INSTRUCTIONS: Simplify and box all your answers. Write neatly and show all work. A correct answer with incorrect or no supporting work may receive no credit. Books, notes, electronic devices (such as calculator or unauthorized electronic resources) are not permitted. Give all answers in exact form.

1. Write the word “agree” as your answer to question 1 to indicate that you will abide by the University honor code for this exam. An honor code violation on the final exam will result in an F in the course.

2. Simplify the following: (21 pts)
   
   (a) \((x - 1)^2 - (3x + 1)(2x - 7)\)
   
   (b) \(\frac{8x^2y^3 - 6x^3y}{2x^2y}\)
   
   (c) \((8x^4y^{-5}) \left( \frac{1}{2} x^{-5} (2y^2)^3 z^0 \right)\)
   
   (d) \(\left( \frac{a^{1/2}c^{1/3}}{a^{-1/2}c^{1/6}} \right)^{-1}\)
   
   (e) \(\sqrt{8x^2y^8}\)
   
   (f) \(\log_5(25) - e^{3\ln 2} + \log(1)\)
   
   (g) \(\frac{1}{a-1} - a \frac{1}{a-1} + 1\)

3. Solve the following equations for \(x\): (24 pts)
   
   (a) \((x - 3)^2 = 7\)
   
   (b) \(\frac{1}{x - 2} + \frac{3}{x + 2} = 1\)
   
   (c) \(3 = \sqrt{17} - x - x\)
   
   (d) \(\log_3(x) = 1 - \log_3(x - 2)\)
   
   (e) \(3^{-x-2} = 27\)
   
   (f) \(2^{x-1} = 5^x\)

4. Consider the function \(f(x) = \frac{3x}{2x^3 - 8x}\). Answer the following: (16 pts)
   
   (a) Find the domain of \(f(x)\)
   
   (b) Determine whether \(f(x)\) is odd, even, or neither. Justify your answer.
   
   (c) Find \(x, y\)-coordinates of any hole(s). If there are none write NONE.
   
   (d) Find any horizontal/slant asymptotes. If there are none write NONE.

KEEP GOING - Exam Continued on Next Page
5. The following graph has equation of the form \( y = a(x - h)^2 + k \). Find the equation of the function whose graph is given. (5 pts)

![Graph with points (-3, 1), (-5, -2), and (-1, -2)]

6. Sketch the graph of the following functions. Label all intercepts and asymptotes as appropriate. (16 pts)
   
   (a) \( f(x) = \ln(x - 1) \)
   (b) \( g(x) = -\sqrt{x} \)
   (c) \( h(x) = \tan x \) on the restricted domain \( \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \)
   (d) \( k(x) = \tan^{-1} x \)

7. Given the following graph, identify a polynomial function that results in the graph. (5 pts)

![Graph with x-axis from -3 to 5 and y-axis from -6 to 3]

8. You are standing 94 feet from the base of a building. You estimate that the angle of elevation to the top of the 86th floor (the observatory) is \( 72^\circ \). If the total height of the building is another 50 feet above the 86th floor, what is the height of the building? Leave your answer in exact form, do not attempt to approximate your answer. (6 pts)
9. Find the exact value: (17 pts)

(a) \( \sin \left( \frac{11\pi}{6} \right) \)
(b) \( \sec \left( \frac{2\pi}{3} \right) \)
(c) \( \tan^{-1}(1) \)
(d) \( \arcsin \left( \sin \left( \frac{5\pi}{4} \right) \right) \)
(e) \( \csc \left( \cos^{-1} \left( \frac{1}{2} \right) \right) \)

10. If an angle \( \theta \) is in the interval \( \left( -\frac{\pi}{2}, \frac{\pi}{2} \right) \) and we know \( \sin \theta < 0 \), what quadrant does \( \theta \) lie in? (4 pts)

11. Verify the identity: \( \frac{1}{1 + \cot^2 \theta} + \cos^2 \theta = 1 \) (6 pts)

12. Find all solutions to the following equations: (10 pts)

(a) \( 2 \sin \theta = \sqrt{3} \)
(b) \( \cos (3\theta) \tan \theta - \frac{1}{2} \tan \theta = 0 \)

13. Find the exact value: (8 pts)

(a) \( \sin(10^\circ) \cos(20^\circ) + \sin(20^\circ) \cos(10^\circ) \)
(b) \( \sin \left( \frac{\pi}{8} \right) \)

14. For \( y = 2 \cos \left( \pi x + \frac{\pi}{2} \right) \) (12 pts)

(a) Identify the amplitude.
(b) Identify the period.
(c) Identify the phase shift.
(d) Sketch two cycles of the curve.

End of Exam

Formula sheet on next page.
Formulas that may be useful:

1. $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

2. The quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

3. Arc length: $s = r\theta$

4. $\sin^2 \theta + \cos^2 \theta = 1$

5. $\tan^2 \theta + 1 = \sec^2 \theta$

6. $\sin(a - b) = \sin a \cos b - \sin b \cos a$

7. $\cos(a - b) = \cos a \cos b + \sin a \sin b$

8. $\cos(2\theta) = \cos^2 \theta - \sin^2 \theta$

9. $\cos(2\theta) = 2\cos^2 \theta - 1$

10. $\sin\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 - \cos \theta}{2}}$

11. $\sin^2 (\theta) = \frac{1 - \cos(2\theta)}{2}$

12. $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

13. Circle: $(x - h)^2 + (y - k)^2 = r^2$

14. Area of a sector: $A = \frac{1}{2}r^2\theta$

15. $1 + \cot^2 \theta = \csc^2 \theta$

16. $\sin(a + b) = \sin a \cos b + \sin b \cos a$

17. $\cos(a + b) = \cos a \cos b - \sin a \sin b$

18. $\sin(2\theta) = 2\sin \theta \cos \theta$

19. $\cos(2\theta) = 1 - 2\sin^2 \theta$

20. $\cos\left(\frac{\theta}{2}\right) = \pm \sqrt{\frac{1 + \cos \theta}{2}}$

21. $\cos^2 (\theta) = \frac{\cos(2\theta) + 1}{2}$