

TEAM ANSWERS**JANUARY REGIONAL**

1. $2\tan^2\theta$ or $\frac{2}{\cot^2\theta}$
2. $\frac{1296}{125}$
3. $\{-.91, 1.71, 3.20\}$
4. 18
5. $\{2, 3, \frac{1}{2}, \frac{1}{3}\}$
6. $16\pi - 32$
7. 4029
8. $(18, \log_2 6)$
9. 23
10. 57
11. 258.17
12. - 1013.7
13. $3^{\frac{3}{4}}$
14. 4095
15. $\sin 48^\circ \cos 28^\circ$

Team Solutions - January Regional


1) $\frac{\sin \theta}{\csc \theta - 1} + \frac{\sin \theta}{\csc \theta + 1} = \frac{1 + \sin \theta + 1 - \sin \theta}{\csc^2 \theta - 1} = \frac{2}{\csc^2 \theta} \text{ or } 2 \tan^2 \theta$

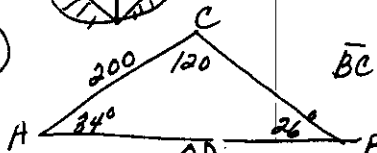
2) $A = \frac{5!}{2!2!} = 30$; $B = 3! \cdot 3! \cdot 2 = 72$; $C = \frac{1}{6} \cdot \frac{1}{12} = \frac{1}{72}$; $D = {}_4 C_3 \left(\frac{3}{5}\right)^3 \left(\frac{2}{5}\right) = \frac{216}{625}$
 $ABCD = \frac{1,296}{125}$

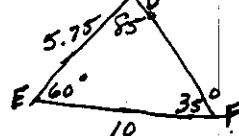
3) $x^3 - 4x^2 + x + 5 = 0$; on Calculator $\{-.91, 1.71, 3.20\}$

4) $y = 2x^2 + x - 3$; $f(3) = 18 + 3 - 3 = 18$

5) $6y^2 - 35y + 50 = 0$; $y = \frac{5}{2}$ or $\frac{10}{3}$; $x = 2, \frac{1}{2}, 3, \frac{1}{3}$

6)  Area of 4 sectors
 $\frac{1}{4} \cdot 16\pi - \frac{1}{2} \cdot 4 \cdot 4 = (4\pi - 8) \cdot 4 = 16\pi - 32$

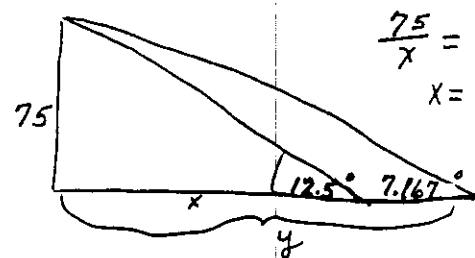
7) 
 $BC = \frac{x}{\sin 34^\circ} = \frac{200}{\sin 26^\circ} \Rightarrow BC = 255$
 $AB = \frac{y}{\sin 20^\circ} = \frac{200}{\sin 26^\circ} \Rightarrow AB = 395$


 $\frac{10}{\sin 85^\circ} = \frac{F}{\sin 35^\circ} \Rightarrow F = 5.75$
 $z = \frac{1}{2}(10)(5.75) \sin 60^\circ = 25$ $\frac{XY}{Z} = 4029$

8) Let $z = 2^y$; $x + 3z = z^2$ $z^2 - 3z = 2z + 6$ $x + 3 \cdot 2^{\log_2 6} = 2^{2 \log_2 6}$
 $x - 2z = 6$ $z = 6, -1$ $x + 18 = 36$
 $2^y = 6$ $2^y = -1$ $x = 18$
 $y = \log_2 6$ $(18, \log_2 6)$

9) You must have an even # of quarters. Count # of even #'s between 0 and 48, can't use 0 or 48. Therefore $\boxed{23}$.

10) $7^3 = 343$
 $7^2 = 49$
 $7^1 = 7$
 $1 + 7 + 49 = \boxed{57}$

11) 
 $\frac{75}{x} = \tan 12.5^\circ$ $x = 338.303$
 $\frac{75}{y} = \tan 7.167^\circ$ $y = 596.477$
 $x - y = \boxed{258.17}$

12) $A^2 = 10^2 + 12^2 - 2(10)(12) \cos 55^\circ$ $A = 10.3$ $B = 0$ $C = (\sqrt{2} \cos 45^\circ)^{20} = 1024 \cos 900^\circ = -1024$
 $A + B + C = \boxed{-1013.7}$

13) $3 \frac{1}{3} + \frac{2}{9} + \frac{3}{27} + \dots$ $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \frac{1}{81} + \dots = \frac{1}{2}$
 $\frac{1}{9} + \frac{1}{27} + \dots = \frac{1}{6}$
 $\frac{1}{27} + \dots = \dots$

14) $A = u \cdot v = -36 + 20 = -16$
 $B = u \times v = \begin{vmatrix} i & j & k \\ 3 & 4 & 0 \\ -12 & 5 & 0 \end{vmatrix} = 63k$ $S = \frac{\frac{1}{2}}{1 - \frac{1}{3}} = \frac{3}{4}$
 $C = \frac{u \cdot v}{|u||v|} = \frac{-16}{65}$ $\frac{AB}{C} = \frac{-16 \cdot 63}{-16} \cdot \frac{65}{65} = \boxed{4095}$ So $\boxed{3 \frac{3}{4}}$

15) $\frac{\sin(48+28) + \sin(48-28)}{2} = \boxed{\sin 48 \cos 28}$