Warmup: Find the positive solution to the equation below: [Brilliant level 3]

$$\frac{1}{x^2 - 10x - 29} + \frac{1}{x^2 - 10x - 45} - \frac{2}{x^2 - 10x - 69} = 0$$

Warmup: ABCD is a square that contains point "P" such that PA:PB:PC = 1:2:3. Find the value of angle $\angle APB$ in degrees (Brilliant.org)
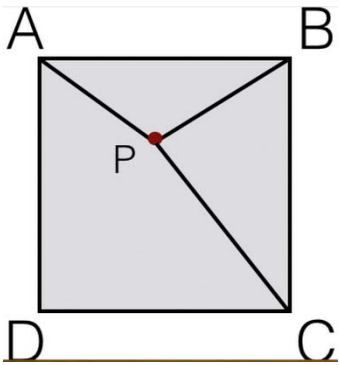
Question#1) Determine all pairs of real numbers (x,y) such that: $\begin{array}{l} x^6 = y^4 + 18 \\ y^6 = x^4 + 18 \end{array}$ (COMC POW)

Question #2) If "x", "y" are non-zero numbers with $x^2 + xy + y^2 = 0$, what is the value of the expression below? [Brilliant Level 4]

$$\left(\frac{x}{x+y}\right)^{2001} + \left(\frac{y}{x+y}\right)^{2001}.$$

Question #3)

Let ABC be a right-angled triangle with the right angle at C. Let $BCDE$ and $ACFG$ be squares external to the triangle. Furthermore, let AE intersect BC at H, and let BG intersect AC at K. Find the size of $\angle DKH$.

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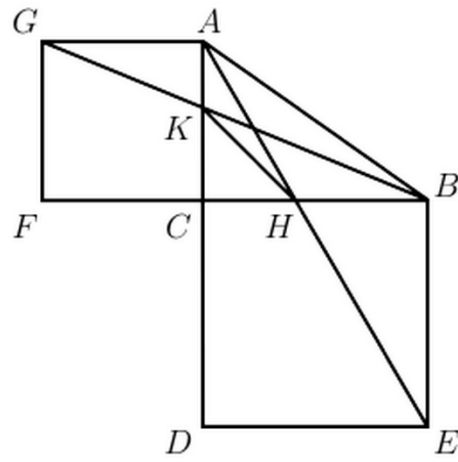
Answer:

Warmup #2) 135 degrees

Question #1) $(x, y) = \left(\pm\sqrt{3}, \pm\sqrt{3} \right)$

Question #2)

Question #3) $KC = HC = \dfrac{ab}{a+b}, \quad \angle DKH = 45°$