I. Simplify. Identify the zeros, vertical asymptotes, horizontal asymptotes, holes and sketch each rational function.

1. \( f(x) = \frac{x^3 - x}{x^3 - 4x} \)  
2. \( f(x) = \frac{x - 4}{x^2 - 3x - 4} \)  
3. \( f(x) = \frac{x^2 - 4x - 32}{x^2 - 16} \) 

II. Complete the following identities:

1. \( \sin^2 x - \cos^2 x = \)  
2. \( 1 + \tan^2 x = \)  
3. \( \cot^2 x + 1 = \)  
4. \( \cos 2x = \)  
5. \( \sin 2x = \)
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III. Simplify each expression:
1. \( \frac{1}{x+h} - \frac{1}{x} \)
2. \( \frac{2}{x^3} \)
3. \( \frac{1}{3+x} \frac{1}{3} \)
4. \( \frac{2x}{x^2-6x+9} - \frac{1}{x+1} - \frac{8}{x^2-2x-3} \)

IV. Solve for \( z \):
1. \( 4x + 10yz = 0 \)
2. \( y^2 + 3yz - 8z - 4x = 0 \)

V. If \( f(x) = \{(3,5), (2,4), (1,7)\} \)  \( g(x) = \sqrt{x-3} \)  \( h(x) = \{(3,2), (4,3), (1,6)\} \)  \( k(x) = x^2 + 5 \) determine each of the following:
1. \( (f + h)(1) = \) ____________  
2. \( (k - g)(5) = \) ____________
3. \( (f \cdot h)(3) = \) ____________  
4. \( (g \cdot k)(7) = \) ____________
5. \( f^{-1}(x) = \) ____________  
6. \( k^{-1}(x) = \) ____________
7. \( \frac{1}{f(x)} = \) ____________  
8. \( (kg)(x) = \) ____________
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VI. Miscellaneous: Follow directions for each problem.

1. Evaluate \( \frac{f(x+h) - f(x)}{h} \) and simplify if \( f(x) = x^2 - 2x \).

2. Expand \((x + y)^3\)

3. Simplify: \( x^2 \left( x + \frac{5}{2} - x^2 \right) \)

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VII. Simplify:

1. \( \frac{\sqrt{x}}{x} \)

2. \( e^{\ln 3} \)

3. \( e^{(1+\ln x)} \)

4. \( \ln 1 \)

5. \( \ln e^7 \)

6. \( \log_3(1/3) \)

7. \( \log_{1/2} 8 \)

8. \( \ln \frac{1}{2} \)

9. \( e^{3\ln x} \)

10. \( \frac{-4xy^{-2}}{12x^3y^{-5}} \)

11. \( 27^{2/3} \)

12. \( (5a^{2/3})(4a^{3/2}) \)

13. \( (4a^{5/3})^{3/2} \)

14. \( \frac{3(n+1)!}{5n!} \)
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VIII. Using the point-slope form \( y - y_1 = m(x - x_1) \), write an equation for the line:

1. with slope \(-2\), containing the point \((3, 4)\)

2. containing the points \((1, -3)\) and \((-5, 2)\)

3. with slope 0, containing the point \((4, 2)\)

4. perpendicular to the line in problem #1, containing the point \((3, 4)\)

IX. Without a calculator, determine the exact value of each expression:

1. \(\sin 0\)
2. \(\sin \frac{\pi}{2}\)
3. \(\sin \frac{3\pi}{4}\)

4. \(\cos \pi\)
5. \(\cos \frac{3\pi}{4}\)
6. \(\cos \frac{\pi}{3}\)

7. \(\tan \frac{7\pi}{4}\)
8. \(\tan \frac{\pi}{6}\)
9. \(\tan \frac{2\pi}{3}\)

10. \(\cos(\sin^{-1} \frac{1}{2})\)
11. \(\sin^{-1}(\sin \frac{7\pi}{6})\)

X. For each function, determine its domain and range:

\[ f(x) = x - 4 \quad \text{and} \quad g(x) = x^2 - 4 \]

<table>
<thead>
<tr>
<th>Function</th>
<th>Domain</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>1. (\sqrt{f(x)})</td>
<td></td>
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<tr>
<td>2. (\sqrt{g(x)})</td>
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<tr>
<td>3. (f(g(x)))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. (g(f(x)))</td>
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</tbody>
</table>
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XI. Graph each function. Give its domain and range.

1. \( y = \sin x \)

2. \( y = e^x \)

3. \( y = \sqrt{x} \)

4. \( y = \frac{1}{\sqrt{x}} \)

Domain__________________

Range__________________

Domain__________________

Range__________________

Domain__________________

Range__________________

Domain__________________

Range__________________
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5. \( y = \ln x \)

6. \( y = |x + 3| - 2 \)

7. \( y = \frac{1}{x} \)

8. \( y = \begin{cases} x^2 & \text{if } x < 0 \\ x + 2 & \text{if } 0 \leq x \leq 3 \\ 4 & \text{if } x > 3 \end{cases} \)
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XV. A function \( f \) is defined on the closed interval from -3 to 3 and has the graph to the lower left:

(a) On the axes provided sketch the entire graph of \( y = |f(x)| \).

(b) On the axes provided sketch the entire graph of \( y = f(\lceil x \rceil) \).

(c) On the axes provided sketch the entire graph of \( y = f(-x) \).

(d) On the axes provided sketch the entire graph of \( y = f\left(\frac{1}{2}x\right) \).

(e) On the axes provided sketch the entire graph of \( y = f(x-1) \).