No notes or books allowed. A scientific calculator is allowed.

You may assume that two-dimensional graphs are in the usual Cartesian xy-plane. Give exact answers, unless you are told to approximate.

**SHORTER PROBLEMS (33 POINTS)**

1) (5 points). Write the domain of \( f \), where \( f(x) = \frac{\sqrt[4]{x} + 2}{x - 3} \), using interval form, the form using parentheses and/or brackets.

2) (3 points). Find and box in the x-intercept(s) (if any) of the graph of \( y = \frac{\sqrt{x^2 - 25}}{x - 5} \) in the usual xy-plane. If there are none, write “NONE.”

3) (1 point). The graph of \( y = \frac{1}{x^4} - x^6 \) is symmetric about … (Box in one:)

   - the x-axis
   - the y-axis
   - the origin
   - (none of these)

4) (1 point). The graph of \( y = x^7 + 1 \) is symmetric about … (Box in one:)

   - the x-axis
   - the y-axis
   - the origin
   - (none of these)

5) (6 points total). If the point \( (1, -5) \) lies on the graph of \( y = f(x) \), where \( f \) is a one-to-one function, what point must then lie on the graph of …

   a) … \( y = f(x - 1) + 4 \)?

   b) … \( y = -f(x) \)?

   c) … \( y = f^{-1}(x) \)?
6) (4 points). The graph below is obtained by taking a basic graph from Section 1.3 and applying rigid transformations. Find an equation for the graph.

Fill in the blank: \( y = \) ________________.

7) (1 point). Evaluate \([-7.1]\). (This is the same as \([-7.1]\).)

8) (6 points). Match the equations with their corresponding graphs by writing the appropriate letters in the blanks. The x- and y-axes are not necessarily scaled the same way.

The graph of \( y = \frac{1}{x} \) is Graph ____.

The graph of \( y = \frac{1}{x^2} \) is Graph ____.

The graph of \( y = \sqrt[3]{x} \) is Graph ____.

The graph of \( y = x^{2/3} \) is Graph ____.

The graph of \( y = \sqrt{16 - x^2} \) is Graph ____.

The graph of \( y = |x| \) is Graph ____.
9) (2 points). Find functions $g$ and $f$ such that $(f \circ g)(x) = \sqrt[3]{x^2 + 1}$.

You may not use the identity function. Fill in the blanks:

$g(x) =$ \underline{__________} \hspace{1cm} f(u) =$ \underline{__________}

10) (2 points). Graph $x = y^2 - 2$ on the grid below.

11) (2 points). Let $f(x) = \sqrt{x + 4}$. What is $f^{-1}(x)$?

LONGER PROBLEMS (27 POINTS)

Show all work, simplify as appropriate, and use “good form and procedure” (as in class). Box in your final answers!

12) Let $s(t) = t^3 - 2t$. Find the average rate of change of $s$ from $t = 1$ to $t = 4$.

Assume that $t$ is time measured in seconds and $s(t)$ is the position of a particle measured in meters. (The particle is moving along a coordinate line.) Write the appropriate unit in your final answer.

Note: You are finding the average velocity of the particle between $t = 1$ second and $t = 4$ seconds. (7 points)
13) $f$ is the function defined piecewise by: 

$$f(x) = \begin{cases} 
  x^2 - 1, & -2 \leq x < 2 \\
  1 - x, & x \geq 2 
\end{cases}. \quad (11 \text{ points})$$

a) Evaluate $f(-2)$. (1 point)

b) Evaluate $f(2)$. (1 point)

c) Graph $y = f(x)$ on the grid below. Be accurate. Clearly indicate whether endpoints are included or excluded, as in class. (6 points)

d) Give the domain of the function $f$ using interval form (the form with parentheses and/or brackets). (1 point)

e) Give the range of the function $f$ using interval form (the form with parentheses and/or brackets). (2 points)
14) Let \( f(x) = \sqrt{x} \). Simplify the difference quotient completely:

\[
\frac{f(x + h) - f(x)}{h}
\]

Hint: You will need to rationalize a numerator. (9 points)