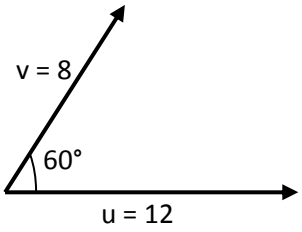
Name _____ Date _____

Vector Sums Magnitude and Direction - Step-by-Step Lesson

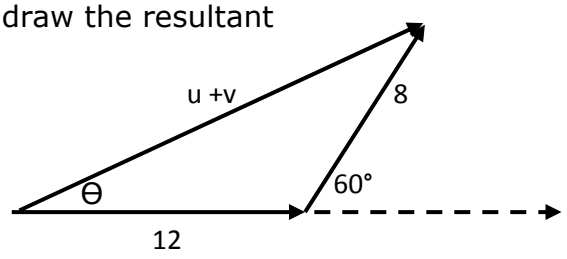
A vector u has a magnitude of 12 and a direction of 0°. A vector v has a magnitude of 8 and a direction of 60°. Find the direction and magnitude of u +v to the nearest whole values.

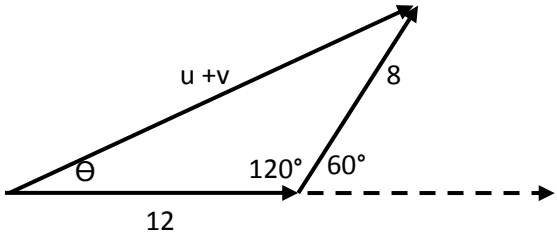
Explanation:

Step 1: Start by sketching the vectors.



Step 2: Translate and draw the resultant





Step 3: Use the Law of cosines, substituting the values and simplify. Let m be the magnitude of the resultant vector "u+v"

$m^2 = u^2 + v^2 - 2uv \cos 120°$

$m^2 = (12)^2 + (8)^2 - 2(12)(8) \cos 120°$

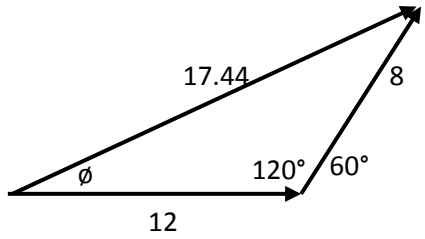
$m^2 = 144 + 64 - 192 \cos 120°$

Name _____ Date _____

m = $\sqrt{144 + 64 - 192\, cos\ 120°}$

m = $\sqrt{304}$

m = 17.44



Step 4: Now use the Law of cosines again to find the direction.

$v^2 = u^2+m^2-2(u)(m)\ \cos ø$

The Law of cosines is rearranged to find the required angle:

$$cos\emptyset = \frac{u^2+m^2-v^2}{2um}$$

$$cos\emptyset = \frac{12^2 + 17.44^2 - 8^2}{2(12)(17.44)} = 0.918$$

$$\emptyset = \cos^{-1} 0.918 = 23.4^o$$