



The University of Zambia  
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Department of Physics

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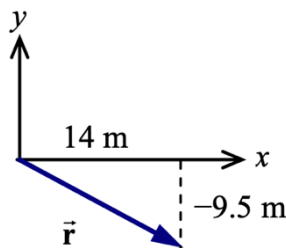
## PHY1015 Introductory Medical Physics 2021/2022 Tutorial Sheet 02

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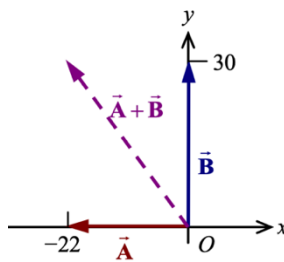
### 2 – Vectors

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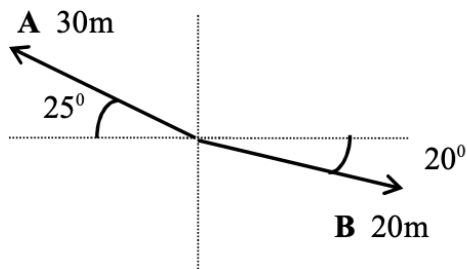
1. The given vector components correspond to the vector  $\mathbf{r}$  as schematically shown in the figure below. (a) Use the inverse tangent function to find the angle  $\theta$ . (b) Use the Pythagorean Theorem to determine the magnitude of  $\mathbf{r}$ . (c) Show that the direction will remain the same but the magnitude will double if both  $r_x$  and  $r_y$  are doubled. [ $-34^\circ$ , 17 m, ( $-34^\circ$ , 34 m)]



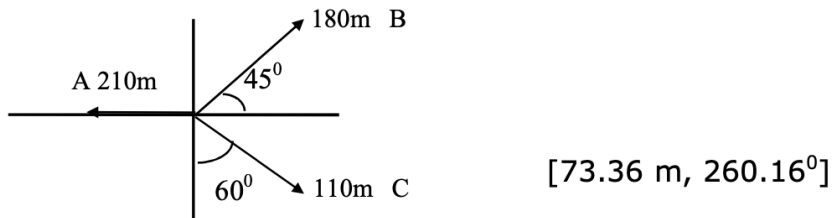
2. The vectors involved in this problem are shown below. Set the length of  $\mathbf{A} + \mathbf{B}$  equal to 37 units. Solve for B. [30 units]



3. A displacement  $\mathbf{D}$  of 100m from the origin at an angle of  $37^\circ$  above the x-axis is the result of three successive displacements:  $\mathbf{d}_1$  of 100 m along the negative x-axis,  $\mathbf{d}_2$  of 200 m at an angle of  $150^\circ$  above the x-axis, and a displacement  $\mathbf{d}_3$ . Find  $\mathbf{d}_3$ .  
[355 m,  $353.5^\circ$ ]
4. Find the direction and magnitude of:
- (i) the vector sum  $\mathbf{A} + \mathbf{B}$  [10.22m,  $145.16^\circ$ ]
  - (ii) the vector difference  $\mathbf{A} - \mathbf{B}$ , [ $49.56$ ,  $157^\circ$ ] and
  - (iii) the vector difference  $\mathbf{B} - \mathbf{A}$ . [ $49.56\text{m}$ ,  $337^\circ$ ]



- The resultant of two force vectors **A** and **B** has a magnitude of 150 N along the y-axis. If the force vector **B** makes an angle of  $60^\circ$  with the positive x-axis, find the magnitude of **B** and the direction of **A** given that the x-component of **A** is equal to  $-60$  N. [120N,  $142.48^\circ$ ]
- When displacement **B** is added to displacement **A**, the result is a displacement **C** that has components  $C_x = -3.0\text{cm}$ ,  $C_y = +6.0\text{cm}$ , and  $C_z = +4.0\text{cm}$ . Displacements **A** and **B** are in the same direction, but the magnitude of **A** is only half that of **B**. Find the components of **A**. [-1, 2,  $4/3$ ]
- A girl delivering newspapers covers her route by travelling 3.00 blocks west, 4.00 blocks north, and then 6.00 blocks east. (a) What is her resultant displacement? (b) What is the total distance travelled? [5.00 blocks at  $53.1^\circ$  north of east, 13 blocks]
- The three vectors **A**, **B**, and **C** are as shown. Find the magnitude and direction of a vector **D** which when added to these three vectors will give a zero resultant.



- While exploring a cave, a person starts at the entrance and moves the following successive distances. She goes 75.0 m north, 250 m east, 125 m at an angle  $30.0^\circ$  north of west, and 150 m south. Find the resultant displacement from the cave entrance. Draw a rough diagram. [ $R = \sqrt{141.75^2 + (-12.5)^2} = 142.3$  m]
- A particle undergoes three successive displacements in a plane as follows: 4.0 m southwest, 5.0 m east, 6.0 m in a direction  $60^\circ$  north of east. Choose the y-axis pointing north and the x-axis pointing east and find (a) The components of each displacement (b) The components of the resultant displacement. [5.17 m, 2.37 m], (c) The magnitude and direction of the resultant displacement, [5.69m,  $24.63^\circ$ ], and (d) Graphically show the approximate displacement of the particle.