Name_____ School_____

SENIOR DIVISION
Category 1: Exponents and Logarithms

CALCULATORS NOT ALLOWED

1. (2 pts) Give the value of $\log_2 64 + \log_7 1 + \log_3 3$ 1. _____

2. (3 pts) Solve for x: $\log(2x+2) + \log(x-9) - \log 2 = \log 24$

2. _____

3. (5 pts) If x and y are both positive integers, list all possible solutions for x and y.

$$\log_3(\log_2 4x^y) = 2$$

3. _____

Name_____ School_____

SENIOR DIVISION
Category 3: Trigonometric Functions, Identities and Equations

CALCULATORS NOT ALLOWED

1. (2pts) If $\sin\theta = -\frac{6}{7}$, with θ in quadrant IV, find $\cos\theta$. 1. _____

2. (3pts) Simplify $\cos x + \sin x \tan x$ 2. _____

3. (5 pts) Write $\frac{1}{1+\sin x}$ so that it is not in fractional form. 3. _____

Name_____ School_____

SENIOR DIVISION
Category 2: Higher Degree Functions

CALCULATORS NOT ALLOWED

1. (2pts) Factor the polynomial $f(x) = x^3 + x^2 - 3x - 3$ if $f(\sqrt{3}) = 0$ and $f(-\sqrt{3}) = 0$.

1. _____

2. (3 pts) Solve for x: $x^5 - 7x^3 = -10x$

2. _____

3. (5pts) If $f(x) = -3x - 7x^4 + 3x^5 - 2x^3$, how many (if any) zero roots, positive roots, negative roots and complex roots does this function have?

3. Zero roots: _____

Positive roots: _____

Negative roots: _____

Complex roots: _____

Names _____ School _____

_____

_____

SENIOR DIVISION
Category 4: Conic Section Team (Pass in only one paper)

1. (2 pts) Write the equation of an ellipse with a center at (3,-1), a vertical major axis of length 6 and a horizontal minor axis of length 4.

1. _____

2. (3 pts) Write the equation of a parabola with a vertex at (-3, -1) and a directrix $y = 4$.

2. _____

3. (5 pts) Given the equation $4x^2 + 40x - 5y^2 - 30y - 45 = 0$, find the following:

Coordinates of vertices: _____

Coordinates of the center: _____

Coordinates of the foci: _____

Equation of the asymptotes: _____