**AP STATISTICS** **Name:** ________________________________ **Per:** _____

**Homework #30** *(skip the problems on the calendar and do this instead!)*

1. X and Y are two independent random variables with the following attributes:

   E(X) = 80 SD(X) = 12

   E(Y) = 10 SD(Y) = 5

   Find the mean and standard deviation of each of these random variables:

   a) X + Y

   b) 3Y

   c) X – Y

   d) $Y_1 + Y_2 + Y_3$

   e) 2X + 4Y

2. An insurance company estimates that the mean annual profit of each homeowner's policy written is $150, with a standard deviation of $6000. Let the random variable "X" represent the annual profit of each policy. Assume that each policy is independent of one another.

   a) If it only writes two of these policies ($X_1 + X_2$), what are the mean and standard deviation of the annual profit?

   b) If it writes 10,000 of these policies ($X_1 + X_2 + \ldots + X_{10000}$), what are the mean and standard deviation of the annual profit?

3. Natalie and Michelle are roommates that both work as waitresses in two different restaurants. The amount of money that Michelle earns in a week is a random variable with a mean of \$500 and a standard deviation of \$75. The amount of money that Natalie earns in a week is a random variable with a mean of \$600 and a standard deviation of \$100. The two of them work in different parts of Austin, so we will assume that the two ladies' earnings are independent of one another. We will also assume that the distributions for each ladies' weekly earnings are approximately normally distributed.

a) What are the mean <u>and</u> standard deviation for Michelle and Natalie's combined earnings (M + N) for one week?

b) What is the probability that Michelle and Natalie's combined weekly income exceeds \$1300? (In other words, what is the probability that the variable "M + N" is at least \$1300.00?)

c) What are the mean <u>and</u> standard deviation for the difference in (N – M), Natalie's earnings and Michelle's earnings for one week?

d) What is the probability that Natalie's weekly income is at least \$240.00 more than Michelle's weekly income? (In other words, what is the probability that the difference "N – M" is at least \$240.00?)

4. Every day at 6AM, two teachers – Brian and Eric – leave their respective homes for Podunk High School from opposite sides of the county. Every day, these two teachers are the first to arrive at school for work. However, due to recent budget cuts, only one of the two teachers (Eric) is allowed to have a key to open the front door of the school. Thus, if Brian arrives at Podunk High School before Eric, he will have to wait until Eric arrives before he can get into the school building.

Assume the amount of time, $B$, it takes Brian to get to PHS is approximately normally distributed with a mean of 45 minutes and a standard deviation of 5 minutes.

Assume the amount of time, $E$, it takes Eric to get to PHS is approximately normally distributed with a mean of 55 minutes and a standard deviation of 10 minutes.

Eric and Brian's travel times are independent of one another.

a) What are the mean and standard deviation of the distribution of $(E - B)$?

b) Over the long run, what proportion of school days will Brian have to wait for Eric before being able to enter the school building?

5. A casino knows that people play a slot machine in hopes of hitting the jackpot, but that most of them will just lose their dollar. One such slot machine at a casino earns an average of $0.23 of profit on each play, with a standard deviation of $87. Let "X" represent the profit from one play of the slot machine, and assume that each play of the slot machine is independent of one another.

a) If the machine is played 800 times in a day ($X_1 + X_2 + ... + X_{800}$), what are the mean and standard deviation of the casino's profits from this slot machine for that day?

b) Based on anecdotal (casual) observations, the casino owner is concerned that a lot of people seem to be winning the jackpot on this slot machine. We will assume that the casino's profits for 800 plays of the slot machine are normally distributed. Based on the mean and standard deviation calculated in part (a), what is the probability that this slot machine will lose the casino more than $5,000 in a given day? (In other words, what is the probability that this slot machine's profits are below -5,000?)

c) In statistics, an event is considered "**UNLIKELY**" if the probability of it occurring is less than five percent. Suppose that on a given day, this slot machine loses the casino more than $5,000. Based on your answer to part (b), would you consider this to be a **RARE** or **UNLIKELY** occurrence? Explain.