

This exam lasts 2 hours. Please silence and put away your cell phone. You are allowed 1 sheet of notes (front and back) and a calculator. Show enough work that it is clear how you arrived at your answer. Decimal answers should be rounded to 4 decimal points. Put a box around your final answer to each question. Good luck!

1. Consider the following sets.

$$A = \{0, 3, 6, 9, 12\}$$

$$B = \{0, 2, 4, 6, 8, 10, 12\}$$

(a) (6 points) True or false:

- | | | |
|-----------------------------|----------------------------------|-------------------------------------|
| i. $0 \in A$ TRUE | iii. $0 \subseteq A$ FALSE | v. $\{4, 8, 10\} \in B$ FALSE |
| ii. $\emptyset \in A$ FALSE | iv. $\emptyset \subseteq A$ TRUE | vi. $\{4, 8, 10\} \subseteq B$ TRUE |

(b) (2 points) What elements belong to $A \cap B$?

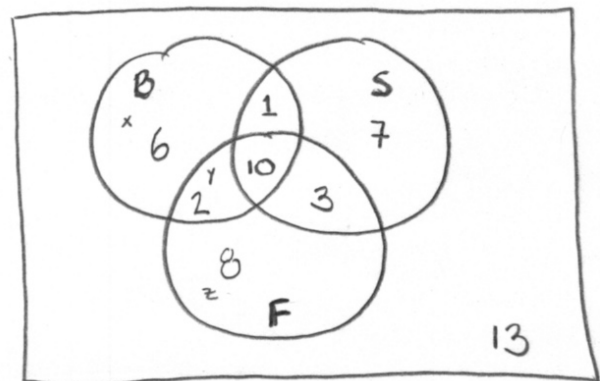
0, 6, 12

(c) (2 points) What elements belong to $A \cup B$?

0, 2, 3, 4, 6, 8, 9, 10, 12

2. A small school has a baseball team, a soccer team, and football team. However, the school has only 50 students. Thus, many students play more than one sport.

- 19 students play baseball
- ✓ • 21 students play soccer
- 23 students play football
- ✓ • 11 students play baseball and soccer
- ✓ • 13 students play soccer and football
- ✓ • 10 students play all three sports
- ✓ • 13 students play no sports



$$\textcircled{1} \quad x + y + 1 + 10 = 19$$

$$\textcircled{2} \quad z + y + 3 + 10 = 23$$

$$\textcircled{3} \quad x + y + z + 1 + 10 + 3 + 7 + 13 = 50$$

(a) (2 points) How many students play only soccer? 7

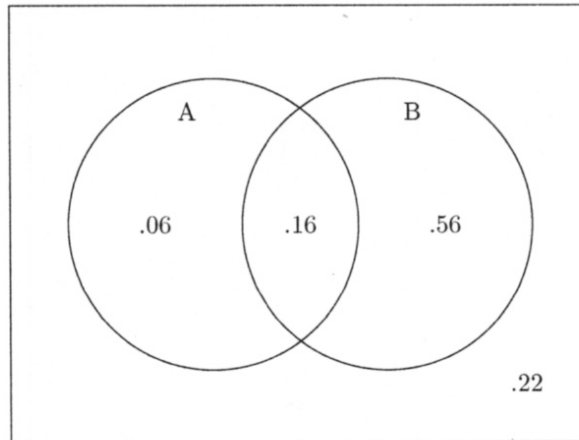
(b) (2 points) How many students play soccer and football, but not baseball? 3

(c) (2 points) How many students play baseball and football? 12

$$\begin{array}{l} \textcircled{1} \Rightarrow x + y = 8 \\ \textcircled{3} \Rightarrow x + y + z = 16 \end{array} \left. \vphantom{\begin{array}{l} \textcircled{1} \\ \textcircled{3} \end{array}} \right\} \begin{array}{l} 8 + z = 16 \\ z = 8 \end{array} \quad \begin{array}{l} \textcircled{2} \Rightarrow z + y = 10 \\ 8 + y = 10 \\ y = 2 \end{array}$$

3. An experiment can result in events A , B , both A and B , or neither with the following probabilities.
(Note: the chart and the Venn diagram are equivalent.)

	A	A'
B	.16	.56
B'	.06	.22



- (a) (3 points) Find $P(A)$.

$$P(A) = P(A \cap B) + P(A \cap B') = .16 + .06 = \boxed{.22}$$

- (b) (3 points) Find $P(A|B)$.

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{.16}{.72} = \boxed{.2222}$$

- (c) (3 points) Are A and B independent? Why or why not?

No. $P(A) \neq P(A|B)$.
 $.22 \neq .2222$

ALSO, $P(A \cap B) \neq P(A)P(B)$
 $.16 \neq (.22)(.72) = .1584$

4. (a) (3 points) How many ways are there for a 12 member committee to choose a president, vice-president, and secretary?

$$3 \text{ STAGE EVENT: } 12 \cdot 11 \cdot 10 = P(12, 3) = \frac{12!}{(12-3)!} = \boxed{1320}$$

- (b) (3 points) How many ways are there for a 12 member committee to choose 5 members to serve on a subcommittee?

$$C(12, 5) = \frac{12!}{5!(12-5)!} = \boxed{792}$$

