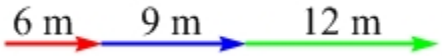
PROBLEM 1 – 20 points

(a) Three vectors have lengths of 6 m, 9 m, and 12 m, respectively. The vectors can be arranged in any orientation you want. When you add the three vectors, what is the ….:

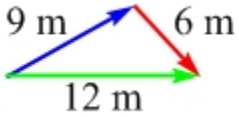
[6 points] (i) largest magnitude possible you can achieve for the resultant vector? Draw a rough sketch to show how you would arrange the three vectors.

6 m + 9 m + 12 m = 27 m. The largest magnitude occurs when the vectors are lined up with them all pointing in the same direction:



[6 points] (ii) smallest magnitude possible you can achieve for the resultant vector? Draw a rough sketch to show how you would arrange the three vectors.

0. You can align the 6 m vector and the 9 m vector to make a vector of length 12 m, and then place the 12 m vector directly opposite. In other words, make a triangle with sides of 6 m, 9 m, and 12 m:



[4 points] (b) Can you obtain resultant vectors with magnitudes covering the entire range between the maximum and minimum values above?

[**X**] Yes [ ] No

Briefly justify your answer: **The fact that we can orient the vectors any way we want gives us so much flexibility that we can obtain a resultant vector with any magnitude we want between 0 and 27 m.**

[4 points] (c) Whatever your answer to the previous question, could you add all three vectors together to get a resultant vector with a length of 12 m? If so, draw a rough sketch to show how you could do it. If not, explain why not.

Yes, it can be done. One way to get a vector of length 12 m is to use our result from (a) part (ii). We can create an equilateral triangle with sides of 12 m each. One side is the resultant of the 6 m vector plus the 9 m vector, the second side is the 12 m vector, and the third side is the resultant, which also has a length of 12 m. This is just one of many possible ways to create a resultant with a magnitude of 12 m.