Please read these instructions carefully before beginning.

1. Do not open the exam until 5:30. You will have 90 minutes to complete the exam.

2. Final answers must be written clearly in the proper space provided. No credit will be given for illegible or ambiguous answers. Answers with no justification will not be given credit.

3. No notes, calculators, or electronic devices are permitted.
1. (15 points) Suppose the line $L_1$ has equation $-7x + 2y = 8$.

(a) Write the equation for $L_1$ in slope-intercept form. Identify the slope and $y$-intercept.

(b) Suppose another line $L_2$ passes through the point $(2, 7)$ and is perpendicular to line $L_1$. Write down the equation for $L_2$ in point-slope form.

(c) Graph both lines $L_1$ and $L_2$ in the $(x, y)$-coordinate plane.
2. (15 points) Let \( f(x) = 4\sqrt{2x - 3} \).

(a) Find the domain and range of \( f(x) \). Write your answer in interval notation.

(b) Find the inverse function \( f^{-1}(x) \).

(c) Find the domain and range of \( f^{-1}(x) \).

(d) Explain in your own words why a function \( f(x) \) must be **one-to-one** in order to have a well defined inverse function.
3. (15 points) Recall that if $f(x)$ is an even function then its graph is symmetric about the $y$-axis. If $f(x)$ is an odd function then its graph is symmetric though the origin.

(a) Write down the algebraic definition for $f(x)$ to be an even function.

(b) Write down the algebraic definition for $f(x)$ to be an odd function.

(c) Is the function $f(x) = 2x^2 - 9$ even, odd or neither? Justify your answer algebraically.
4. (15 points) Let $g(x)$ be the function whose graph is shown below.

(a) What is a possible simple function whose graph could be shifted and scaled into $g(x)$ when $x \leq 1$?

(b) What is a possible simple function whose graph could be shifted and scaled into $g(x)$ when $x > 1$?

(c) Write down an equation for the entire function $g(x)$. (Hints: Your final answer will be piecewise defined; each piece will be a shifted version of the simple functions from parts a and b; test points to see if you have the correct scaling factors)
5. (10 points) Simplify the following expression. Write down your final answer with only **positive** exponents.

\[
\left( \frac{y^{-10}(x^4t^{11})^3}{x^{-1}(t^3)^4y^{8}x^{5}} \right)^{-2}
\]
6. (15 points) Let \( h(t) = -t^7 - 5t^4 + 14t \).

(a) What is the maximum possible number of zeros that this function, \( h(t) \), could have? Does \( h(t) \) necessarily have this number of zeros?

(b) Find all the real numbers, \( r \), such that \( h(r) = 0 \).

(c) i. As \( t \) becomes large in the positive or negative direction, which term of \( h(t) \) is the overall function behaving like?

ii. Describe the behavior of the function \( h(t) \) as \( t \) becomes large and positive (approaches \( +\infty \)).

iii. Describe the behavior of function \( h(t) \) as \( t \) becomes large and negative (approaches \( -\infty \)).
7. (15 points) Consider the following linear system of equations.

\[
\begin{align*}
    x + 2y & = 5 \\
    y - z & = -1 \\
    x + 2y + z & = 8
\end{align*}
\]

(a) Solve this system of equations.

(b) Explain in your own words what these three linear equations and their solution means geometrically.
Extra Credit (10 points) Consider the following polynomial functions.

\[ p(x) = -7x^3 + 4x^2 + 2 \quad \quad \quad q(x) = x^2 + 2 \]

1. What is the remainder when you divide \( p(x) \) by \( q(x) \)?

2. For large values of \( x \), what is the end behavior of the rational function \( r(x) = \frac{p(x)}{q(x)} \)?