**ALPHA INDIVIDUAL: ANSWERS & SOLUTIONS (PG 1): FAMAT State Convention 2004**

1) sin $\vartheta = \frac{-24}{25}$ , so y = -24, r = 25: Solve for x, x = -7 (quad III). cot $\vartheta = \frac{x}{y} = \frac{-7}{-24} = \frac{7}{24}$: *ans A*

2) $60^0 + 180^0 = 240^0, \cos 240^0 = \frac{-1}{2}$: *ans C*

3) $2(2)^4 - k(2)^2 - 4(2) + 2 = 6$, $4k = 20$, $k = 5$: *ans B*

4) S = ( 3.142 + 2.718 + 1.414 ) / 2,
$\sqrt{s(s-3.142)(s-2.718)(s-1.414)} \approx 1.92 : 1 + 9 + 2 = 12$ : *ans C*

5) $\sec\left(Sin^{-1}\left(\frac{1}{2}\right)\right)$, sec $(30^0) = \frac{2\sqrt{3}}{3}$: *ans C*

6) $\frac{\cos x \cos x}{\sin x}\left(\frac{\sin x(\sin^2 x + \cos^2 x)}{1}\right)\frac{1}{\sin x \cos x} = \frac{\cos x}{\sin x} = \cot x$ : *ans E*

7) $0 = \frac{1}{4}e^{(x+3)} - 2004$ , $x = \ln 8016 - 3$ : $y = \frac{1}{4}e^3 - 2004$ : $x + y \approx -1992.99$, *ans E*

8) $5 = \frac{3x - 4y + 12}{\sqrt{3^2 + 4^2}} : 25 = 3x - 4y + 12$ : $3x - 4y - 13 = 0$, *ans D*

9) $x = -\sqrt{3}\cos 135^0$, $y = -\sqrt{3}\sin 135^0$ : $\left(\frac{\sqrt{6}}{2}, \frac{-\sqrt{6}}{2}\right)$: *ans A*

10) $\begin{vmatrix} 4 & -1 & 0 \\ -2 & 1 & 3 \\ x & y & z \end{vmatrix} \begin{matrix} 4 & -1 \\ -2 & 1 \\ x & y \end{matrix} = (4z - 3x) - (12y + 2z)$: $(-3, -12, 2)$: *ans E*

11) Only choice C has a dot product of zero. $(-1,3) \bullet (6,2) = 0$: *ans C*

12) Plug the three points into the general form for a circle and solve the system to get D=2, E=-2, F=-8:

$$\begin{cases} 16 - 4D + F = 0 \\ 8 + 2D + 2E + F = 0 : x^2 + y^2 + 2x - 2y - 8 = 0 : \quad (x+1)^2 + (y-1)^2 = (\sqrt{10})^2 : \quad \textit{ans D} \\ 4 - 2E + F = 0 \end{cases}$$

13) $4(x^2 - 6x) + 9y^2 = 0 : \frac{(x-3)^2}{9} + \frac{y^2}{4} = 1$: major axis = 2a = 2(3) = 6: *ans C*

14) $\frac{(x+4)^2}{7} - \frac{y^2}{5} = 1 : c^2 = 7 + 5 :$ *Foci* $(-4 \pm 2\sqrt{3}, 0)$ : *ans A*

15) Major axis parallel to x axis is in the form of $\frac{x^2}{a^2}$. 2a=14, a = 7: 2b=10, b = 5: center (-3, 6).

$\frac{(x+3)^2}{49} + \frac{(y-6)^2}{25} = 1$, *ans B*

16) Using $B^2 - 4AC = 29$, therefore this is a hyperbola. *ans B*

17) $\frac{c}{a} = \frac{5}{4}$, 2c = distance between foci points = 20, so c = 10: $\frac{10}{a} = \frac{5}{4} : so\ a = 8 :$
$10^2 = 8^2 + b^2 : so\ b = 6 :\ 2b = 12,\ ans\ D$

18) center ( 4, -1 ) and p = 1, fits form of $(y-k)^2 = 4p(x-h)$: $(y+1)^2 = 4(x-4)$ exp*anded is ans C*.

19) $\frac{({}_4C_2)({}_7C_3)}{{}_{11}C_5} = \frac{210}{462} = \frac{5}{11} : ans\ E$

20) $Ln7^{x-2} = Ln37.23 :\ x = \frac{Ln37.23}{Ln7} + 2 \approx 3.86 : 3+8+6 = 17,\ ans\ A$

21) $\lim_{x\to 3}\left(\frac{(x-3)(x^2+3x+9)}{x-3}\right) = \lim_{x\to 3}(x^2+3x+9) = 27,\ ans\ D$

22) $({}_8C_3)(2x)^5(-y)^3 = (56)(32)(-1) = -1792,\ ans\ A$

23) Even functions are symmetric to the y axis. *ans B*

24) $\frac{5x+3}{x^2-3x} = \frac{A}{x} + \frac{B}{x-3} : 5x+3 = A(x-3) + Bx :\ by\ letting\ x = 0\ and\ 3 :\ \frac{-1}{x} + \frac{6}{x-3};\ ans\ D$

25) $y = \frac{D_y}{D} : D_y = \begin{vmatrix} 1 & 2004 & 1 \\ 2 & 2004 & -1 \\ 1 & 2004 & 3 \end{vmatrix} = -4008 : D = \begin{vmatrix} 1 & 1 & 1 \\ 2 & -1 & -1 \\ 1 & 2 & 3 \end{vmatrix} = -3,\ y = 1336,\ ans\ E$

26) $(2x+27)\ln 23 = \ln 2004,\ x = \frac{\ln 2004 - 27\ln 23}{2\ln 23} \approx -12.28761$
$5^{2.004} = 2004y,\ y = \frac{5^{2.004}}{2004} \approx .01256 :\ x + y \approx -12.2751,\ ans\ A$

27) $\frac{(\log x \log x) - (\log y \log y)}{(\log x)(\log y)} = \frac{\log x \log x}{\log x \log y} - \frac{\log y \log y}{\log x \log y} = \frac{\log x}{\log y} - \frac{\log y}{\log x} = \log_y x - \log_x y,\ ans\ A$

28) $50000 = x\left(1 + \frac{.2004}{12}\right)^{(12)(4)} : x \approx 2257.951 : sum\ of\ digits = 31,\ ans\ D$

29) Numerator: $(x-5)(x+5) \geq 0 :\ (-\infty, -5] \cup [5, \infty)$
Denominator: $(x-6)(x+2) > 0 :\ (-\infty, -3) \cup (6, \infty) :\ together\quad (-\infty, -5] \bigcup (6, \infty)$, *ans* D

30) $\left(e^{1002x} + 9\right)\left(e^{1002x} - 3\right) = 0 :\ only\ \ln e^{1002x} = \ln 3\ gives\ a\ real\ answer :\ 1002x = \ln 3$
$x = \frac{\ln 3}{1002} \approx .0011 :\ sum\ of\ the\ digits = 2,\ ans\ B$

**ALPHA INDIVIDUAL**
**FAMAT State Convention 2004**
**Answers Key**

1) A) Cotangent
2) C) $\frac{-1}{2}$
3) B) 5
4) C) 12
5) C) $\frac{2\sqrt{3}}{3}$
6) E) cot x
7) E) -1992.99
8) D) 3x - 4y -13 = 0
9) A) $\left(\frac{\sqrt{6}}{2}, \frac{-\sqrt{6}}{2}\right)$
10) E) ( -3, -12, 2 )
11) C) ( -1, 3 ), ( 6, 2 )
12) D) $\sqrt{10}$
13) C) 6
14) A) $\left(-4 \pm 2\sqrt{3},\ 0\right)$
15) B) $\frac{(x+3)^2}{49} + \frac{(y-6)^2}{25} = 1$
16) B) Hyperbola
17) D) 12
18) C) $y^2 + 2y - 4x + 17 = 0$
19) E) $\frac{5}{11}$
20) A) 17
21) D) 27
22) A) -1792
23) B) the y-axis
24) D) $\frac{-1}{x} + \frac{6}{x-3}$
25) E) 1336
26) A) -12.2751
27) A) $\log_y x - \log_x y$
28) D) 31
29) D) $(-\infty, -5] \cup (6, \infty)$
30) B) 2