MATH 1040  
Test 1  
Version A  
Fall 2015  
QP 1-14, 18-24  
App B, C, D

Student’s Printed Name: ________________________  
CUID: __________________

Instructor: ______________________  
Section # : __________

You are not permitted to use a calculator on any part of this test. You are not allowed to use any textbook, notes, cell phone, laptop, PDA, or any technology on any part of this test. All devices must be turned off while you are in the testing room.

During this test, any communication with any person (other than the instructor or his designated proctor) in any form, including written, signed, verbal, or digital, is understood to be a violation of academic integrity.

No part of this test may be removed from the testing room.

Read each question very carefully. In order to receive full credit, you must:
1. Show legible and logical (relevant) justification which supports your final answer.
2. Use complete and correct mathematical notation.
3. Include proper units, if necessary.
4. Give exact numerical values whenever possible.

You have 90 minutes to complete the entire test.

On my honor, I have neither given nor received inappropriate or unauthorized information at any time before or during this test.

Student’s Signature: ________________________

Do not write below this line.

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Test Total 100
Read each question carefully. In order to receive full credit you must show legible and logical (relevant) justification which supports your final answer. Give answers as exact answers. You are NOT permitted to use a calculator on any portion of this test.

1. (8 pts.) Evaluate $\sin\left(\frac{13\pi}{3}\right) + \cos\left(-\frac{11\pi}{6}\right) - \tan\left(\frac{\pi}{4}\right) + \csc\left(\frac{\pi}{2}\right)$.

2. (6 pts.) Find all real solutions of the equation $x^4 - x^2 - 6 = 0$.

3. (5 pts.) State the domain of the function $g(x) = \frac{\sqrt{5-x}}{x^2}$. Show work, not just an answer. State your answer in interval notation.
4. Consider the parabola $y = 2x^2 - 8x + 12$.

a. **(4 pts.)** Complete the square to write the parabola in the form $y = a(x-h)^2 + k$.

b. **(1 pt.)** State the coordinates of the vertex of the parabola.

c. **(3 pts.)** Sketch the graph of the parabola.

5. **(6 pts.)** Suppose $\sec x = -\frac{13}{5}$ and $\pi < x < \frac{3\pi}{2}$. Find $\sin 2x$.
6. Consider the equation of the circle $y^2 + (x - 3)^2 = 4$.

a. (1 pt.) What is the radius of the circle?

b. (1 pt.) What are the coordinates of the center of the circle?

c. (3 pts.) Sketch the graph of the circle.

7. (6 pts.) Given that $x = 2$ is a root of the polynomial $f(x) = x^3 + 4x^2 - 7x - 10$, find all other roots of the expression. Show all of your work in a clear, logical manner.

Real roots of $f(x)$: $x = 2$, ________________
8. **(6 pts.)** Find the solution(s) of the equation \(4x^2 + \frac{9}{2}x + \frac{1}{2} = 0\).

9. **(4 pts.)** State the equation for each of these basic graphs. Note that neither graph has been shifted, scaled, or reflected from the basic position.
   a. \[ f(x) = \]
   b. \[ g(x) = \]
10. (4 pts.) Find the real root(s) of the rational function \( f(x) = \frac{x^2 - 9}{x + 3} \).
Also find the \( y \)-intercept.

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<tr>
<td>( y )-intercept</td>
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11. (3 pts.) This is a transformed \textbf{cosine} curve. Write an equation for this curve.
   Note that \textbf{no phase shifts} were applied.

\[ y = \underline{\text{______________}} \]

\textit{Your answer must contain cosine, not sine.}

12. (5 pts.) Perform the subtraction below, simplify completely, and present your answer as a single fraction.
\[
\frac{x^2 + 2}{x - 1} - \frac{x + 3}{3}
\]
13. A pot of water is placed on the stove. The temperature of the water is initially 20 degrees Celsius. As the water is heated, its temperature increases by 5 degrees per minute.

a. (4 pts.) Express the temperature of the water (in degrees Celsius) as a linear function of time $t$ in minutes.

b. (3 pts.) How long will it take the water to boil?
Note: Water boils at 100 degrees Celsius.
Be sure to include units on your final answer.

14. (4 pts.) Given $f(x)$ as graphed below, sketch $-f(x + 2)$.

![Graph of $f(x)$ with a parabolic shape.]}
15. Let $f(x) = \begin{cases} 
|x| & x \leq 0 \\
x^2 + 1 & x > 0
\end{cases}$

a. (1 pt.) Evaluate $f(-3) =$ 

b. (1 pt.) Evaluate $f(0) =$

c. (4 pts.) Graph $f(x)$. Clearly label at least one point on each piece of the function.

d. (2 pts.) State the range of $f(x)$. State your answer in interval notation.

16. (4 pts.) Let $g(x) = x - 1$.

Find a function $f(x)$ that satisfies the composition $(f \circ g \circ g)(x) = f(g(g(x))) = x^2 - 4x + 4$. 
17. (6 pts.) Solve the following equation on \([0, 2\pi]\)
\[6\sin^2 x = 3\]

18. (5 pts.) Find the equation of the line \textbf{perpendicular} to the line \(y = -\frac{5}{7}x + 1\) passing through the point \((10, 0)\). Present your answer in slope-intercept form.