

**PART I: Solve the following equations:**

1)  $14x - \frac{45}{4x} = 17$

2)  $\sqrt[4]{2x+9} = 2 \times \sqrt[4]{\frac{14}{x}}$

3)  $27^{(2x-1)} = \frac{1}{9^{2x}}$

4)  $\frac{2}{x^2-7x+10} = \frac{3}{x-5} - \frac{x}{x-2}$

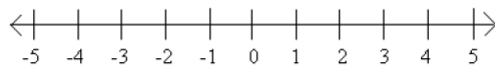
5)  $\frac{4}{3x} - \frac{x}{x+3} = \frac{1}{x}$

6)  $23x^2 - 2 = 4x^2 + 4$

7)  $2^{x+2} = 16 \times 2^{7-x}$

8) Solve for Y:  $\frac{x+1}{xy} + \frac{x}{y^2} = \frac{1}{y}$

9) Solve and graph  $\left\{ \left| \frac{5-x}{-5} \right| + 1 \geq -2 \right\} \cap \{-x + 6 < 3\}$





- 5) The product of two positive consecutive integers exceeds the sum of the two integers by one. Find the two integers. [ *Only an algebraic solution will be accepted.* ]
- 6) John is now 3 times as old as his brother Sam. In 5 years, John will be twice as old as Sam will be then. Find their present ages.
- 7) The price of an item is reduced after a 20% sale followed by a 10% sale. By what percent must we increase the price to get back to 90% of the original sale price?
- 8) Water leaks out of a tank that initially holds 100 cubic meters of water in such way that it results in a reduction of water level by 2% every day. Write an exponential decay model and solve it to see how much water is left in the tank after 14 days:
- 9) What volume of a 15% acid solution must be mixed with 20L of 30% acid solution to obtain 25% acid solution?

**PART III: Complete the following operations:**

1)  $\frac{6\sqrt{27}+12\sqrt{15}}{3\sqrt{3}} =$

2)  $\frac{\sqrt{3}}{4\sqrt{3}+2} =$

3) Divide:  $(x^5 - 3x^3 + 2x^2 - x + 1) \div (y - 1) =$

4) Simplify  $\frac{\frac{1}{x^2} + \frac{1}{xy^2}}{\frac{1}{y^2} + \frac{1}{x}} =$

5)  $\frac{\sqrt[3]{x^2y} \cdot x^{\frac{1}{6}}}{\sqrt[6]{x^3y} \cdot y^{\frac{1}{3}}} =$

6)  $\left(\frac{-x^{-3}y^3}{(-x)^3y^{-1}z^0}\right)^{-2} =$

**PART IV: Factorization and Operations:**

1.  $x^5 + x^3 + x^2 + 1 =$

2.  $3x^5y - 243xy =$

3. If  $x + y = 9$  and  $xy = 20$ , then find  $x^3 + y^3$ :  
(Hint: we can write  $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$ )

4.  $x^4 + 3x^2 + 4 =$

5.  $y^4 + y^3 + y - 1 =$

6.  $-x^3 + 2x^2 + x - 2$

$$7. \left( \frac{x^2+8x+15}{x^2-5x-14} \right) \cdot \left( \frac{x-7}{x^2-25} \right) =$$

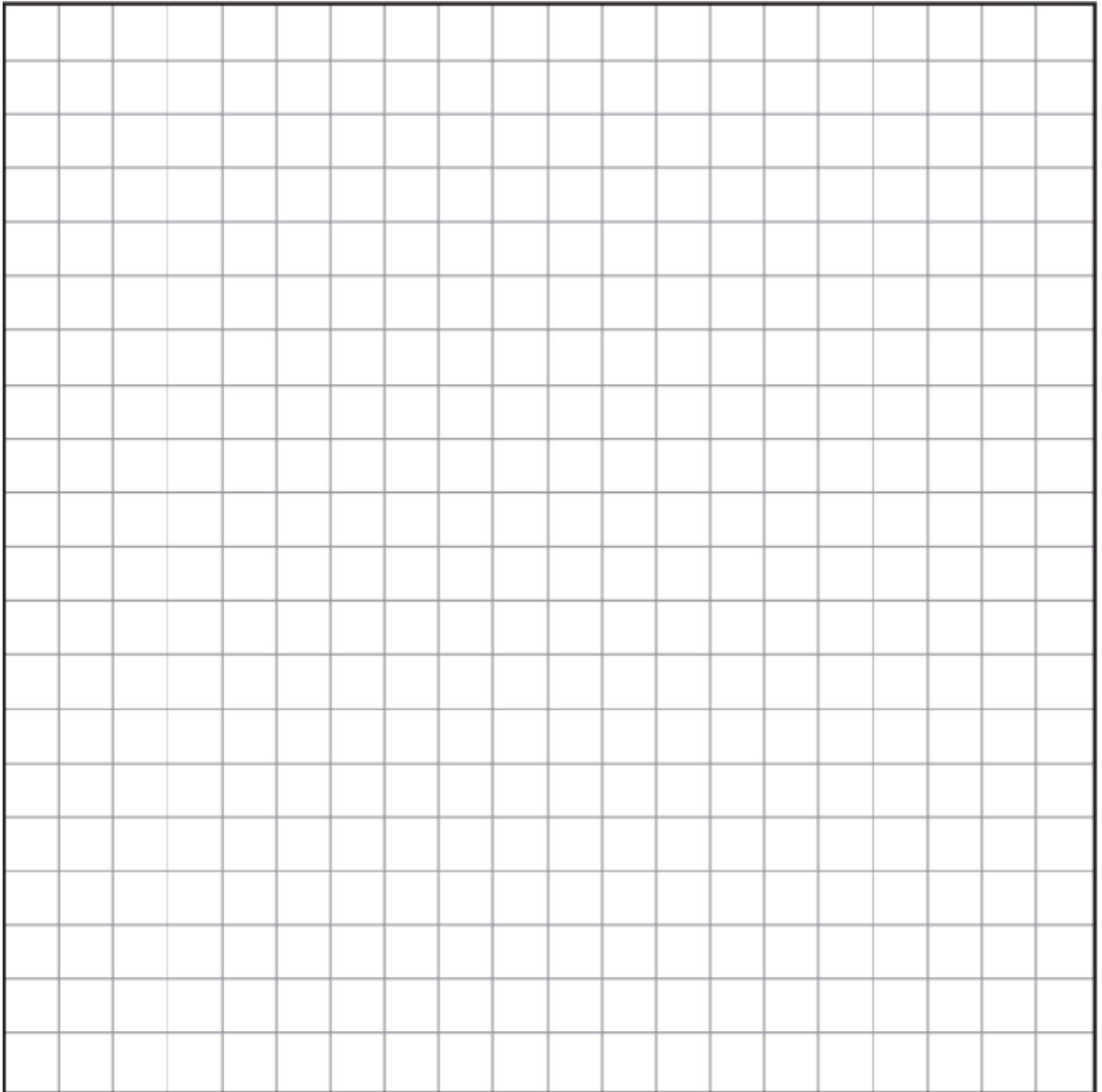
$$8. \left( \frac{x^2-4x+4}{x^2+11x+30} \right) \div \left( \frac{x^2}{x^2+7x+10} \right) =$$

$$9. \left( \frac{5}{x-1} \right) - \left( \frac{2x}{x+7} \right) =$$

$$10. \left( \frac{3x}{x^2+3x-18} \right) + \left( \frac{7}{x^2+8x+12} \right) =$$

**Part V: Coordinate Geometry and word Problems**

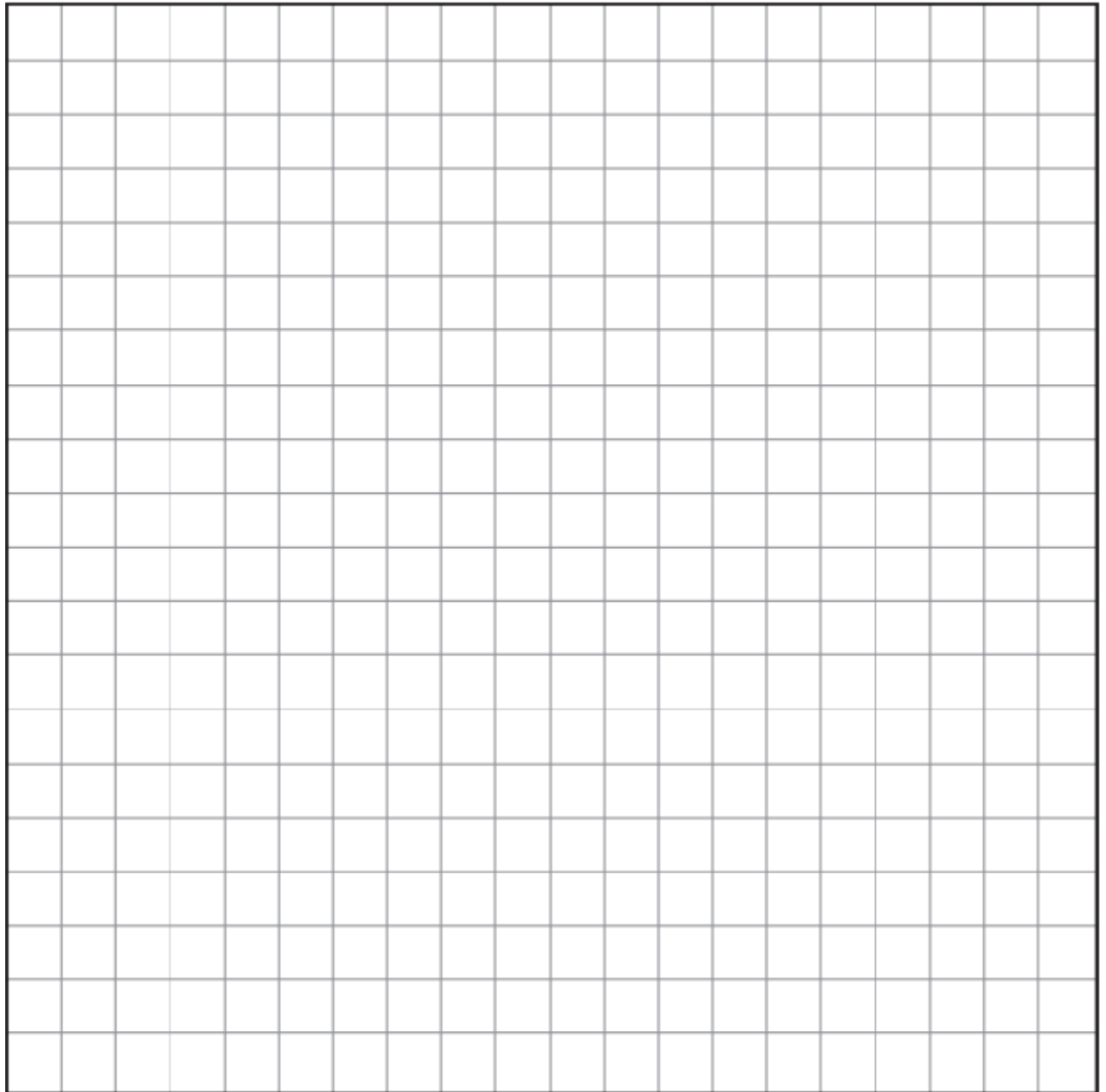
1) Graph the functions  $y = -2^x + 1$  and  $y = \left(\frac{1}{2}\right)^x - 3$ ,  $y = -2|4x - 2| - 1$



A) State domain and range of each function

B) Find the points of intersection of the three graphs using your graphing calculator

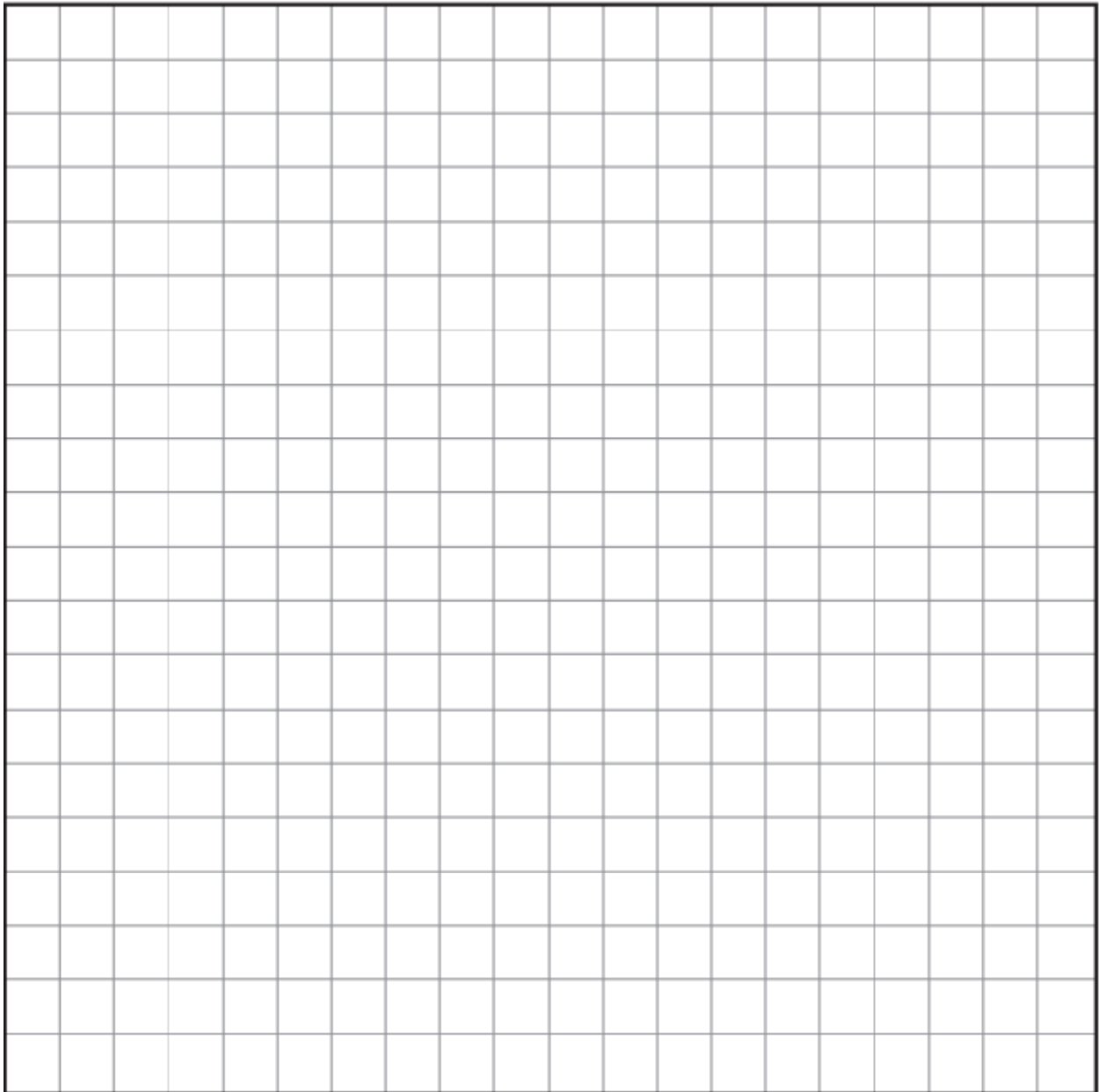
2) Graph  $y = \frac{2}{2x-2} - 3$  and  $y = \sqrt{x-5}$



A) State the domain and range of both functions

B) Find the points of intersection using your calculator (if any)

- 3) Suppose the motion of two objects are modeled by  $y = -t^2 - 2t + 1$  and  $y = 3t$ .
- A) Graph the two equations accurately and find the time after which the two objects meet again!



- B) What is the maximum height of the first object?

4) Suppose we throw a ball with an initial vertical velocity of 10 meters per second from an initial height of 2 meters. (The model equation would be  $h(t) = -5t^2 + v_i t + h_i$ )

A) How long will it take before the ball is only 1 meter above the ground?

B) How high is the ball 1 second after we throw it?

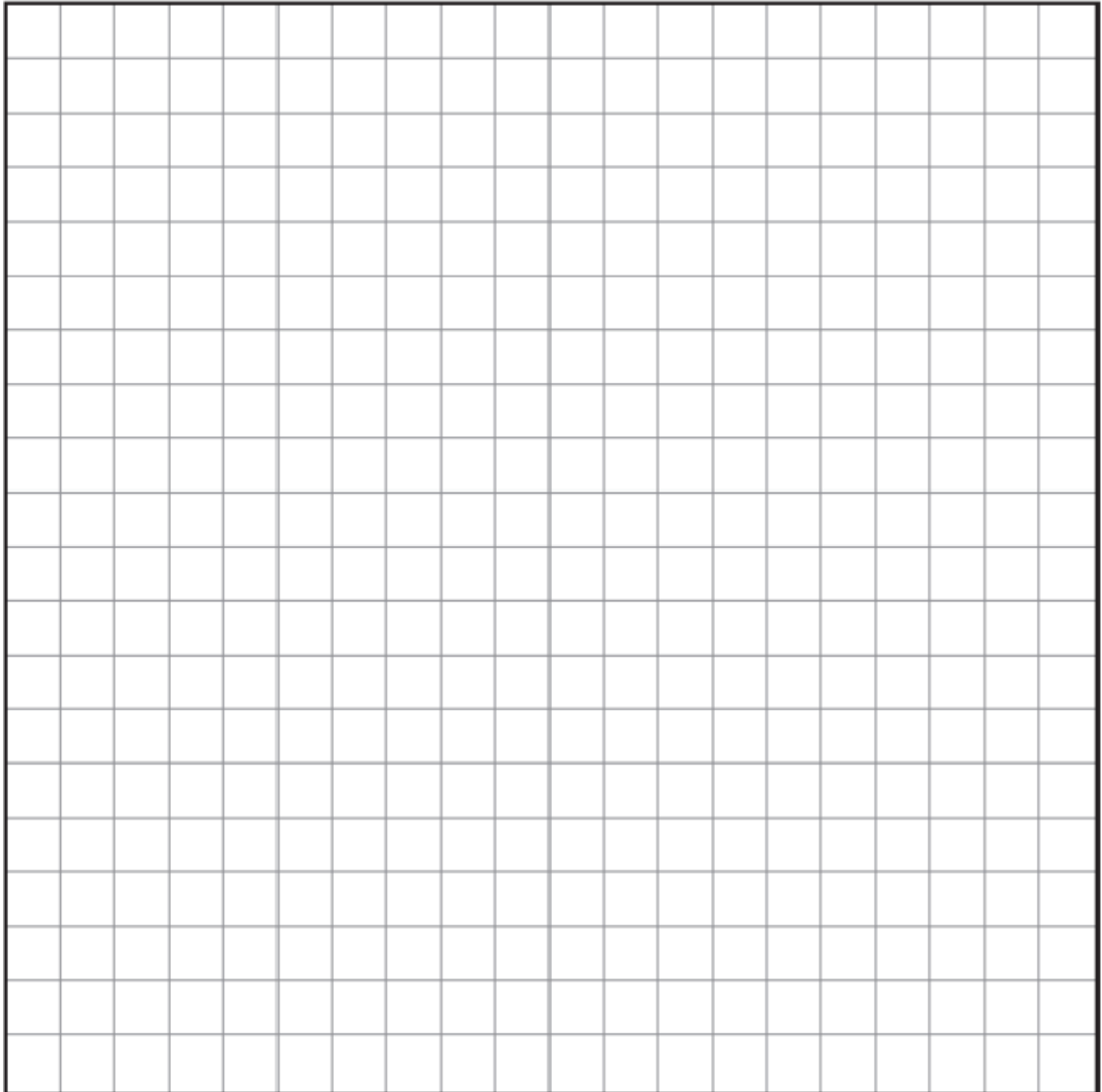
5) The ratio of pennies to nickels is 4:3 and the ratio of nickels to dimes is 3:1 and the total value of the coins is 87 cents. How many of each coin do we have?

6) The sum of the digits of a two digit number is 9. If you reverse the order of the digits, the number will be 63 more than the original number; what is the numbers?

7) Suppose you have a \$40 gift card to a movie theatre! A ticket to a matinee movie costs \$5 and a ticket to an evening movie costs \$8; however, you cannot watch more than 6 movies...

A) Write a system of 2 linear inequalities (as well as 2 boundary conditions) for the number of tickets you may buy:

B) Graph the equations that you wrote accurately:





5) A ladder is leaning on a wall 10 meters high such that the tip of the ladder is on the top edge of the wall.

A) If the ladder is 20 meters long, then find the angle that it makes with the ground

B) Based on your answer from part A, find how far from the wall the bottom of the ladder rests?

6) Let  $f(x) = -3x^2 - 5$  and  $g(x) = 5x + 1$

A)  $f(g(x)) =$

B)  $g(f(x)) =$

C)  $f(g(-1)) =$

D)  $g(-2) =$

E)  $g(f(-2)) =$

## **PART VII: Probability and statistics**

- 1) What is the probability of selecting a multiple of 2 at random among numbers between 123 and 184?
  
- 2) How many diagonals does an octagon have (8 sided shape)?
  
- 3) What is the probability of getting *at least* 2 heads in 3 throws of a coin?
  
- 4) There are 24 members on a swim team. How many different combinations of 5 swimmers can be chosen to sit in the front row of a team photo?
  
- 5) There are 13 teams of cheerleaders at a competition; the order of performance is determined at random. What is the probability that your team performs first and your friend's team second?
  
- 6) Suppose we roll a die;
  - A) What is the probability of getting an odd number or a prime?(Hint: compound event)
  
  
  - B) What is the probability that if we roll two dice, we get a 4 and a 5 OR a 6 and a 5?

- 7) A school with 300 students offers Mathematics and Science classes; 180 students take math; 150 students take science, and 30 students take neither math nor science.  
A) Draw a Venn Diagram where Mathematics is labeled A and Science B

B) Find how many students are taking both math and science

C)  $A' =$

D)  $(A \cup B)' =$

E)  $(A \cap B)' =$

F)  $(A \cap B) =$

G)  $(A \cup B)' =$

- 8) The test scores for an algebra class are: 75, 85, 97, 72, 86, 93, 91, 81, 85, 82, 88  
A) What measure of central tendency is best for this data (calculate it)

B) Make a stem and leaf plot

C) Make a box and whisker plot

D) Make a histogram showing both normal and cumulative frequencies