1. A
2. A
3. D
4. A
5. C
6. B
7. A
8. D
9. A
10. C
11. B
12. D
13. B
14. C
15. C
16. C
17. C
18. A
19. C
20. D
21. C
22. B
23. A
24. C
25. A
26. D
27. B
28. E
29. D
30. D

1. A $(8x10x10-3)(10^4)=7,970,000 \to 23$
2. A $(1x2x6)+(2x6x6)=12+72=84$
3. D $2 \bullet 6!=1440$
4. A $\frac{(6-1)!}{3!}=20$
5. C ${}_{12}C_2-12=66-12=54$
6. B $2\,{}_9C_4+{}_9C_5=2\bullet 126+126=378$
7. A ${}_{22}C_2-11=231-11=220$. Twenty-two present so 11 board members
8. D ${}_3C_2 \bullet {}_5C_3 \bullet 5!=3600$
9. A ${}_9C_3 \bullet (-2)^3=-672$
10. C We have the rectangle with dimensions 10x11 (10 horizontal and 11 vertical). ZL is parallel to y-axis and ZU is parallel to x-axis.
    First, we choose the (x,y) coordinates for vertex Z: ${}_{10}C_1 * {}_{11}C_1$
    Then, we choose the x coordinate for vertex U (as y coordinate is fixed by Z): ${}_9C_1$
    Then, we choose the y coordinate for vertex Q (as x coordinate is fixed by Z): ${}_{10}C_1$
    $${}_{10}C_1 * {}_{11}C_1 * {}_9C_1 * {}_{10}C_1 = 9900$$
11. B Since the coefficient of the 4th and 10th terms are the same, we can deduce that there are 13 terms , so $n=12$. $a_8={}_{12}C_5w^5(-f)^7 \to -792$
12. D If you use the coefficients from Pascal's triangle 1, 6,15, 20, 15, 6, 1, the first three correspond to exponents for "M">3. 15 + 6 +1 =22. divide this by 64 since the row sums to 64. $\frac{11}{32}$
13. B $2^7=128$
14. C Products of perfect squares so 1,4,9,16,25,36. 8 ways to get these products
15. C Look at just the first 2 die and those 36 cases. 6 of those cases the numbers are the same. There are 5 possibilities then for the third die. The other 30 cases have 2 ways to match up so final answer is $6\bullet 5+30\bullet 2=90$
16. C Three cases: $\frac{6\bullet 5+6\bullet 2+2\bullet 6}{110} \to 54$
17. C $5N+10D+25Q=835$
    $N+2D+5Q=167$
    $N+D+Q=100$
    $D+4Q=67$
    The extremes would be 3 dimes and 67 dimes so 67-3=64
18. A (100,1), (79,21), and (58,41). Start with 100 and drop 21 for M and start with 1 for U and add 20
19. C $2^4=16$ cases. Lets compliment count. The ways we get less than 15 cents are P, N, D, PN, ND, PD. That is 6 cases. So the answer is 16-6=10

20. D 5+4 equals 9 so J+W must sum to 0, 9 or 18. 0 and 18 only have 1 case each. 9 can be gotten with 0,9 and 1,8 and 2,7 and 3,6 and 4,5 but those can go both ways that is 10 additional ways for a total of 12

21. C Let us label the vacant spaces V and the occupied spaces O. The number of ways that the cars can be parked in the lot is the permutation of 8 V's and 4 O's, or $\frac{12!}{8!4!} = 495$. David will not be able to park if no two V's are adjacent, which occurs when you insert the 4 V's into the 9 spaces between the O's, or $\frac{9!}{5!4!}$ 126. The number of configurations that David is able to park is $495 - 126 = 369$, and the probability he can park is $\frac{369}{495} = \frac{41}{55}$.

22. B Best to use decimals and a little trial and error. You want to be between .6 and .625. 8/13 fits between those so answer is 13

23. A Perfect square prime greater than 10 is 11 so 121. 1+2+!=4

24. C Since $20 = 2^2 5$, we need this factor to have power of 2 at least 2 and 5 at least 1. We can compute that $20! = 2^{18} 5^4 n$ for n not divisible by 2 or 5, so if we select a factor uniformly and at random, there is a 17/19 chance it has enough 2's and a 4/5 chance it has enough 5's, and these selections are independent, so the total probability is 68/95.

25. A We want prime raised to the 4th power so 16+81+625=722 answer is 7+2+2=11

26. D Need to find the number of 2's that are factors of 100! 50+25+12+6+3+1=97. $8^n = 2^{3n} < 2^{97} \to n = 32$

27. B $360 = 3^2 \bullet 5^1 \bullet 2^3 \to 3 \bullet 2 \bullet 4 = 24$ must subtract out 180 and 360 so 22

28. E $\frac{5}{14} = .3\overline{571428}$ so we are looking for the 2020th digit in the 6 repeating block of 571428. Divide 6 into 2020 and you get a remainder of 4 so want 4th digit which is 4

29. D 2021 is 43 times 47. You are adding 43 each time so we have 47 negatives and 47 positives and 0 so 95

30. D 156,168,456,468 they can all be arranged 6 ways for a total of 24. 114,441,558,885 can all be arranged 3 ways for a total of 12. 111,444,555,666,888 can all be arranged 1 way for a total of 5. 24+12+5=41