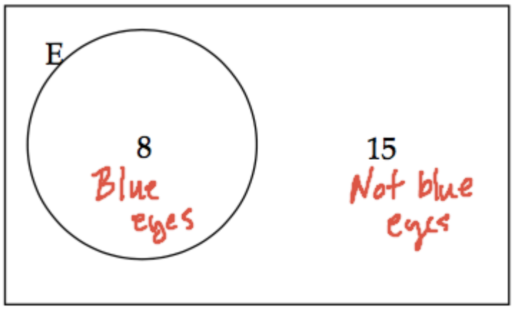
Venn Diagrams and Probability Date: ____________________

A number of probability laws can be established using Venn Diagrams.

This Venn diagram represents a sample space, S, of all children in a class. The event, E, shows all those students with blue eyes.



S = 23

Determine the probability that a randomly selected child:

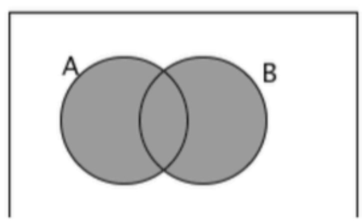
a) has blue eyes:

$\frac{8}{23} = .35 = 35\%$

b) does not have blue eyes:

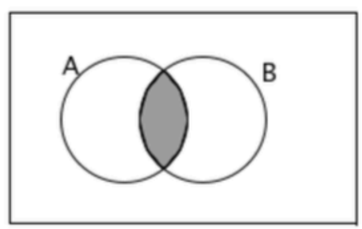
$\frac{15}{23} = .65 = 65\%$

If A and B are two events in the sample space then the B means that any member of this event is in `at least events A or B'. This shaded region is A or B.



event A **or** one of the

A **and** B means that any member of this event is in B'.

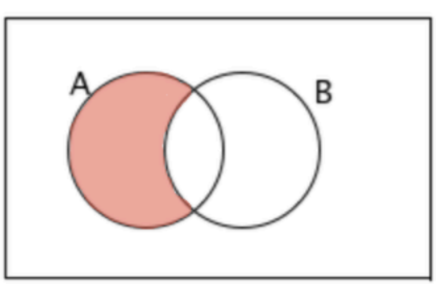


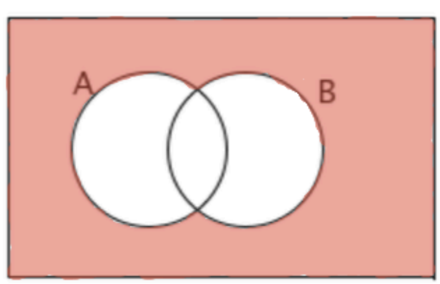
`both A and

1) Shade the region representing:

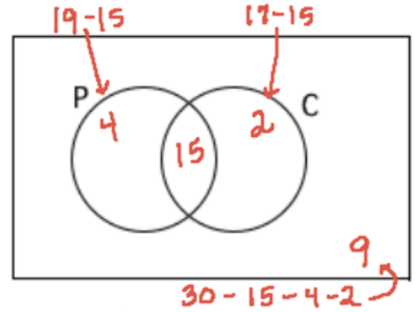
a) in A but not in B

b) neither in A nor B.





2) In a class of 30 students, 19 study Physics, 17 study Chemistry and 15 study both of these subjects. Display this information on a Venn diagram and determine the probability that a randomly selected class member studies:



a) both subjects
$\frac{15}{30} = \frac{1}{2} = .5 = 50\%$

b) at least one of the subjects $4+15+2$
$\frac{21}{30} = \frac{7}{10} = .7 = 70\%$

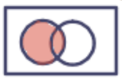
c) Physics, but not Chemistry
$\frac{4}{30} = \frac{2}{15} = .13 = 13\%$

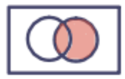
d) Chemistry, but not Physics
$\frac{2}{30} = \frac{1}{15} = .07 = 7\%$

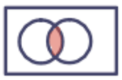
e) Neither subject
$\frac{9}{30} = \frac{3}{10} = .3 = 30\%$

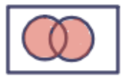
Extra Practice:

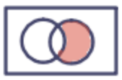
1) On separate Venn diagrams, using two events A and B, shade the region representing:

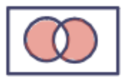
a) in A 

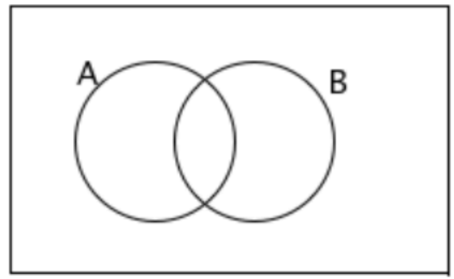
b) in B 

c) in both A and B 

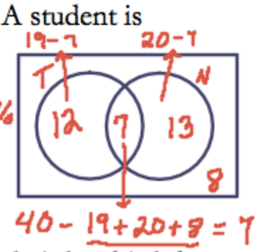
d) in A or B 

e) in B but not in A 

f) in exactly one of A or B 



2) In a class of 40 students, 19 play tennis, 20 play netball and 8 play neither of these sports. A student is randomly chosen from the class. Determine the probability that the student:



a) plays tennis $\frac{19}{40} = .475 = 47.5\%$

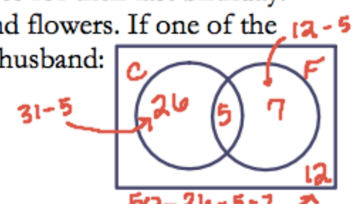
b) does not play netball $\frac{20}{40} = \frac{1}{2} = .5 = 50\%$

c) plays at least one of the two sports
$12+7+13 = 32/40 = 4/5 = .8 = 80\%$

d) plays one and only one of the sports
$12+13 = \frac{25}{40} = \frac{5}{8} = .625 = 62.5\%$

e) plays netball, but not tennis
$\frac{13}{40} = .325 = 32.5\%$

3) 50 married women were asked whether they gave their husband flowers or chocolates for their last birthday. The results were: 31 gave chocolates, 12 gave flowers and 5 gave both chocolates and flowers. If one of the married women was chosen at random, determine the probability that she gave her husband:

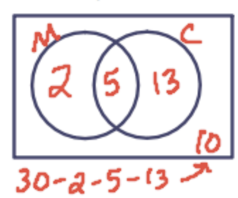


a) chocolates or flowers $\frac{19}{25} = .76 = 76\%$
$26+5+7 = 38/50 = \frac{19}{25}$

b) chocolates but not flowers
$\frac{26}{50} = \frac{13}{25} = .52 = 52\%$

c) neither chocolates nor flowers
$\frac{12}{50} = \frac{6}{25} = .24 = 24\%$

4) The medical records for a class of 30 children showed whether they had previously had measles or chicken pox. The records showed 7 had had measles, 18 had had chicken pox, and 5 had had measles and chicken pox. If one child from the class is selected randomly from the group, determine the probability that he/she has had:

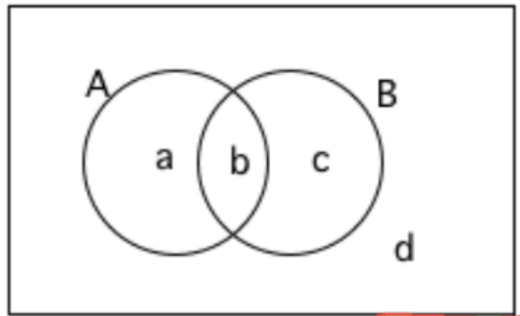


a) chicken pox $\frac{18}{30} = \frac{3}{5} = .6 = 60\%$

b) chicken pox but not measles
$\frac{13}{30} = .43 = 43\%$

c) neither chicken pox nor measles
$\frac{10}{30} = \frac{1}{3} = .33 = 33\%$

5) Use the diagram on the right to find:



a) P(B)

$$\frac{b+c}{a+b+c+d}$$

b) P(A and B)

$$\frac{b}{a+b+c+d}$$

c) P(A or B)

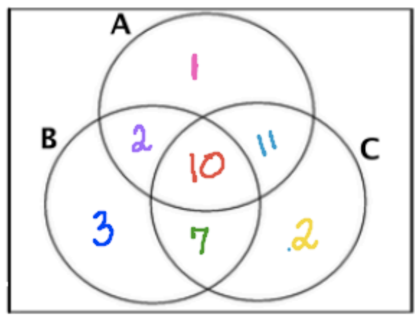
$$\frac{a+b+c}{a+b+c+d}$$

d) P(A) + P(B) – P(A and B)

$$\frac{a+b}{a+b+c+d}+\frac{b+c}{a+b+c+d}-\frac{b}{a+b+c+d}=\frac{a+b+b+c-b}{a+b+c+d}=\boxed{\frac{a+b+c}{a+b+c+d}}$$

6) The 36 students in 8 classes were assigned three challenging problems, A, B and C. A poll of the classes, one week later, showed that each student had solved at least one of the problems. It also showed this additional information.

- 10 students had solved all three problems
- 12 students had solved A and B
  12-10
- 17 students had solved B and C
  17-10
- 21 students had solved A and C
  21-10
- 24 students had solved A
  24-2-10-11
- 22 students had solved B
  22-2-10-7
- 30 students had solved C
  30-10-7-11



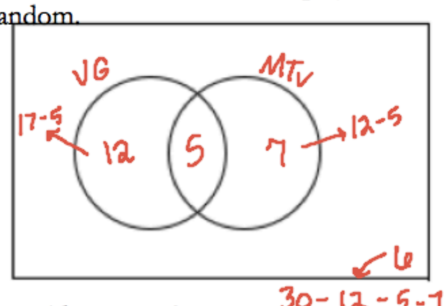
a. What is the probability a student solved problem C only? $\frac{2}{36}=\frac{1}{18}=.056=5.6\%$

b. What is the probability a student solved problem A only? $1/36=.028=2.8\%$

c. What is the probability a student solved exactly one problem? $6/36=1/6=.167=16.7\%$
$1+2+3=6$

d. What is the probability a student solved exactly two problems? $20/36=5/9=.556=55.6\%$
$2+11+7=20$

7) In a class of 30 students, 17 play video games and 12 watch MTV. It turns out that 5 students play video games and watch MTV. A student in this class is to be selected at random.



a. What is the probability that a student plays video games?

$17/30=.567=56.7\%$

b. What is the probability that a student watches MTV?

$12/30=2/5=.4=40\%$

c. What is the probability that a student watches MTV and plays video games?

$5/30=1/6=.167=16.7\%$

d. What is the probability that a student neither plays video games nor watches MTV?

$6/30=1/5=.2=20\%$