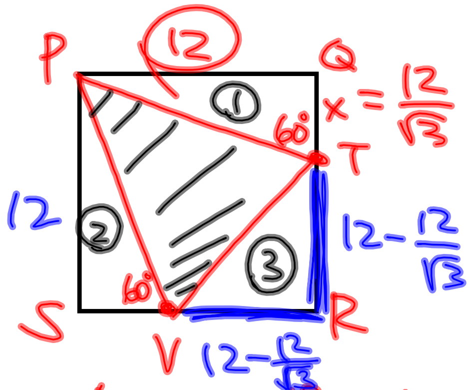
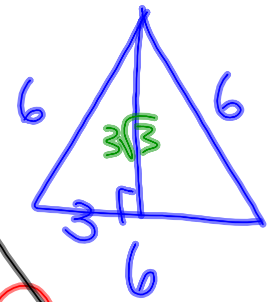
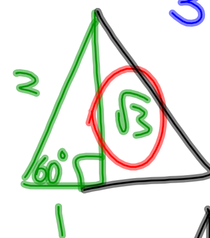
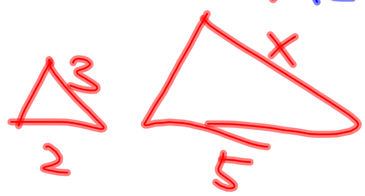
4) Quadrilateral $PQRS$ is a square with point T on side $\overline{QR}$ and point V on side $\overline{RS}$, with $PQ = 12$, and $m\measuredangle PTQ = m\measuredangle PVS = 60°$. Compute the area of ΔPTV.

$$12\cdot\frac{12}{\sqrt3}\cdot\frac12 = \frac{72}{\sqrt3}$$

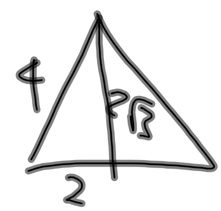




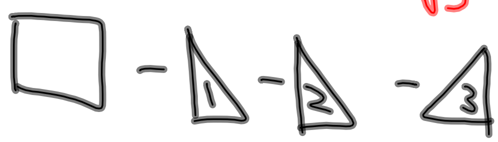




$$\frac{12}{\sqrt3}=\frac{x}{1}$$



$$\frac{12}{\sqrt3}=x$$



$$=144-\frac{72}{\sqrt3}-\frac{72}{\sqrt3}-\left(96-\frac{144}{\sqrt3}\right)$$

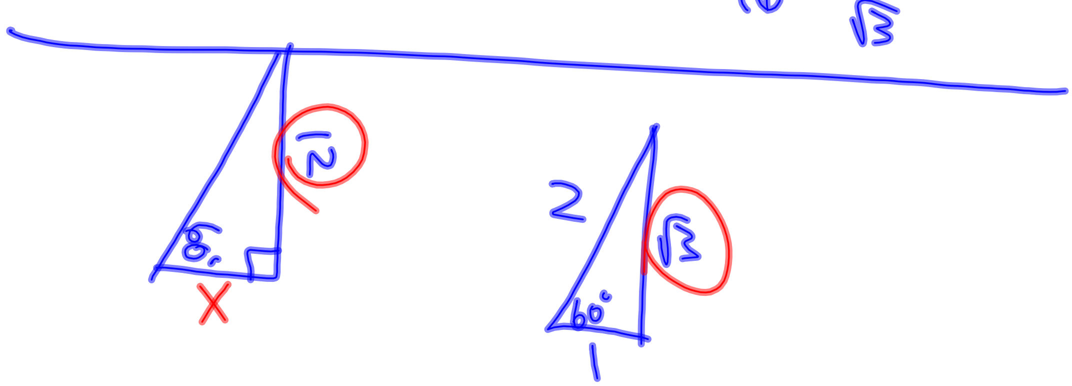
$$=144-\cancel{\frac{144}{\sqrt3}}-96+\cancel{\frac{144}{\sqrt3}}$$

$$=48$$

$$\frac12\left(\frac{12}{1}-\frac{12}{\sqrt3}\right)\left(12-\frac{12}{\sqrt3}\right)=\frac12\left(144-\frac{144}{\sqrt3}-\frac{144}{\sqrt3}+\frac{144}{3}\right)$$

$$=\frac12\left(192-\frac{288}{\sqrt3}\right)$$

$$=96-\frac{144}{\sqrt3}$$



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2) Points D, E, and F are chosen respectively on sides $\overline{AB}$, $\overline{BC}$, and $\overline{CA}$ of ΔABC. If $AD:DB = BE:EC = CF:FA = 1:3$ and the ratio of the area of ΔDEF to the area of ΔABC is expressed as p/q in simplest form, compute $p+q$.