**GENERAL PHYSICS 1 VECTOR ADDITION and COMPONENTS OF VECTOR**

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Directions:  Date: 9/9/22

Read and understand each situation. Show a comprehensive step-by-step solution and your final answer.

1. A grab driver drives a delivery vehicle along a route shown in Figure 1. Determine the magnitude and direction of the resultant displacement by drawing a scale diagram.

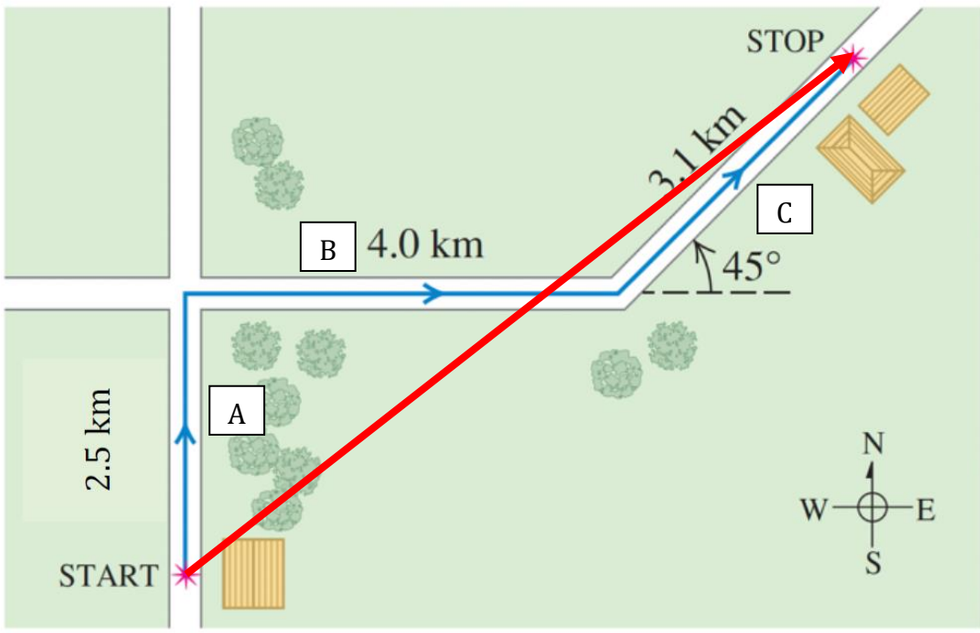



Figure 1

| Vector | Magnitude = M | Direction = A | x-component M(cos(A)) | y-Component M(sin(A)) |
|---|---|---|---|---|
| A | 2.5 | 90 degrees | 0 | 2.5 |
| B | 4 | 0 degrees | 4 | 0 |
| C | 3.1 | 45 degrees | 2.19 | 2.19 |
| Summation of x and y components | | | 6.19 | 4.69 |

$M_{new}$ = New Magnitude

X = sum of x components

Y = sum of y components

$M_{new} = \sqrt{X^2 + Y^2}$

$M_{new} = \sqrt{6.19^2 + 4.69^2}$

$\sqrt{38.32 + 21}$

$\sqrt{59.32}$

$M_{new} = 7.7\ km$

$A_{new}$ = New Direction

X = sum of x components

Y = sum of y components

$A_{new} = \frac{180}{\pi}\tan^{-1}(\frac{Y}{X})$

$A_{new} = \frac{180}{\pi}\tan^{-1}(\frac{4.69}{6.19})$

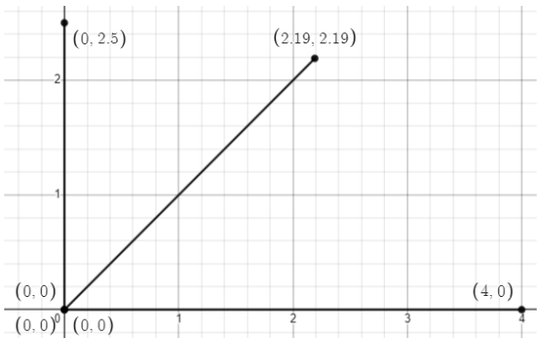
$\frac{180}{\pi}\tan^{-1}(0.7577)$

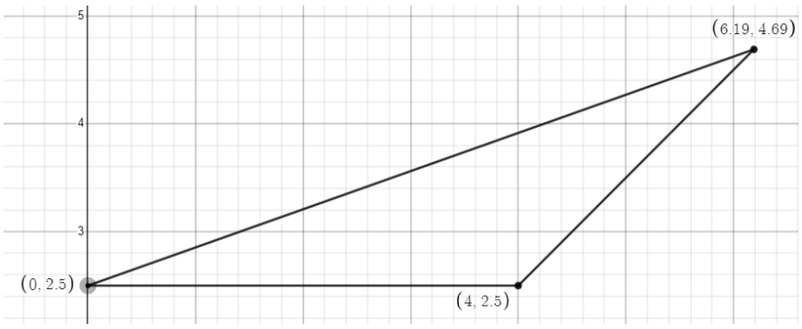
$\frac{180}{\pi}(0.6484)$

$A_{new} = 37\ degrees$

The resultant vector has a magnitude of 7.7 kilometers with a direction of 37 degrees north of east.

Scale Diagram is in the next page




## 2. Compute the x- and y-components of vectors A, B and C in Figure 2.

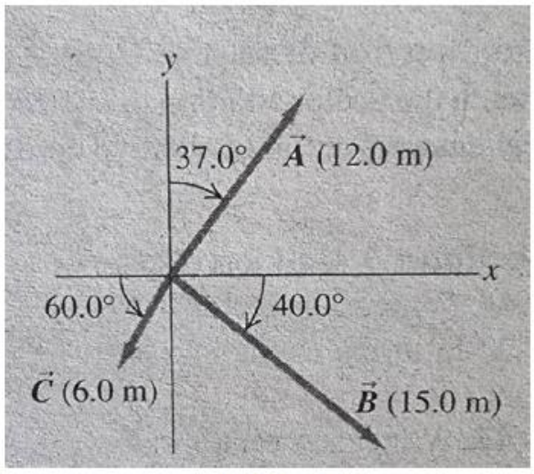



Figure 2

| Vector | Magnitude = M | Direction = A | x-component M(cos(A)) | y-Component M(sin(A)) |
|---|---|---|---|---|
| A | 12 | 53 degrees | 7.22 | 9.58 |
| B | 15 | 320 degrees | 11.49 | -9.64 |
| C | 6 | 240 degrees | -3 | -5.2 |
| Summation of x and y components | | | 15.71 | -5.26 |

$M_{new}$ = New Magnitude

X = sum of x components

Y = sum of y components

$M_{new} = \sqrt{X^2 + Y^2}$

$M_{new} = \sqrt{15.71^2 + -5.26^2}$

$\sqrt{246.8 + 27.67}$

$\sqrt{274.47}$

$M_{new} = 15.73\ m$

$A_{new}$ = New Direction

X = sum of x components

Y = sum of y components

$A_{new} = \frac{180}{\pi}\tan^{-1}(\frac{Y}{X})$

$A_{new} = \frac{180}{\pi}\tan^{-1}(\frac{-5.26}{15.71})$

$\frac{180}{\pi}\tan^{-1}(0.3348)$

$\frac{180}{\pi}(-0.323)$

$A_{new} = = -19\ or\ 341\ degrees$

The resultant vector has a magnitude of 15.73 meters with a direction of 341 degrees along the x axis or -19 degrees south of east.

3. Given the following displacements of a moving car, illustrate and calculate for the resultant displacement.
   - $\mathbf{d_1}$ = 72.4 m, 58.0$^0$ north of east
   - $\mathbf{d_2}$ = 57.3 m, 36.0$^0$ south of west
   - $\mathbf{d_3}$ = 17.8 m, south

| Vector | Magnitude = M | Direction = A | x-component M(cos(A)) | y-Component M(sin(A)) |
|---|---|---|---|---|
| D1 | 72.4 | 32 degrees | 61.4 | 38.37 |
| D2 | 57.3 | 213 degrees | -48.06 | -31.21 |
| D3 | 17.8 | 270 degrees | 0 | -17.8 |
| Summation of x and y components | | | 13.34 | -10.64 |

$M_{new}$ = New Magnitude

X = sum of x components

Y = sum of y components

$M_{new} = \sqrt{X^2 + Y^2}$

$M_{new} = \sqrt{13.34^2 + -10.64^2}$

$\sqrt{117.96 + 113.21}$

$\sqrt{231.17}$

$M_{new} = 15.2\ m$

$A_{new}$ = New Direction

X = sum of x components

Y = sum of y components

$A_{new} = \frac{180}{\pi}\tan^{-1}(\frac{Y}{X})$

$A_{new} = \frac{180}{\pi}\tan^{-1}\left(\frac{-10.64}{13.34}\right)$

$\frac{180}{\pi}\tan^{-1}(-0.7976)$

$\frac{180}{\pi}(-0.6733)$

$A_{new} = = -39\ or\ 321\ degrees$

The resultant vector has a magnitude of 15.2 meters with a direction of 321 degrees along the x axis or -39 degrees south of east.