7.) Which of the following are vector quantities and which are scalar quantities?(a) your age (b) acceleration (c) velocity (d) speed (e) mass

8.) Given the following vectors, create head to tail models and find the resultant magnitude and direction. the arrows are not perfect but use the corner that they are closest to

$E - G = E + (-G)$

E

$\langle \hat{i} - 2\hat{j} \rangle$

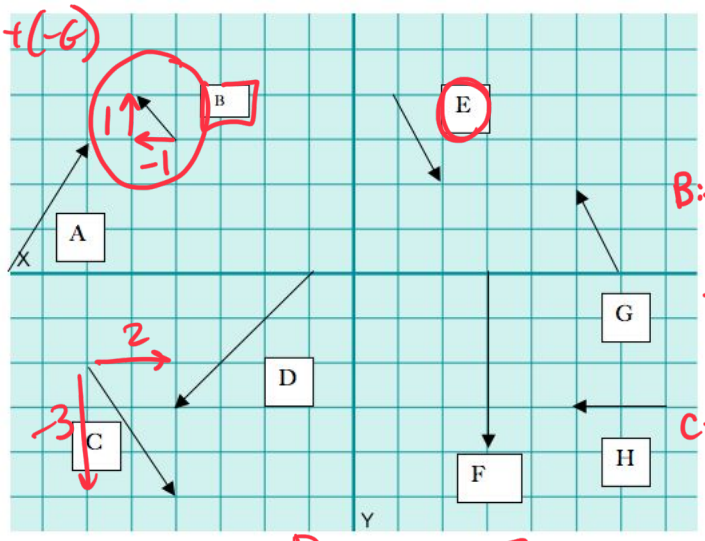
G

$\langle -\hat{i} + 2\hat{j} \rangle$

-G

$-(-\hat{i} + 2\hat{j}\rangle$

$\hat{i} - 2\hat{j}$



B

x	y
-1	1

$B: \langle -\hat{i} + \hat{j} \rangle$

C

x	y
2	-3

$C: \langle 2\hat{i} - 3\hat{j} \rangle$

D+E

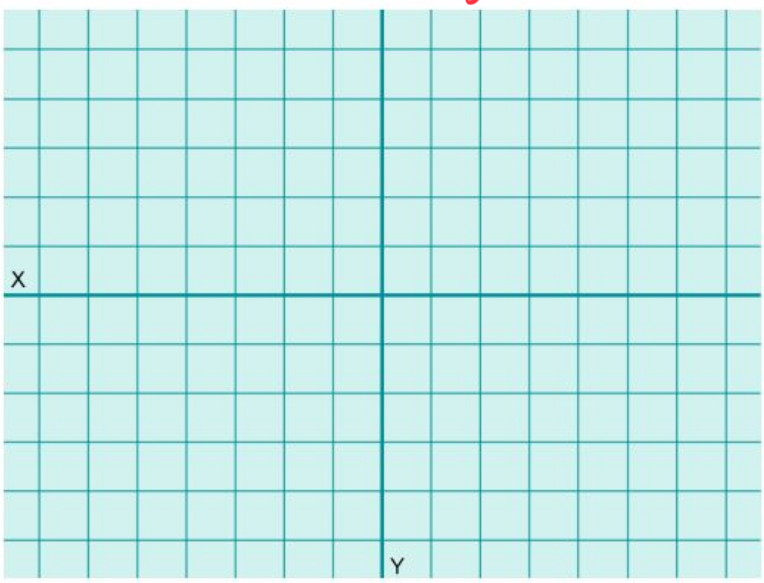
D

$\langle -3\hat{i} - 3\hat{j} \rangle$

E

$\langle \hat{i} - 2\hat{j} \rangle$

a) A + B



Magnitude = _____ Direction = _____

b) B + C

$B: \langle -\hat{i} + \hat{j} \rangle$

$C: \langle 2\hat{i} - 3\hat{j} \rangle$

$\hat{i} - 2\hat{j}$

$r = \sqrt{x^2 + y^2}$

$\sqrt{(1)^2 + (-2)^2}$

$\sqrt{1+4} = \sqrt{5}$

$\theta = \tan^{-1}\left(\frac{y}{x}\right)$

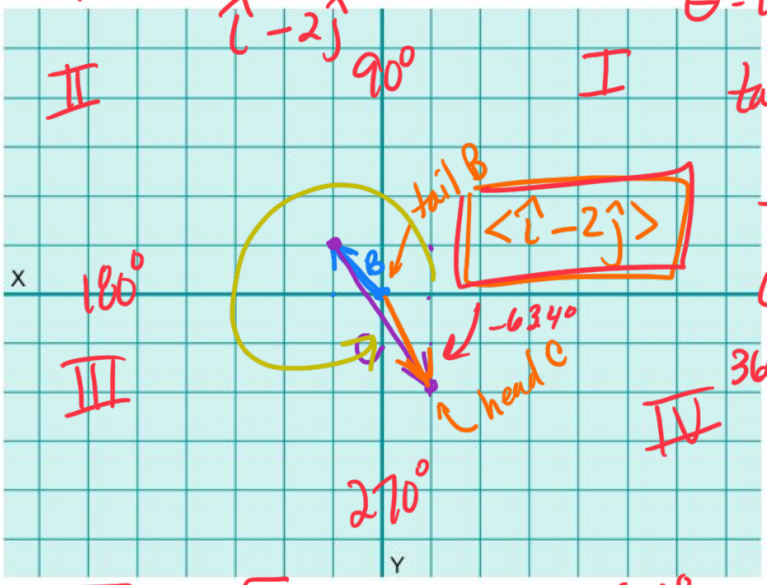
$\tan^{-1}\left(\frac{-2}{1}\right)$

$-63.4°$

$0°, 360°$

$360 + (-63.4)$

$296.6°$



Magnitude = $r = \sqrt{5}$ Direction = $296.6°$

c) E - G

$E: \langle \hat{i} - 2\hat{j} \rangle$

$-G: \langle \hat{i} - 2\hat{j} \rangle$

$\langle 2\hat{i} - 4\hat{j} \rangle$

$r = \sqrt{x^2 + y^2}$

$\sqrt{(2)^2 + (-4)^2}$

$\sqrt{4+16} = \sqrt{20}$

$\sqrt{4}\sqrt{5}$

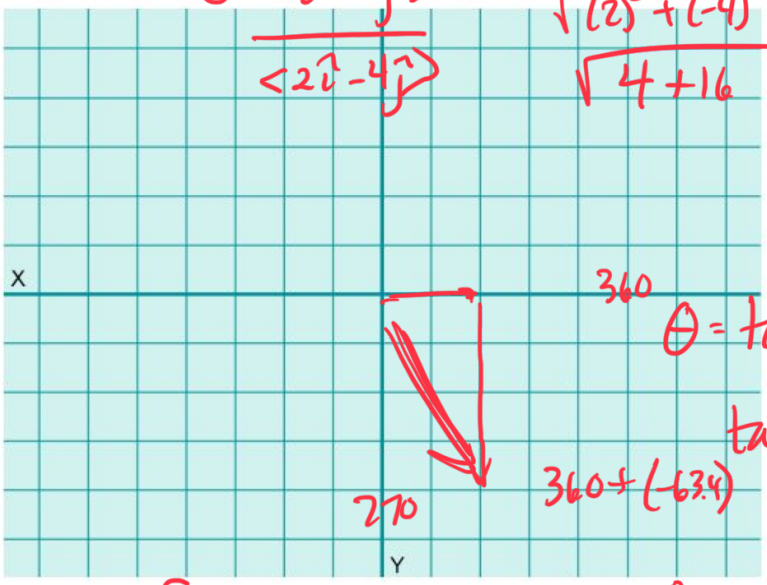
$2\sqrt{5}$

$\theta = \tan^{-1}\left(\frac{y}{x}\right)$

$\tan^{-1}\left(\frac{-4}{2}\right)$

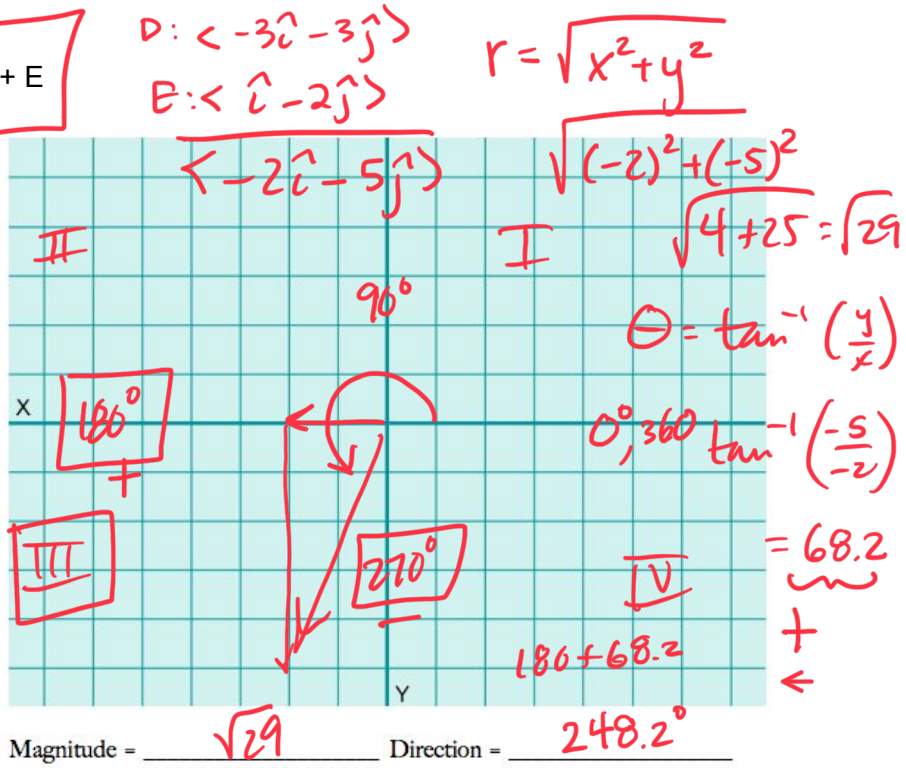
$-63.4°$

$360 + (-63.4)$



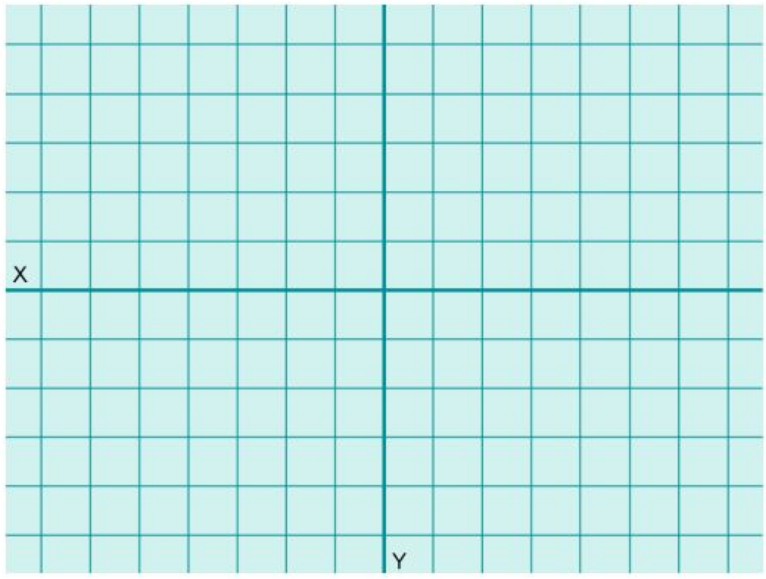
Magnitude = $\sqrt{20} = 2\sqrt{5}$ Direction = $296.6°$

d) D + E



Magnitude = $\sqrt{29}$ Direction = 248.2°

e) A - C



Magnitude = _____ Direction = _____

TH-GP General Physics Week 15 1/11

Sum of Vectors

$A: \langle 2\hat{i} + 3\hat{j} \rangle \quad B: \langle 4\hat{i} - 5\hat{j} \rangle$

$A+B \quad \langle 6\hat{i} - 2\hat{j} \rangle$

resultant: $r = \sqrt{x^2 + y^2}$

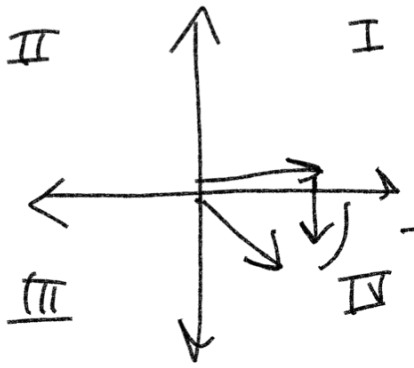
$\sqrt{(6)^2 + (-2)^2} = \sqrt{36+4} = \sqrt{40}$

$\sqrt{4} \quad \sqrt{10}$

$2\sqrt{10}$

$\theta = \tan^{-1}\frac{y}{x}$

$\tan^{-1}\left(\frac{-2}{6}\right) = -18.4$



$360 - 18.4 = 341.6$

(Mag, Dir)

$(2\sqrt{10}, 341.6^\circ)$

$$d_1 = \langle 15\hat{i} - 30\hat{j} + 12\hat{k} \rangle$$

$$d_2 = \langle 23\hat{i} + 14\hat{j} + 5\hat{k} \rangle$$

$$d_3 = \langle 13\hat{i} + 15\hat{j} \rangle$$

$$\langle 51\hat{i} - \hat{j} + 17\hat{k} \rangle$$

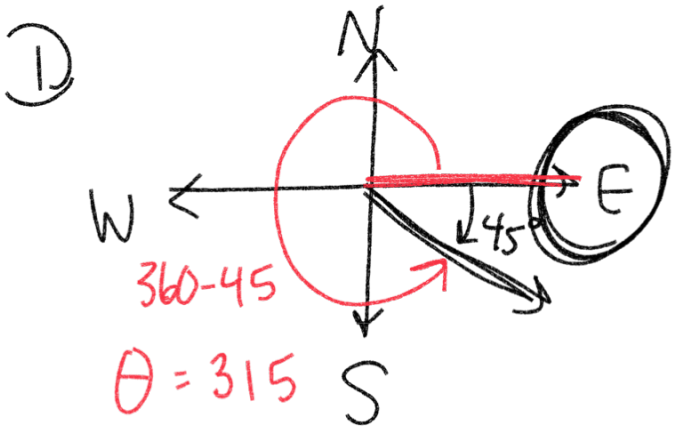
Find magnitude/resultant

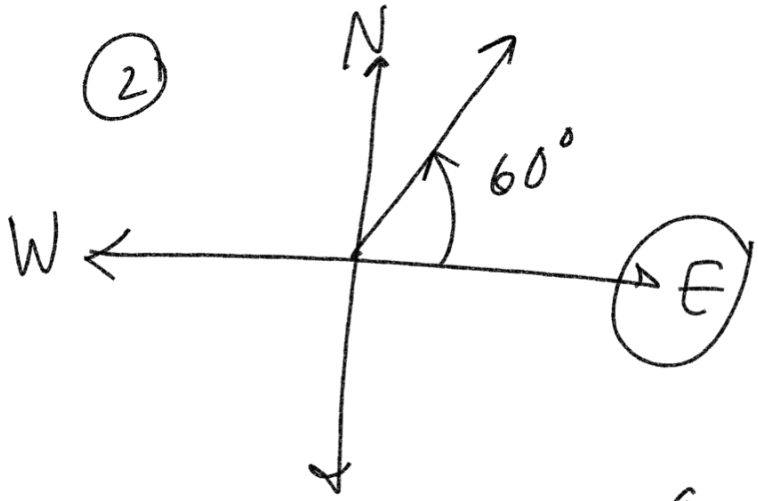
$$r = \sqrt{x^2 + y^2 + z^2}$$

$$\sqrt{(51)^2 + (-1)^2 + (17)^2} = \boxed{53.7}$$

Hiker ① 25 km 45° south of east

② 40 km 60° north of east





$x = r\cos\theta$

$= 25\cos 315 = \boxed{17.7\text{ km}}$

$x = r\cos\theta$

$= 40\cos 60$

$\boxed{20\text{ km}}$

$y = r\sin\theta$

$25\sin 315 = \boxed{-17.7\text{ km}}$

$y = r\sin\theta$

$= 40\sin 60°$

$\boxed{34.6\text{ km}}$

total x: $17.7 + 20 = 37.7$ km

total y: $-17.7 + 34.6 = 16.9$ km

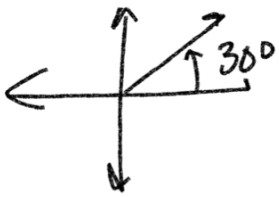
$$r = \sqrt{x^2 + y^2} = \sqrt{(37.7)^2 + (16.9)^2} = \boxed{41.3\text{ km}}$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right) = \tan^{-1}\left(\frac{16.9}{37.7}\right) = 24.1°$$

$\boxed{41.3\text{ km},\ 24°\text{ N of E}}$

① 4 km 30° North of East

② 6 km 60° North of West

① 

$\theta = 30°$

② 

$\theta = 120°$

[x] $r \cos \theta$

$4 \cos 30° = 3.46$

$r \cos \theta$

$6 \cos 120° = -3$

---

[y] $r \sin \theta$

$4 \sin 30° = 2$

$r \sin \theta$

$6 \sin 120 = 5.2$

x total: $3.46 + (-3) = 0.46$

y total: $2 + 5.2 = 7.2$

$$r = \sqrt{x^2 + y^2} = \sqrt{(0.46)^2 + (7.2)^2} = 7.21$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right) = \tan^{-1}\left(\frac{7.2}{0.46}\right) = 86.3°$$

(7.21 km, 86.3°)