Standard 5B – Review: Independence & Complex Probabilities Name Key Hr_____

For questions 1 – 7: Consider a standard well shuffled deck of 52 playing cards, which consist of 2 colors (Red, Black), 4 suits (Diamond, Heart, Club, Spade), and 13 cards of each suit (Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King)

1-3. You randomly choose one card from the deck. Calculate the following probabilities: Write as a percent.

1. P(Black and a 5) = $\frac{2}{52} = 3.8\%$
2. P(Queen or 10) = $\frac{8}{52} = 15.4\%$
3. P(Red or an Ace) = $\frac{26}{52} + \frac{4}{52} - \frac{2}{52} = \frac{28}{52} \approx 53.8\%$

4. **Find the probability of choosing a King card, not replacing it, and then choosing a second card with a two on it from a standard deck of 52 cards.** $\frac{4}{52} \cdot \frac{4}{51} = \frac{4}{663} \approx .006 \approx 0.6\%$

5. **Find the probability of choosing a card with a face card on it, replacing it, and then choosing a second card with a spade on it from a standard deck of 52 cards.** $\frac{12}{52} \cdot \frac{13}{52} = \frac{3}{52} \approx .058 \approx 5.8\%$

6. **You randomly select 3 cards one at a time, with replacement, from a standard deck. Round to 5 decimal places.**
P(Queen, Queen, Queen) = $\frac{4}{52} \cdot \frac{4}{52} \cdot \frac{4}{52}$ 4.55166E-4 → move decimal left 4 times .0004.55166 = $\boxed{.00046}$ or .046%

7. **You randomly select 3 cards one at a time, without replacement, from a standard deck. Round to 5 decimal places.**
P(Queen, Queen, Queen) = $\frac{4}{52} \cdot \frac{3}{51} \cdot \frac{2}{50}$ 1.80995E-4 → move decimal left 4 .0001.809 = $\boxed{.00018}$ or .018%

Use the formulas to the right to answer questions 8-10.

$$P(A \text{ and } B) = P(A) \cdot P(B)$$
$$P(A \text{ and } B) = P(A) \cdot P(B \mid A)$$
$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

8. Events A and B are ***dependent***. Find the missing probability.
$P(A) = 0.32$
$P(B|A) = 0.55$
$P(A \text{ and } B) =$ 0.176 = (.32)(.55)

9. Events A and B are ***independent***. Find the missing probability.
$P(A) = 0.42$
$P(B) =$ 0.26
$P(A \text{ and } B) = 0.11$
.11 = (.42) P(B)
.11 / .42 = (.42) P(B) / .42
.26 = P(B)

10. Out of 80 college students at a university, 68 used the library or computer labs. There were 34 that used the library and 58 that used the computer lab. What is the probability that a randomly selected college students used both the library and the computer lab?

80 total
68 library or lab
34 library (A)
58 lab (B)
P(A and B) = ?
P(A or B) = P(A) + P(B) − P(A & B)
$\frac{68}{80} = \frac{34}{80} + \frac{58}{80} - P(A \& B)$
68 − 92 = −24/80 = −P(A & B) 24/80 = P(A & B)
$\frac{24}{80} = .3$ = 3/10 or 30%

Questions 11 – 19: A survey asks Junior and Senior high school students whether they prefer having a study hall or not. The results, given as joint relative frequencies, are shown in the two-way table below.

11-15. Fill in the missing marginal relative frequencies.

	Juniors	Seniors	Total
Does prefer	0.41	0.49	**11.** 0.90
Does NOT prefer	0.06	0.04	**12.** 0.10
Total	**13.** 0.47	**14.** 0.53	**15.** 1.0

16. P(Does Not prefer | Senior)
$\frac{.04}{.53} = .075 \approx 7.5\%$

17. Find the probability that **a randomly selected student who does prefer study hall** is a Junior.
$\frac{.41}{.90} \approx .456$ or 45.6%

18. Are preferring study hall and being a senior independent Events? **HINT:** Listing Event "A" and Event "B" and using a mathematical formula will help you figure it out.

a) Yes they are independent $\boxed{\text{b)}}$ No they are not independent

Event A Prefers study hall
Event B Senior

19. To figure out or prove the answer to number 18, write an equation you could use, using one of the probability formulas.

If Indep: P(A & B) = P(A) · P(B)
.49 = (.9)(.53)
.49 ≠ .477