiply by 2. Thus, the permutations with UI/IU as one letter are $\frac{8!}{2!2!} \cdot 2$. Divide to yield $\frac{8!}{2!2!} \cdot 2 \cdot \frac{2!2!}{9!} = \frac{2}{9}$.

10. **B.** Using the given equation, it is easy to see that the desired answer is a form of $10^{-5.7}$. This can be separated into $10^{-6} * 10^{.3}$. With the knowledge that $\log_{10} 2 = .3$ (approximated), $10^{.3} = 2$ so our expression becomes $2\ x\ 10^{-6}$.

11. **C.** The problem reveals that Newton's equation is $F = k\frac{m_1 m_2}{D^2}$. Since the force is quartered but the masses remain the same, $\frac{F}{4} = k\frac{m_1 m_2}{{D_2}^2}$. Dividing the two equations gives $4 = \frac{{D_2}^2}{D^2}$ and $D_2 = 2D$.

12. **E.** Since the balls are stacked on top of each other, the height of the cylinder is equal to the sum of the 3 diameters, or 6r. Thus, $A_{cylinder} = \pi(r^2)(6r) = 6\pi r^3$. The sum of the areas of the three spheres is $A_{spheres} = 3\left(\frac{4}{3}\right)\pi r^3 = 4\pi r^3$. The spheres take up $\frac{4\pi r^3}{6\pi r^3} = \frac{2}{3}$ of the sphere, so $\frac{1}{3}$ empty.

13. **B.** Let n be the number of minutes past 3:15 needed in order for the hands of a clock to first make a right angle. Since each hourly section of the clock is 30 degrees, 15+n minutes past the third hour the hour hand forms an angle of $3 * 30 + \frac{n+15}{60} * 30$ degrees with the vertical. Since each minute section of the clock is 6 degrees, the minute hand forms an angle of $(15 + n) * 6$ degrees with the vertical. Subtracting the two gives the angle formed by the two hands $(15 + n) * 6 - \left(3 * 30 + \frac{n+15}{60} * 30\right) = \frac{11}{2}n - \frac{15}{2}$. This value equals 90 degrees so $n = \frac{195}{11}$

14. **B.** Assume there are 100 people in the audience. 20 people heard 60 minutes of the talk, for a total of 120 minutes. 10 people heard 0 minutes. 35 people heard 20 minutes, for a total of 700 minutes. 35 people heard 40 minutes, for a total of 1400 minutes. Altogether, there were 3300 minutes heard among 100 people, for an average of 33 minutes.

15. **C**. Let y = the amount of pure acid added. Then, $x\left(\frac{x}{100}\right) + y = (x + y)\left(\frac{2x}{100}\right)$. Thus, $x^2 + 100y = 2x^2 + 2xy$ and $x^2 = y(100 - 2x)$ so $y = \frac{x^2}{100-2x}$

16. **D.** Consider Brother #1. In order for him to have 5 brothers, there must be a total of 6 brothers in the family. Consider Sister #1. In order for her to have 6 sisters, there must be a total of 7 sisters in the family. 7+6=13

17. **D.** The last four digits $GHIJ$ are either 9753 or 7531, and the other odd digit (1 or 9) must be $A, B,$ or C. Since $A + B + C = 9$, that digit must be 1. Thus the sum of the two even digits in ABC is 8. DEF must be 864, 642, or 420, which respectively leaves the pairs 2 and 0, 8 and 0, or 8 and 6 as the two even digits in ABC. Only 8 and 0 has sum 8, making ABC 810 and A=8.

18. **C.** There are eight possible head/tail combinations. Only one of these is three heads, and only one is three tails. Thus, the probability of three heads is .125, and the probability of three tails is .125. The probability of another outcome is .75. Note that the question says net profit – the five dollars to play must be subtracted from all winnings. The expected winnings for one game are thus (10)(.125)+(5)(.125)+(-5)(.75) = -1.875. For two games this is -3.75.

19. **D.** In 1994, if Walter is x years old then his grandmother is $2x$ old. Call Walter's date of birth $1994 - x$ and his grandmother's date of birth $1994 - 2x$. Thus, $3988 - 3x = 3838$ and $x = 50$. Thus, in 1999 he will be 55.

20. **B.** Let r and b be the numbers of red and blue marbles respectively originally in the bag. After 1 red marble is removed, there are $r + b - 1$ marbles left in the bag and $r - 1$ red marbles left. So, $\frac{r-1}{r+b-1} = \frac{1}{7}$. When two blue marbles are removed, there are r red marbles and $r+b - 2$ total marbles left in the bag. So, $\frac{r}{r+b-2} = \frac{1}{5}$. Cross multiplying for each yields $7r - 6 = r + b$ and $5r + 2 = r + b$. Equate each expression to get $7r - 6 = 5r + 2$ and $r = 4$ so $b = 18$ and $r + b = 22$.

21. **D.** Let a, b, and c denote the three numbers and assume $a \le b \le c$. Then $(a + b + c)/3 = 10 + a = c - 15$. The number b is the median, which is 5. Therefore, $a + c + 5 = 30 + 3a$ and $a + c + 5 = 3c - 45$. Thus $2a - c = -25$ and $2c - a = 50$. Solving simultaneously for a and c, we get $a = 0$ and $c = 25$. Therefore $a + b + c = 30$.

22. **C.** Each decade of numbers 0, 1, 2, 3, . . . , 99; 100, 102, . . . , 199; . . . 900, 902, . . . 999, except the 300 – 399 decade has exactly 20-3s. The number of 3 printed on the pages 300 to 399 is 120. Adding these groups of 20, we see that a 700 page book would have 240 copies of the digit 3 printed. Removing the last three 3s means the book could not have the pages 693, 683, or 673. So the largest number of pages it could have is 672.

23. **D**. The first few facts can be interpreted as saying $n = 4i + 1$, $n = 5j + 1$ and $n = 6k + 1$, where i, j and k are integers. This means that $n - 1$ must be a multiple of 4, 5, and 6. Thus $n - 1 = 60m$ for some integer m. But n is a multiple of 7 also. Dividing each of 61, 121, 181, 241, 301 by 7, we finally find that 301 is a multiple of 7.

24. **A**. The terms of the arith. progression are 9, 9+d, and 9+2d for some real number d. The terms of the geom. progression are 9, 11 + d, and 29 + 2d. Therefore (11 + d) 2 = 9(29 + 2d) so d 2 + 4d – 140 = 0. Thus d = 10 or d = –14. The corresponding geom. progressions are 9, 21, 49 and 9, –3, 1, so the smallest possible value for the third term of the geom. progression is 1.

25. **C.** Two colors will be used twice each and the others will be used once each. There are 10 ways to make this choice. Note that the color in the center disk can be used only once. Choose one of the colors that is to be used twice (for example the one that comes first alphabetically for these two) and paint two sections with it. There are 6 · 3/2 = 9 ways to do this (for any one section, two (plus the center) are adjacent, thus there are 6 · 3/2 ways to choose two nonadjacent sections). For the other color to be used twice, there are 4 ways to color two nonadjacent sections from the four remaining. Finally for the three remaining colors & sections there are 3! = 6 ways to finish painting the sign for a total of 10 · 9 · 4 · 6 = 2160.

26. **B.** Let J and N be the distances traveled by Jalen and Nick, respectively. And let *r*. *t* be the rate and time of Nick. So, we get N = *rt* and J = $\left(\frac{4}{5}r\right)(2t)=\left(\frac{8}{5}rt\right)$. Also, 13 = N + J = $\left(\frac{13}{5}rt\right)$. So, rt = N = 5.

27. **E** $\left(\frac{1}{2}\right)$--The only way to get a total of $20 or more is if you pick a twenty and another bill.

There are a total of $\binom{8}{2}=28$ ways to choose 2 bills out of 8. There are 12 ways to choose a twenty and some other non-twenty bill. There is one way to choose both twenties and also one way to choose both tens. Adding these, we get a total of 14 ways to get a sum of 20 or more. So the probability is 14/28 = ½ .

28. **A.** From the payment of the first cowboy we find the price of 8 sandwiches, 2 cups of coffee, and 20 doughnuts = $16.90. From the payment of the second cowboy we calculate the price of 9 sandwiches, 3 cups of coffee, and 21 doughnuts = $18.90. The difference of the sums 18.90 – 16.90 = 2.00 is exactly the price of one sandwich, a cup of coffee, and a doughnut.

29. **B.** Add the length of the gate to the length of the fencing material to get 204 yards of fencing. If the width of the enclosed area is x yards then the length is (204 – 2x)/2 = 102 – x yards. The enclosed area is x(102 – x) = 102x – x 2 = 512 – (x – 51)2 square yards. The largest area of 51^2 = 2601 is achieved when the length and the width are both 51 yards.

30. **C**. Let p denote the number of pigeons and s the number of sparrows. Then p/(s – 5) = 2 and (s – 5)/(p – 25) = 3. Solve these two equations simultaneously to get s = 20 sparrows and p = 30 pigeons, so the original number of birds is 50.