Mu Alpha Theta National Convention 2004

Alpha Equations & Inequalities

Answers

#	Answer	#	Answer
1	D	18	A
2	D	19	D
3	C	20	B
4	A	21	C
5	C	22	C
6	D	23	B
7	B	24	C
8	E	25	A
9	C	26	D
10	E	27	B
11	D	28	C
12	D	29	A
13	B	30	B
14	A	TB1	$\frac{100}{99}$
15	D	TB2	$\frac{-1}{3}$
16	A	TB3	88
17	B		

1	D	$15x+10y=89.5$ $-15x+21y=62.4$ $\Rightarrow y=4.9$ and $x=2.7,$ so $x+y\approx 7.6$
2	D	$\frac{\sin 40^o}{35}=\frac{\sin 70^o}{x}, x\approx 51.166577, p=2x+35, p\approx 137$
3	C	$S_n=\frac{10}{2}(2\cdot 13+9\cdot -.4), S_n=112$
4	A	$5x+6y+10z=272$ $7x+8y+12z=336 \Rightarrow 5x+36y=272 \quad 35x+252y=1904$ $z=3y \qquad\qquad 7x+44y=336 \Rightarrow 35x+220y=1680 \Rightarrow y=7, \text{so } x=4$
5	C	$\frac{-1\pm\sqrt{1-4(-k+3\sqrt{3})}}{2}$, difference squared is $1+4k-12\sqrt{3}$, so $k=5$ and $\log k\approx .7$
6	D	$-42+8\le -33,\ -12+11>-53,\ -30-3>-41,\ (-6,1)$ is a solution $-21-16\le -33,\ -6-22>-53,\ -15+6>-41,\ (-3,-2)$ is a solution $-56+8\le -33,\ -16-11>-53,\ -40+3>-41,\ (-8,-1)$ is a solution $-42-40\le -33,\ -12-55<-53,\ -30+15>-41,\ (-6,-5)$ is not a solution
7	B	$17^2=30^2+25^2-2\cdot 30\cdot 25\cos A,\ A\approx 35^o$
8	E	using the graphing calculator, $\approx -1.419952,\ -.5694717,$ and $2.1927686,$ so the sum is $.203$
9	C	$1500=1200(1+\frac{.035}{12})^{12t}$, $t=\frac{1}{12}\cdot\frac{\log 1.25}{\log(1+\frac{.035}{12})}$, $t\approx 7$
10	E	this system has 4 solutions $(3,2),\ (2,-3),\ (-3,2),\ (-2,-3)$
11	D	$x(x-2)=x+10$, $(x-5)(x+2)=0, x=5$ or $x=-2,$ but eliminate $-2,$ so $\ln 5\approx 1.609$
12	D	$(3a^2)^4+4(3a^2)^3(2b)+6(3a^2)^2(2b)^2+4(3a^2)(2b)^3+(2b)^4$, $81+216+216+96+16=625$
13	B	$\frac{500(1-.9^n)}{1-.9}<4392$, $(1-.9^n)<.8784$, $.9^n>.1216$, $n<\frac{\log .1216}{\log .9}$, $n<19.998$, ln 19=2.94
14	A	$20^2=15^2+30^2-2\cdot 15\cdot 30\cos A$, $\sin A=\frac{x}{15}$, $x\approx 8.9$
15	D	the solutions are $\frac{\sqrt{3}}{2}+\frac{1}{2}i$, $\frac{-\sqrt{3}}{2}+\frac{1}{2}i$, $\frac{-\sqrt{3}}{2}-\frac{1}{2}i$, $\frac{\sqrt{3}}{2}-\frac{1}{2}i$, i, and $-i$
16	A	sum of zeroes is 10 $\left(\frac{-a_2}{a_3}\right)$, sum of pairwise products is 31 $\left(\frac{a_1}{a_3}\right)$, product of zeroes is 28 $\left(\frac{-a_0}{a_3}\right)$, let a_3=1, so $x^3-10x^2+31x-28=0$
17	B	$4(t+2)=28t$, $28/3\approx 9$

18	A	$2^{9x+3}=2^{-2x+5}$, $x=\frac{2}{11}$, $3^{6y-3}=3^{12y+20}$, $y=\frac{-23}{6}$, $\frac{2}{11}+\frac{-23}{6}=\frac{-241}{66}$
19	D	$x^2-5x+6\overline{)2x^3+8x^2-22x-60}$ $\quad 2x+18$ so y-intercept is 18
20	B	use graphing calculator, the points of intersection are $(9,1)$ and $(-1,-9)$, so the solution is $(-\infty,-1)\cup(0,9)$
21	C	$25(x^2-6x+9)+16(y^2+4y+4)=400$, $\frac{(x-3)^2}{16}+\frac{(y+2)^2}{25}=1$, so center is $(3,-2)$, sum is 1
22	C	$F=\frac{kws^2}{r}$, $3870=\frac{k\cdot 2000\cdot 35^2}{400}$, $k\approx .6318367$, $F=\frac{k\cdot 2500\cdot 40^2}{450}$, $F\approx 5600$
23	B	$\frac{x-5}{6}=\frac{y+8}{10}$, $10x-50=6y+48$, $5x-3y=49$
24	C	$t_1=1,\ t_2=2,\ t_3=3,\ t_4=4,\ t_5=29,$ so sum is 39
25	A	$30(.40)=(x+30)(.35)$, $x=\frac{30}{7}$
26	D	use graphing calculator, $A=4x\sqrt{16-\frac{16}{9}x^2}$, $w\approx 4.242643784,\ l\approx 5.656850121,$ sum ≈ 9.9
27	B	use graphing calculator
28	C	$-44287=\frac{-1(1-(-3)^n)}{1+3}$, $177148=1-(-3)^n$, $n=11$
29	A	$d=\frac{\lvert 3\cdot 6+-2\cdot 7+10\rvert}{\sqrt{9+4}}$, $d\approx 3.88$
30	B	$x=\frac{y-7}{3y+2}$, $3yx+2x=y-7$, $y=\frac{2x+7}{1-3x}$
TB 1	$\frac{100}{99}$	$\frac{x}{x-1}-6\left(\sqrt{\frac{x}{x-1}}\right)-40=0 \rightarrow \left(\sqrt{\frac{x}{x-1}}-10\right)\left(\sqrt{\frac{x}{x-1}}+4\right)=0 \rightarrow \frac{x}{x-1}=100 \rightarrow x=$
TB 2	$\frac{-1}{3}$	$9k+6+k=0$ $k=\frac{-3}{5}$ $\frac{-3}{5}x^2-2x-\frac{3}{5}=0 \rightarrow 3x^2+10x+3=0 \rightarrow (3x+1)(x+3)=0$ $x=\frac{-1}{3}$
TB 3	88	$\log_2[\log_3(\log_4 x)]=0 \rightarrow \log_3(\log_4 x)=1 \rightarrow \log_4 x=3 \rightarrow x=64$ $\log_3[\log_2(\log_4 y)]=0 \rightarrow \log_2(\log_4 y)=1 \rightarrow \log_4 y=2 \rightarrow y=16$ $\log_4[\log_3(\log_2 z)]=0 \rightarrow \log_3(\log_2 z)=1 \rightarrow \log_2 z=3 \rightarrow z=8$ $x+y+z=88$