You are allowed one page of notes and a calculator. No phones. More than 25pts to earn. Thanks!

Problem 1: (1pt) Multiply the following expressions and collect like power terms to give your answer as a polynomial in standard form:

$$(x-3)^2(x^2+1)$$

Problem 2: (3pt) Let $A = \{x \in \mathbb{R} \mid |x-1| \leq 3\}$ and $B = (3,6]$. Picture A and B on a number line and find $A \cup B$ and $A \cap B$ in interval notation.

Problem 3: (2pt) Find the domain of the expression $\sqrt{3x-21}$. Provide answer in interval notation.

Problem 4: (2pt) Assume $x, y > 0$ and use laws of algebra to determine A, B as indicated below:

$$x^A y^B = \sqrt[3]{\frac{y^{-2}(xy)^2}{x^{-1}y^3}}$$

Problem 5: (2pt) Peform the addition and simplify the resulting expression.

$$\frac{3-x}{2x+1} + 3$$

Problem 6: (4pt) **Factor** each $f(x)$ given below completely over $\mathbb{R}$ and **solve** $f(x) = 0$.

(a.) $2x^4 + x^3$,

(b.) $x^4 + 2x^2 - 24$.

Problem 7: (4pt) For each quadratic polynomial $f(x)$ given below, complete the square and find all real or complex solutions of $f(x) = 0$:

(a.) $f(x) = x^2 + 8x + 6$,

(b.) $f(x) = x^2 + 10x + 27$.

Problem 8: (3pt) **Choose one** of the the following equations to solve over $\mathbb{R}$,

(a.) $|2x + 1| = 11$

(b.) $\sqrt{x + 1} - \sqrt{x - 4} = 1$

Problem 9: (3pts) **Solve one** of the inequalities below and express your answer in interval notation as well as with a number line picture.

(a.) $\dfrac{1}{4} - \dfrac{1}{12}x \geq \dfrac{1}{6} - 3x,$

(b.) $|2x - 1| > 5,$

Problem 10: (3pts) Solve the following inequality using an appropriate technique. Show your work and write the answer using interval notation (you might need to use $\cup$ for union)

$$\frac{(x+4)^2(x+2)^3}{x^2(x-3)^5} \geq 0$$

Problem 11: (2pts) Use completing the square and algebra as needed to place each circle equation below into standard form. Find the center and radius of the circle.

$$x^2 - 4x + y^2 + 12y = 12$$

Problem 12: (1pt) Find the area of the triangle with vertices $P = (1,2)$, $Q = (1,7)$ and $R = (6,4)$. Show your work including appropriate diagrams.

Problem 13: (1pt) Consider the equation $\frac{x^2-1}{xy} = 0$. Is $P = (0,0)$ on the graph of the equation ? Is $Q = (1,3)$ on the graph of the given equation ?

Problem 14: (1pts) Find the equation of a line given that contains points $(2,-1)$ and $(3,5)$.