Part I: Answer all 6 questions in this part (10 points each)

1. Let $p(x) = 2x^3 - 7x^2 - 14x - 5$

    (a) Use the **Rational Root Theorem** to list **all** possible roots of $p(x) = 0$

    (b) Find all roots of $p(x) = 0$

2. (a) Find the vertex, y-intercept and x-intercepts of the graph of the parabola $y = x^2 - 4x - 5$

    (b) **Sketch** the graph labeling the vertex and all intercepts

3. (a) Find the equation of the **ellipse** with vertices at $P(-9, 4)$, $Q(-3, 7)$, $R(3, 4)$, $T(-3, 1)$.

    (b) **Sketch** the graph, label the **major** and **minor** axes and the **foci**.

4. Sketch the graph of of the hyperbola

$$\frac{(x-3)^2}{36} - \frac{(y+5)^2}{64} = 1$$

    Label the center, vertices, foci and the asymptotes.

5. Sketch the graph of $y = 3\sin 2x$ over the interval $0 \le x \le \pi$. Indicate all intercepts. (Use increments of $\pi/8$ on the x-axis.)

6. Let $f(x) = \dfrac{4x - 12}{x + 3}$

    (a) Find the vertical and horizontal asymptotes

    (b) Find all x and y intercepts

    (c) Using the above information, **sketch** the graph of $f(x)$

Please turn over!

Part II. Answer 8 out of 10 problems on this part (5 points each)

7. Find the equation of the perpendicular bisector of the line segment PQ where $P(-3, -2)$ and $Q(5, 6)$.

8. (a) If $\sin A = -8/17$ and A is in quadrant III, find the numerical value of $\cos 2A$

   (b) Find the exact value of $\cos(\arctan(-3/4))$.

9. Find the center and radius of the circle $x^2 + y^2 + 6x - 10y + 9 = 0$

10. Prove the trigonometric identity:

$$\frac{\sin x + \tan x}{1 + \sec x} = \sin x$$

11. Solve and check : $\sqrt{x + 24} - x = 4$

12. Solve and check: $\log_{10} x + \log_{10}(x - 21) = 2$

13. (a) Solve the inequality $|3x - 5| \leq 4$

    (b) Find the **domain** of the function $f(x) = \dfrac{\sqrt{4 - x^2}}{1 - x^2}$

14. Let $f(x) = 3x - 2$ and $g(x) = x^2 + 2$.
    Find   (a) $(f \circ g)(x)$ (b) $(f \circ f)(x)$ (c) $(g \circ f)(-2)$

15. (a) Given that $f(x) = \dfrac{x - 1}{2x + 3}$ is a one-to-one function, find the **inverse** function $f^{-1}(x)$.

    (b) Show $f(-1) = -2$, then show that $f^{-1}(-2) = -1$.

16. Let $A = -1$ and let $f(x) = 3x^2 - 2x$. Find and simplify

$$\frac{f(x) - f(A)}{x - A}$$