CADAB ABBDD ECCAD CEDBC BBAAB BDBDC

1. C Basic concentration problem: 3x/5=7.2 x=12

C	A	T
3/5	x	3x/5
0	20-x	0
36/100	20	7.2

2. A There are 58 integers from 18 to 75 inclusive
3. D The roots come in conjugate pairs so if we use sum of roots =-3 and product of roots=$\frac{11}{4}$ we get:$x^2+3x+\frac{11}{4}=0$ multiply by 4 to make relatively prime and we get 12
4. A $4=\sqrt{\frac{x-1}{5}}+7$ -3=$\sqrt{\frac{x-1}{5}}$ square roots can't be negative so no solution
5. B $A^{-1}=\frac{1}{10}\begin{bmatrix}4 & -2\\ 1 & 2\end{bmatrix}=\begin{bmatrix}\frac{2}{5} & \frac{-1}{5}\\ \frac{1}{10} & \frac{1}{5}\end{bmatrix}\rightarrow 3A^{-1}=\begin{bmatrix}\frac{6}{5} & \frac{-3}{5}\\ \frac{3}{10} & \frac{3}{5}\end{bmatrix}\rightarrow D=\frac{18}{25}+\frac{9}{50}=\frac{9}{10}$
6. A Draw yourself a 2-dimensional picture with a circle inside a triangle. We can use similar triangles or Pythagorean theorem and power of a point.12^2+r^2=$(r+4\sqrt{6})^2$ 144=96+8r$\sqrt{6}$ r=$\sqrt{6}$
7. B Sideways parabola:$4p(x-4)=(y-1)^2$plug in (3,3) and 4p=-4. Plug in x=0 and you get y-1=±4 do 5 and -3 sum to 2
8. B 160=10e^{8r}then $e^r=\sqrt{2}$ so 160$\sqrt{2}$ is just over 226 if you use 1.414 approximation
9. D Draw yourself a picture. Call MUF area y and RLF area x. That makes MRF area equal to x+y then x-y=x+y-x so 2y=x and if y=8 then we need 16+8=24
10. D $\frac{\binom{6}{3}+\binom{2}{1}\binom{6}{4}}{\binom{8}{5}}$=$\frac{20+30}{56}=\frac{25}{28}$
11. E This is a circle with a radius of 5 and centered at the origin. There are 4 solutions in each quadrant plus the 4 quadrantals for a total of 12 but only 6 of those satisfy our restriction those are: (0,5), (-5,0), (3,4), (-3,4), (-4,3), and (-4,-3) so answer is -9
12. C The circles intersect at (0,1) and (0,-1) with centers at (1,0) and (-1,0). This creates a central angle of 90 degrees. We want a sector minus a triangle and then double it. We subtract this from the full circle. $2\left(\frac{\pi}{2}-1\right)=\pi-2$
13. C Draw a picture and make an altitude to one of the legs. This creates a 30-60-90 triangle. Call the leg x then the other leg has segments of $\frac{x\sqrt{3}}{2}$ and $x-\frac{x\sqrt{3}}{2}$. You can then use Pythagorean theorem to get:$(\frac{x}{2})^2$+$(x-\frac{x\sqrt{3}}{2})^2=(\sqrt{3}-1)^2$ $8x^2-4\sqrt{3}x^2=16-8\sqrt{3}$ so $x^2=2$ and $x^6=8$
14. A 5-9=5 50-99=50 500-999=500 5+50+500=555 2025-555=1470 5000+1470-1=6469
15. D If you draw a good picture and connect vertices S and I you get an isosceles trapezoid with base angles of 60 and an isosceles triangle of 30-30-120. You can draw an altitude from the 120 angle and an altitude for the trapezoid and you get 30-

60-90 triangles you can exploit. SI=30 and half of that is 15 which is opposite the 60-degree angle so GS=$10\sqrt{3}$

16. C You can use interior angles and arithmetic formula, but exterior is easier. The exterior angles form an arithmetic sequence going 8+12+16+…(n+1)4=360 divide by 4 and you get 2+3+4+… n+1=90 add 1 to both sides and you get the first 13 integers summing to 91so n+1=13 and n=12

17. E $ln\frac{(k-2)}{e} = \ln(k+2)$ $k-2 = ke + 2e$ k-ke=2+2e $k = \frac{2+2e}{1-e}$ this is answer choice A but it is an extraneous solution so no solution here.

18. D 6 ways if they don't tie. 1 way if all 3 tie. If 2 tie you could have them tie for first or last and you can choose 3 different pairs to tie which adds 6 more choices. Total 13

19. B Raise both sides to the -2 power and you get:$(x-5)^2 = \pm\frac{1}{64}$ then$x = 5 \pm \frac{1}{8}$ so smallest is 39/8

20. C ${}_{30}C_2 = 435 \rightarrow 435 - 15 - {}_{15}C_2 = 435 - 15 - 105 = 315$

21. B Rearrange the terms and you get:$(x-y)^2 \leq 36(x+y)$ with the first constraint x+y=4 is best. Then we get:$x - y = \pm 12$ so x=8 and y=-4 is the highest value for x that satisfies both constraints

22. B Draw yourself a picture and you get a friendly trapezoid with height 3 and bases k and 4k. $\frac{1}{2}(3)(k+4k) = 30$ then k=4

23. A This is a right triangle, so it is easy to exploit power to the point:42-r+40-r=58 82-2r=58 2r=24 r=12

24. A Factor what is under the radical and you see the domain is [-2,4]. Plug in x=1 and you get the function to equal -5 so the range is [-5,1] You add up the integers and you get -14

25. B If the volume of the top piece to the whole cone is in the ratio 1:2 then the scale factor is $\frac{1}{\sqrt[3]{2}}$ we set this equal to h/8. $\frac{1}{\sqrt[3]{2}} = \frac{h}{8}$ then h=$4\sqrt[3]{4}$

26. B Centroid is where the medians intersect. We have an 8-15-17 right triangle in disguise so 24-45-51 so BS=51 and FS is one-third of 51 so 17

27. D The median would be the 5^{th} entry from low to high. If you insert 3 small integers the median would be 2 and if you insert 3 large integers the median would be 8. We can choose integers to make any integer between 2 and 8 as well to be the median so 2+3+4+…+8=35

28. B 12x/100 + 9x/100 + (20000-24x)/100=185 21x+20000-24x=18500 3x=1500 x=500

R	A	T
6/100	2x	12x/100
8/100	2500-3x	20000-24x/100
9/100x	x	9x/100
	2500	185

29. D Basic probability just don't forget to subtract out getting 2 black kings since they would have been counted twice.$\frac{26}{52}\cdot\frac{25}{51} + \frac{4}{52}\cdot\frac{3}{51} - \frac{2}{52}\cdot\frac{1}{51} = \frac{55}{221}$

30. C Finish off with a friendly multiplication problem. The digit number must be 998 in some order. 13 times 11 times 7 is 1001. When we multiple 998 times 1001 we get 998998. The 9's and 8's could flip around but the number of 9's is 4 either way.