

Minnesota State High School Mathematics League

2018-19 State Tournament, Individual Event C

Th 2/25/2021

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Forum CD

Question #1 is intended to be a quickie and is worth 1 point. Each of the next three questions is worth 2 points. Place your answer to each question on the line provided. You have 15 minutes for this Tournament event.

NO CALCULATORS are allowed on this event.

SOH-CAH-TOA

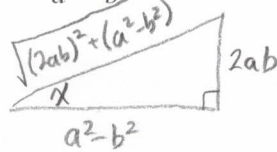
$$\frac{2ab}{a^2+b^2}$$

$$(a^2-b^2)(a^2-b^2)$$

$$a^2(-b^2) = a \cdot a(-b \cdot b) = -a^2b^2$$

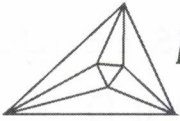


1. If $\tan x = \frac{2ab}{a^2-b^2}$, where $a > b > 0$ and $0^\circ < x < 90^\circ$, what is $\sin x$ in terms of a and b ? $\sqrt{123^2} = 123$



$$\begin{aligned} \sin x &= \frac{2ab}{\sqrt{(2ab)^2 + (a^2 - b^2)^2}} = \frac{2ab}{\sqrt{4a^2b^2 + (a^4 - 2a^2b^2 + b^4)}} \\ &= \frac{2ab}{\sqrt{a^4 + 2a^2b^2 + b^4}} = \frac{2ab}{\sqrt{(a^2 + b^2)^2}} = \frac{2ab}{a^2 + b^2} \quad \checkmark \end{aligned}$$

For $0 < x < 2\pi$ determine exactly the two ordered pairs (x, y) that satisfy this



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NO CALCULATORS are allowed on this event. $360^\circ = 2\pi$

$C = \pi d$
 $= 2\pi r$
 $C = 2\pi$ (unit circle)

4039π

1. If the positive solutions to the equation $\cos x = -1$ are listed in increasing order, determine exactly, in radians, the 2020th solution in the list.

$\pi, 3\pi, 5\pi, \dots$
 $\cos x = -1$ for $x = 180^\circ = \pi, 3\pi, 5\pi, \dots, \boxed{4039\pi}$
 1st 2nd 3rd nth

nth solution is $(2n-1)\pi$ $n=2020$, then $(2n-1)\pi = (2 \cdot 2020 - 1)\pi = \boxed{4039\pi}$

