Part I (60 points). Answer all five (5) questions.

QUESTION 1.

a) Find an equation of the straight line passing through the point P(3, -4) and perpendicular to the line with equation \(5x - 4y = 7\).

b) Find the center and radius of the circle with equation
\[x^2 + y^2 + 8x - 12y + 27 = 0\]
and sketch its graph showing at least four points on it.

QUESTION 2.

a) Find the vertex and all of the \(x\) and \(y\) intercepts of the parabola
\[y = -3x^2 + 12x + 15\]
and sketch its graph using this information.

b) Simplify and express \((3 + 4i)/(2 - i)\) in the form \(a + bi\), where \(a, b\) are real numbers.

QUESTION 3.

a) Use the rational root test to list all possible rational roots of the equation
\[2x^3 - 7x^2 + 6x + 5 = 0\]
and find all the roots of the equation given that there is a fractional root.

b) Find the exact value of \(\log_2(1/8) + (16)^{-3/2}\).

QUESTION 4.

a) Find the vertical and horizontal asymptotes and all the intercepts and sketch the graph of the function
\[f(x) = \frac{2x + 3}{x - 4}\]

b) Find and graph the solution set of \(|\frac{2x - 5}{3}| \leq 1\).

QUESTION 5.

a) Find the amplitude and period of the function \(f(x) = 4 \sin(2x)\) and sketch its graph over the interval \(0 \leq x \leq 2\pi\).

b) Find the exact value of \(\csc(4\pi/3)\).
Part II (40 points). Answer any four (4) of the six (6) questions.

QUESTION 6.
Solve each of the following equations and check your answers.
a) \( \sqrt{16 - x} + 4 = x \), b) \( \log_7 x + \log_7(2x - 13) = 1 \).

QUESTION 7.
Given functions
\( f(x) = \frac{2x + 1}{x - 3}, \quad g(x) = 2x^2 + x + 3 \)
find each of the following:
a) \((g \circ f)(2)\), b) \((f \circ g)(x)\), c) the inverse function \( f^{-1}(x) \).

QUESTION 8.
a) Find and simplify \( \frac{f(x + h) - f(x)}{h} \) given \( f(x) = x^2 - 2x + 3 \).
b) Solve the equation \( (27)^{2x-3} = 9^x \).

QUESTION 9.
a) Find the center, vertices and foci of the ellipse
\( \frac{(x + 2)^2}{4} + \frac{(y - 3)^2}{9} = 1 \)
and sketch its graph showing these points.
b) Find the domain of the function
\( h(x) = \frac{\sqrt{13 - 3x}}{4 - x^2} \).

QUESTION 10.
a) Evaluate exactly \( \tan(\arcsin(-\frac{2}{3})) \).
b) Verify the identity
\( \frac{\cos \theta}{\sec \theta - \tan \theta} = 1 + \sin \theta \).

QUESTION 11.
a) Find \( \sin(2\theta) \) given that \( \theta \) is in the third quadrant and \( \tan \theta = 5/12 \).
b) Find the term involving \( y^3 \) in the expansion of \( (x + 2y)^9 \).