Show all work and justify all your answers!

Calculator answers are not acceptable in starred (*) questions!

Part I: (40 points) Do all FIVE questions in this part.

1. (a) Find the midpoint of the line segment with endpoints A(−1, 5) and B(7, 3).
   (b) Find an equation of the straight line through the point (1, 7) parallel to the straight line passing through A and B.

2. (a) Sketch the graph of the quadratic function $y = x^2 - 14x + 46$. Where is the function increasing? decreasing? What are the coordinates of its maximum (or minimum)?
   (b) Simplify $\frac{1 + 2i}{-2 + 3i}$. Express your answer in the form $a + bi$, where $a$ and $b$ are real numbers.

3. (a) Give the term involving $y^8$ in the expansion of $(2x - y^2)^{10}$.
   (b) *Evaluate $\log_9 27 + \log_7 \frac{1}{49}$.

4. Solve each of the following inequalities. Use interval notation to describe your solution.
   (a) $|4 - 5x| > 49$
   (b) $\frac{3 - 2x}{x + 2} \leq 0$

5. (a) *Find the sin, tan and sec of the angle $\theta$ in standard position if $(-12, -5)$ is a point on the terminal side.
   (b) Convert the expression $\log_b \left( \frac{\sqrt[3]{X}}{YZ^3} \right)$ into an expression involving $\log_b X$, $\log_b Y$ and $\log_b Z$.
   (c) *Evaluate $\cos^{-1}(\frac{\sqrt{3}}{2}) + 2\tan^{-1}(\sqrt{3})$

Please turn over!
Part II. (60 points) Do SIX of the following seven questions.

6. (a) Find the center and radius of the circle having the equation
   \[ x^2 + y^2 + 6x - 8y = 7 \]

   (b) Find the center, vertices, equations of the asymptotes and sketch the hyperbola with equation
   \[ \frac{(x+6)^2}{4} - \frac{(y-4)^2}{16} = 1 \]

7. (a) Solve \( \log_7(x) + \log_7(2x - 13) = 1 \).

   (b) Solve \( \sqrt{16 - x + 4} = x \).

8. \( f(x) = 2x + 3 \) and \( g(x) = x^2 + 4x + 3 \). Find and simplify
   
   (a) \( g \circ f(x) \)

   (b) \( f^{-1}(x) \)

9. (a) Use the Rational Root theorem to list all possible rational roots of the equation \( 4x^3 + 4x^2 - 35x + 52 = 0 \).

   (b) Show that \( -4 \) is a root of the equation of part (a), and find the remaining roots.

10. (a) *Find exactly* the \( \sin, \sec \) and \( \tan \) of the angle \( t \) if \( \cos t = \frac{4}{9} \) and angle \( t \) is in the fourth quadrant.

   (b) Use your calculator to find a seven digit approximation to the angle \( t \). Your answer should be in radians!

   (c) Sketch the graph of \( y = \sin^{-1} x \)

11. (a) Find the amplitude and period of \( c(x) = 2 \cos 3x \).

   (b) Sketch the graph of \( y = c(x) \) over one period of the function. Label the points at which the maximums and the minimums of \( c(x) \) occur.

12. (a) Find the intercepts, asymptotes and sketch the graph of
   \[ r(x) = \frac{x + 2}{x^2 - 6x + 5} \]

   (b) Verify the identity:
   \[ \cos^4 x - \sin^4 x = \cos 2x \]

Place the numbers of the question you chose to omit in Part II on the front of your booklet!