

\*\*\*\*\*

*General directions: Provide what is asked for in each item.*

**I. Lines, Points, Circles, and Parabolas**

- Find the value of  $a$  and  $b$  so that the line  $ax + y = b$  will pass through the point  $(-1,2)$  and parallel to a line whose slope is 1.
- Let  $l_1$  be the line  $2x + \beta y + 7 = 0$ ,  $l_2$  be the line  $y = \alpha x + 3$ , and  $l_3$  be the line  $(\beta + 2)x - 4y = 2$ . Find  $\alpha$  and  $\beta$  such that  $l_2$  is perpendicular to  $l_1$  and parallel to  $l_3$ .
- Find the radius and center of the circle with the following equations:
  - $x^2 + y^2 + 6x = 0$
  - $x^2 + 3x + y^2 + y = 0$
- Given  $y = 2x^2 + 5x + 2$  and  $y = x + 2$  Find
  - Find the slope and intercepts of  $y = x + 2$ .
  - Find the vertex and intercepts of  $y = 2x^2 + 5x + 2$
  - Find the intersection of the two.
- Find the values of  $k$  so that
  - $y = x^2 + kx + k + 8$  intersects the  $x$  axis at two distinct points.
  - $3x^2 - 4kx + k$  will have real roots.

**II. Find the solution set of the unknowns.**

- $\frac{x}{x^2 - 9} = \frac{2}{x} - \frac{6}{x^2 + 3x}$
- $(1 + \frac{1}{|x - 1|})^2 - (1 + \frac{1}{|x - 1|}) = 2$
- $\sqrt{3 + \sqrt{2x - \sqrt{7 + x}\sqrt{3 - x}}} = 2$
- $1 + x^2 = 2x + \sqrt{1 - x}$
- $|4 - x| \leq |3x + 2|$
- $x^2 - x - 4 = \sqrt{x^2 - x - 2}$
- $\frac{10 - 4x}{x^2 - 7x + 10} \geq 3$
- $\frac{|x^2|}{|4 - x|} \geq 2$
- $2x^{-1} - x^{-2} - 5 = 0$
- $\left| \frac{2x + 1}{x + 2} \right| > 1$
- $\left| \frac{x^2 - 7x}{x^2 - 4} \right| \leq 1$
- $\begin{cases} 2x - 3y + 2z = 1 \\ x + 2y - 3z = 5 \\ -2x + y - 5z = 7 \end{cases}$
- $\begin{cases} \frac{2}{x} - \frac{2}{y} = 1 \\ \frac{3}{x} + \frac{3}{z} = 4 \\ \frac{8}{y} - \frac{3}{z} = 3 \end{cases}$
- $\begin{cases} (x - 2)^2 + (y - 3)^2 = 4 \\ x + y + 3 = 0 \end{cases}$
- $\begin{cases} 3z - 2y - x^2 = 3 \\ 2z - 6y - x^2 = 4 \\ z - 2y + 3x^2 = 3 \end{cases}$

### III. Problem Solving.

1. The dimensions of a rectangle are  $\sqrt{3x - 5}$  inches and  $\sqrt{x + 1}$  inches. Find the area of the rectangle if the perimeter is 8 inches.
2. Two wheels, forbidden by their parents to love each other, are 50 meters away. After seeing each other, they roll towards each other (along a straight path) to “kiss”. The first wheel’s rate is 6m/s while The second wheel’s rate is 4m/s. As they start to roll, another wheel runs towards the second wheel at 8m/s. Upon reaching the second wheel, it turns around and runs back to the first wheel and continues back and forth until they meet. What is the distance traveled by the third wheel?
3. Harry Potter and the Ron Weasley can defeat Lord Voldemort together in 8 mins. However, Ron had a date with Hermione so he came 3 minutes later. So, the two wizards were able to defeat the Dark Lord 6 minutes later. How long can each wizard defeat you-know-who if they fight alone?
4. The Black Pearl traveled 3km downstream in 9 minutes, but it took 15 minutes for it to cover the same distance upstream. How fast is the Black Pearl in still water and what is the rate of the current?
5. Mr. Krabs invests part of P80000 at 9% annual simple interest and the rest at 11% annual simple interest. His annual income from these investments is P8500. How much is invested at each interest rate?
6. Professor Utonium has 40% Chemical X solution and 60% Chemical X solution. He needs to make 100L of solution of 48% concentrate (to ‘accidentally’ make perfect little girls). How much of each available solution should he use?

\*\*\*\*\*

*“It is the unknown we fear when we look upon death and darkness, nothing more.”*  
*-Albus Dumbledore*