1. Find the domain of each of the following functions:
   \[(a) \quad f(x) = \frac{1}{x^2 + x - 6} \quad (b) \quad g(x) = \sqrt{x^2 - 49}\]
2. (a) Write \(\frac{5+3i}{2+i}\) in the form \(a+bi\), where \(a\) and \(b\) are real numbers.
   (b) Solve \(|2x - 1| < 7\).
3. (a) Find an equation of the straight line that passes through the point 
    \((1, -1)\) and is perpendicular to the line \(2x + 3y = 6\).
   (b) Find the distance between the points \((1, -2)\) and \((-1, 0)\).
4. (a) Find the center and radius of the circle having equation
    \(x^2 + y^2 - 2x - 6y + 9 = 0\).
   (b) Sketch the circle in part (a).
5. Solve the inequality \((x + 5)(x - 1) \geq 0\). Write the solution using 
    interval notation and sketch it on the real number line.
6. Let \(f(x) = -x^2 + 3\). Find \(\frac{f(x+h)-f(x)}{h}\) and simplify your answer.
7. Solve the following equation: \(\sqrt{2x - 3} = x - 6\)
8. Sketch the graph of \(y = -x^2 + 4x - 3\).

   Indicate (as coordinates) its vertex and \(x\) and \(y\) intercepts.

Please turn over!

1
PART II: Answer 6 out of 8 questions. Each question is worth 6 points. Justify each answer and show all your work.

9. Suppose the graph \( y = x^2 \) is given.
   (a) Describe how the graph of \( y = -(x + 3)^2 - 1 \) can be obtained from the graph of \( y = x^2 \).
   (b) Sketch both graphs on the same coordinate plane and indicate their vertices and (if any) x and y intercepts.

10. Find all zeros (also called roots), real or complex, of the polynomial \( P(x) = 2x^3 - 3x^2 + 2x - 1 \). **Hint:** First use the Rational Zeros Theorem and then the quadratic formula if necessary.

11. Let \( f(x) = \frac{3x + 6}{x - 2} \).
    (a) Find the x and y intercepts of the graph of \( f(x) \).
    (b) Find the vertical and horizontal asymptotes of \( f(x) \).
    (c) Use the information above to sketch the graph of \( f(x) \).

12. A 50-foot ladder leans on a vertical wall. Suppose the bottom of the ladder is 25 feet away from the wall. Find the angle which the ladder makes with the ground.

13. (a) Let \( \theta \) be an acute angle and let \( \sec \theta = \sqrt{2} \). Find \( \cot \theta \).
    (Do not use your calculator).
    (b) In triangle \( ABC \) with right angle at \( C \), side \( a = 6\sqrt{3} \) and side \( b = 6 \). Find angle \( A \).
    (Do not use your calculator).

14. Verify the following identity: \( \frac{\tan^2 \theta + 1}{\tan \theta \csc^2 \theta} = \tan \theta \)

15. **Without** using your calculator
    (a) Convert \( \frac{2\pi}{3} \) radians to degrees.
    (b) Evaluate and simplify the following expression:
        \( (\sin \frac{\pi}{4} + \cos \frac{\pi}{6}) \cot \frac{\pi}{3} \)

16. Solve the system of equations:
    \[-9x + 3y = 30 \]
    \[8x - 4y = 24 \]

End of Examination