1. A = 3(69) + 89 = 296; B = $2\sqrt{8^2+15^2}=34$; C = $(4\cdot8)^2+(3\cdot15)^2=3049$; D = $\sqrt{(5\cdot8)^2+(2\cdot15)^2}=50$
A + B + C + D = 3429

2. Use a 2-sample t-test; we want $\mu_{\text{Sophia}}>\mu_{\text{Liz}}$ → $t<\dfrac{-4}{\sqrt{\dfrac{4.9^2+6.6^2}{15}}}\to t<-1.88\to p\approx0.035$

3. A is the definition of the standard deviation of a probability distribution → A to 2 places = C = 2.07; B is just $\left(\frac{5}{12}\right)(0.15+0.15+0.1+0.1)=\frac{5}{24}$; $\left|C-\frac{1}{B}\right|=\frac{273}{100}$ or 2.73.

4. For part A: if it's a uniform probability density curve, then two sides must lie parallel to the *x*-axis and two sides parallel to the *y*-axis; (0, 0), (*x*, 0), (0, *f*(*x*)), and (*x*, *f*(*x*)) are the vertices. Hence, the area will be $xf(x)$; setting $2x-x^3=1$ gives solutions $x=1, x=\frac{-1+\sqrt{5}}{2}, x=\frac{-1-\sqrt{5}}{2}$. However, $x=\frac{-1-\sqrt{5}}{2}$ is extraneous.
For parts B&C: a continuous probability density curve implies that at *x* = 1, $x=2k-kx\to k=1$; the value of *n* which would make this a probability density curve is *n* = 2. Thus, $1+1+2+\frac{-1+\sqrt{5}}{2}=\frac{7+\sqrt{5}}{2}$.

5. Since $\sigma$ must be positive, $x>0; y>0; \sigma^2_{M+N}=x^2+y^2<25$; quarter-circle of radius 5 → area = $25\pi/4$.

6. A = $\binom{10}{7}(0.3)^7(0.7)^3$; B = 1 – $(0.7)^{10}$; C = $\binom{10}{9}(0.3)^9(0.7)^1+(0.3)^{10}$; D = binomcdf(10, .3, 6) – binomcdf(10, .3, 4) = $\binom{10}{4}(0.3)^4(0.7)^6+\binom{10}{4}(0.3)^5(0.7)^5+\binom{10}{6}(0.3)^6(0.7)^4$; A + B + C + D = 1.321

7. The expected value of a single roll is $\left(\frac{1}{9}\right)(3)(1+3+5)+\left(\frac{2}{9}\right)\left(\frac{1}{2}\right)(2+4+6)=\frac{13}{3}$. It can easily be seen that the trace of a *k* x *k* matrix has *k* elements, so the expected value of the sum is $\frac{13k}{3}$.

8. The probability of Sida getting a full house with the remaining cards is $\frac{12({}_4C_3)}{{}_{48}C_3}$ (note that he has rigged the deck such that he cannot draw aces). There are 47 cards left for Lisa to get a full house; there are 11 possible cards for her to get a 3 of a kind from → $11({}_4C_3)$ ways; there are now 11 cards left for her to get her pair from. Note that there is only 1 way to get 2 aces, compared to ${}_4C_2=6$ for the rest of the cards, so $10({}_4C_2)+1$ = 61 ways to get her pair, with ${}_{47}C_5$ possible hands; total probability is $\frac{(12({}_4C_3))(11({}_4C_3))(61)}{({}_{48}C_3)({}_{47}C_5)}\approx0.0000049$.

9. It's easiest to find A by just summing the first 50 triangular numbers, doubling that sum, then adding the required sum to account for the numbers which are both triangular and square (these are $R_1, R_8$, and $R_{49}$). Thus, $2\sum_{n=1}^{50}\frac{n(n+1)}{2}$ = $\sum_{n=1}^{50}n^2+n=\left(\frac{50(51)(101)}{6}\right)+\left(\frac{50(51)}{2}\right)$ (use the hints given in question 3). We need to add this to $R_1+R_8+R_{49}$, divide by 50, and round to the nearest integer; hence, A = 934.
The median of S is $\frac{R_{25}+R_{26}}{2}=\frac{25(26)+26(27)}{2}=676$. Now, use the hint from question 2 to find parts C and D: note that $\text{var}(X)=E(X^2)-(E(X))^2$, and $D=(E(X))$; $C+D^2=E(X^2)=\frac{1}{50}\sum_{n=1}^{50}n^2\approx859$.
A + B + C + D$^2$ = 2469

10. *a* + *b* = 0.6; *a* + 3*b* = 0.7 → 2*b* = 0.1 → *b* = 0.05 → *a* = 0.55; 0.55 – 0.5 = 0.5

11. $c_{10} = \left(\sqrt{\frac{2}{9}}\right)\left(\frac{\Gamma(5)}{\Gamma(4.5)}\right) = 0.972804$ ; $s \approx 2.78089 \rightarrow \frac{s}{c_{10}} = \sigma \approx 2.86$

12. A: There are 3 prime numbers and 3 nonprime numbers in [1, 6] →

$$3\left(P(\text{prime})\log_2\left(\frac{1}{P(\text{prime})}\right)\right) + 3\left(P(\text{nonprime})\log_2\left(\frac{1}{P(\text{nonprime})}\right)\right) = \frac{2}{3}\log_2\left(\frac{9}{2}\right) + \frac{1}{3}\log_2(9) \approx 2.50 = \text{A}$$

B: $0.6\log_2\left(\frac{5}{3}\right) + 0.4\log_2\left(\frac{5}{2}\right) \approx 0.97$

C: First note that P(X = 5) = 0 does not make this undefined; it simply means that X = 0 isn't a possible outcome and should be ignored. It can easily be seen that $k$ = 0.18, so $0.18\log_2\left(\frac{1}{.18}\right) + 0.19\log_2\left(\frac{1}{.19}\right) + 0.2\log_2\left(\frac{1}{.2}\right)$ $+0.21\log_2\left(\frac{1}{.21}\right) + 0.22\log_2\left(\frac{1}{.22}\right) \approx 2.32$ ; A + B + C = 5.79.

13. Note that $55 = 2(3^3) + 1$, $161 = 2(3^4) - 1$, $488 = 2(3^5) + 2$, $1460 = 2(3^6) + 2$; transformation (3) will be almost perfectly linear → A = 3
The LSRL of the raw data is $y = 454.2x - 1502.9$ → B = 4542, C = -15029
The LSRL of the transformed data ($y$ vs. $3^x$) is $y = 2.003t + .2857$ , where $t = 3^x$ → D + E = 10(2 + .3) = 23

$$\frac{(4(4542) - 15029)\log_2(3)}{23} \approx 216$$

14. Just plug them into the calculator. Note that the whole numbers are 0 through 9, not 1 through 10; $\frac{AB}{CD} = 7.96$

15. For part A, use a 1-sided matched-pairs t-test → A = 0.58; for B use a 2-sided matched-pairs t-test → B = 0.60; A + B = 1.18