(9 points)

1. Evaluate each of the following. Show all work and give a single integer as your answer.

   a) $7!$

   b) $C(9, 3)$

   c) $P(11, 3)$

In problems 2,3 and 4 you may leave your answers in terms of products, powers, permutations and/or combinations. You need not simplify your answers.

(10 points)

2. A computer passcode consists of five letters followed by two digits which cannot be zero.

   a) How many passcodes are possible?

   b) How many passcodes are possible if only the letters cannot be repeated?

(15 points)

3. A professional golfer makes his putts exactly 89% of the time on the first attempt. He plays a round of golf in which he attempts 18 putts the first time.

   a) What is the probability he makes exactly 13 putts on the first attempt?

   b) What is the probability he makes every putt on the first attempt?

   c) What is the probability he misses at least two putts on the first attempt?

(15 points)

4. A hand of five cards is dealt from a standard 52-card deck. Find the probability that

a) The hand contains no kings and no queens.

b) The hand contains the ace of hearts and the ace of clubs.

c) The hand contains at least two queens.

(10 points)

5. a) Find the equation of the line through the points (2, 11) and (6, 39). Give your answer in slope-intercept form.

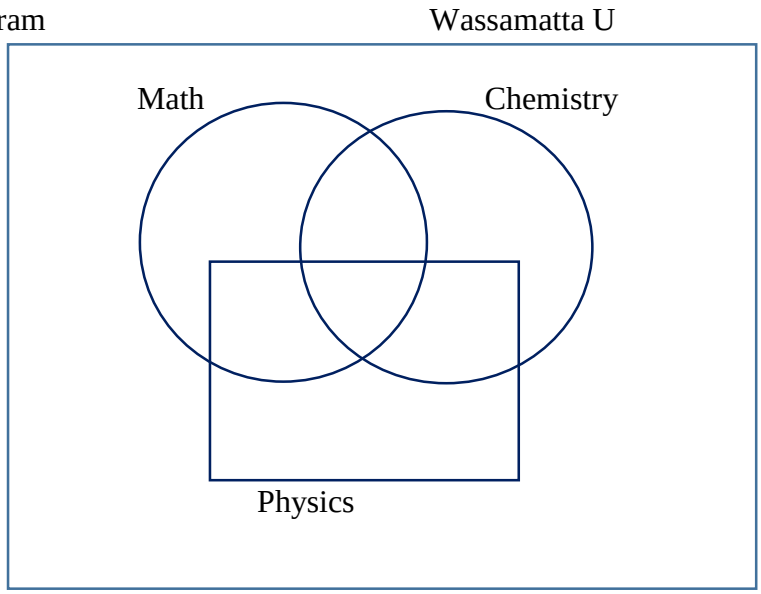
b) Find the x and y intercepts of this line as ordered pairs.

i) x-intercept ii) y-intercept

(10 points)

6. At Wassamatta U, Bullwinkle did a survey of 150 of his fellow graduates. He found that 64 had taken a math class, 53 a chemistry class, and 60 a physics class. He also found 23 took both math and chemistry, 24 took chemistry and physics, 29 took math and physics while 10 took all 3 of the subjects.

a) Complete the Venn diagram



b) How many students took only two of the three classes?

c) How many students took a physics class, but did not take a math class?

(8 points)

7. How many different permutations are there of all of the letters in ‘ ESSENTIALS ’ ? Show all work and give a single integer as your answer.

(15 points)

8. On a table are three identical boxes. Box A has one red and one green marble, box B has one red and two green marbles and box C has one red and three green marbles. A box is selected and a marble is chosen.

   a) Construct the tree diagram for this problem, complete with the branches labeled and the assigned probabilities.

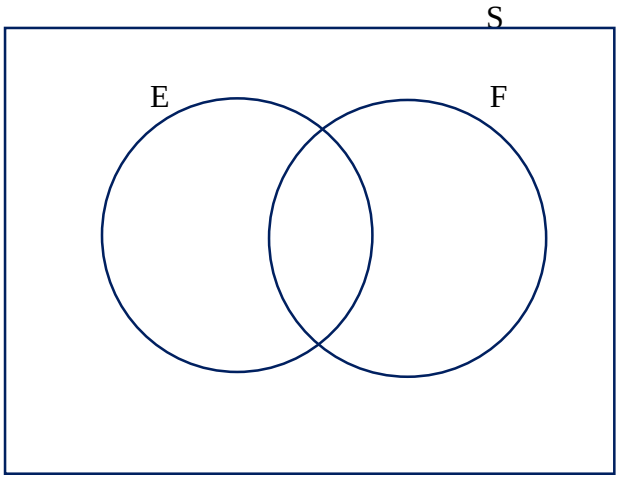
   b) What is the probability the marble selected is green?

   c) If the marble selected was green, what was the probability it came from box C?

(18 points)

9. Let E and F be events of sample space S. The $P(E \cup F) = 0.7$, $P(E) = 0.3$, $P(\bar{F}) = 0.4$.

a) Complete the Venn diagram



b) Find $P(E \cap F)$.

c) Find $P(E \cup \bar{F})$.

d) Find $P(E|F)$.

e) Are E and F independent ? Justify your answer.

(12 points)

10. a) Let $A = \begin{pmatrix} 2 & 5 \\ 3 & 4 \end{pmatrix}$. Find A^{-1} the inverse of A.

b) Use the inverse found in part a of this problem to solve the system

$$2x + 5y = -4$$
$$3x + 4y = 8$$

(15 points)

11. Solve the following system by using reduced row-echelon form.

$$\begin{aligned} 2x + y + 5z &= 23 \\ 3x - y \quad\quad &= 22 \\ x + 2y + 4z &= 13 \end{aligned}$$

(9 points)

12. The following augmented matrices represent systems of equations in terms of *x*, *y*, and *z*. For each find the general solution or state that no solution exists.

a) $\left(\begin{array}{ccc|c} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 3 \\ 0 & 1 & 1 & 10 \end{array}\right)$ b) $\left(\begin{array}{ccc|c} 1 & 0 & 0 & 8 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 5 & 12 \end{array}\right)$ c) $\left(\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 0 & 0 & 7 \\ 0 & 1 & 0 & 4 \end{array}\right)$

(14 points)

13. Formulate an LP model for the following problem. DO NOT ATTEMPT TO SOLVE IT.

ACME manufactures three road runner traps. Red traps which yield a profit of $55 require 3 hours of labor, 6 pounds of metal and 4 springs. Green traps yield $10 less in profit than red traps while requiring the same amount of labor along with 7 pounds of metal and 5 springs. Blue traps need 4 hours of labor, 6 springs and 8 pounds of metal but produce twice the profit of red traps. Each week ACME has 4500 springs and 5350 pounds of metal available. Due to a negotiated contract with Coyote Local 101 labor union ACME must provide 25 hours of labor to a minimum of 10 employees but due to costs cannot provide more than 25 hours of labor to 30 employees. Find the amount of each trap ACME should produce in order to maximize their profit.

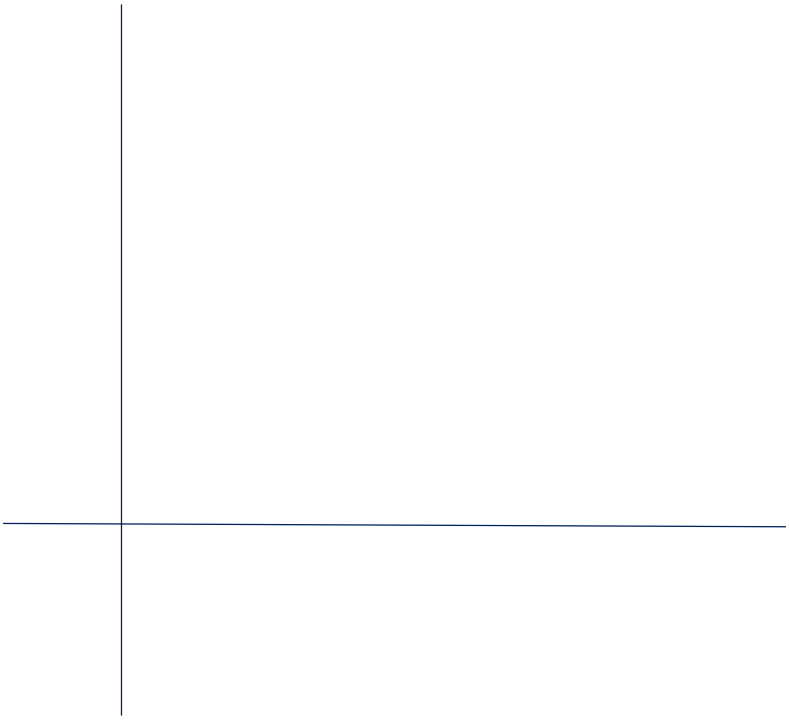
(12 points)

14. Solve the following linear programming problem:

Maximize $P = 8x + 5y$ subject to the following constraints:

$$x \geq 0,\ y \geq 0,\ x - y \leq 4,\ 2x + 3y \leq 36,\ x \leq 6$$

a) Sketch the feasible region



b) List the corner points of the feasible region.

c) Report the complete solution.

(12 points)

15. For each tableau perform one of the following steps:

1) If a pivot is required, write 'pivot needed', circle the pivot element, but do not pivot.
2) If there is no optimal solution, say so and state why.
3) If the problem is finished, report the complete solution.

a)

BV	P	x_1	x_2	s_1	s_2	s_3	RHS
x_2	0	0	1	2	1	2	7
x_1	0	1	0	2	2	4	22
P	1	0	0	4	0	5	44

b)

BV	P	x_1	x_2	x_3	s_1	s_2	s_3	RHS
s_1	0	0	4	1	1	0	1	15
s_2	0	1	5	2	0	1	0	21
s_3	0	0	0	−2	0	0	0	6
P	1	3	−4	−2	1	1	3	15

c)

BV	P	x_1	x_2	x_3	s_1	s_2	s_3	RHS
s_1	0	1	−2	5	1	0	0	10
s_2	0	1	0	2	0	1	0	12
s_3	0	0	−5	−1	0	0	1	19
P	1	2	−2	1	0	0	0	33

(16 points)

16. Use the simplex method to solve the following LP problem.

Maximize $P = 5X_1 + 6X_2$ subject to the following constraints:

$$X_1 \geq 0,\ X_2 \geq 0,\ X_1 + X_2 \leq 8,\ X_1 + 3X_2 \leq 14$$