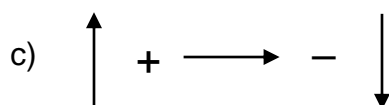
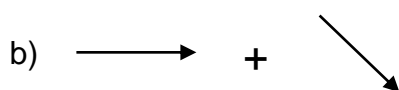
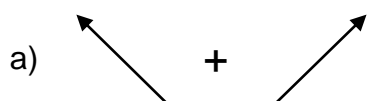




## Vector Practice Problems

1. Add the vectors graphically:



2. Add the vectors algebraically. Write your answer in vector hat notation. (e.g.  $3\hat{x} + 2\hat{y}$ )

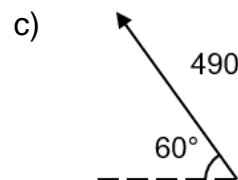
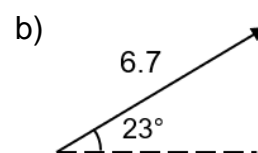
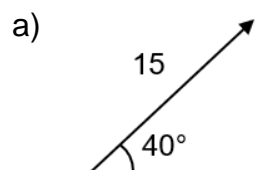
a)  $(7\hat{x} - 2\hat{y}) + (-5\hat{x} + 2\hat{y})$

b)  $(-\hat{x} + \hat{y}) - (4\hat{x} - 4\hat{y})$

c)  $(9\hat{x} - 4\hat{y} - 2\hat{z}) - (\hat{x} + 3\hat{y} + 10\hat{z})$

3. A vector of length 3 meters is added to another vector of length 7 meters. If you get to choose which way each vector points, what is the maximum and minimum lengths of the resultant vectors?

4. Split the vectors into their x and y components:

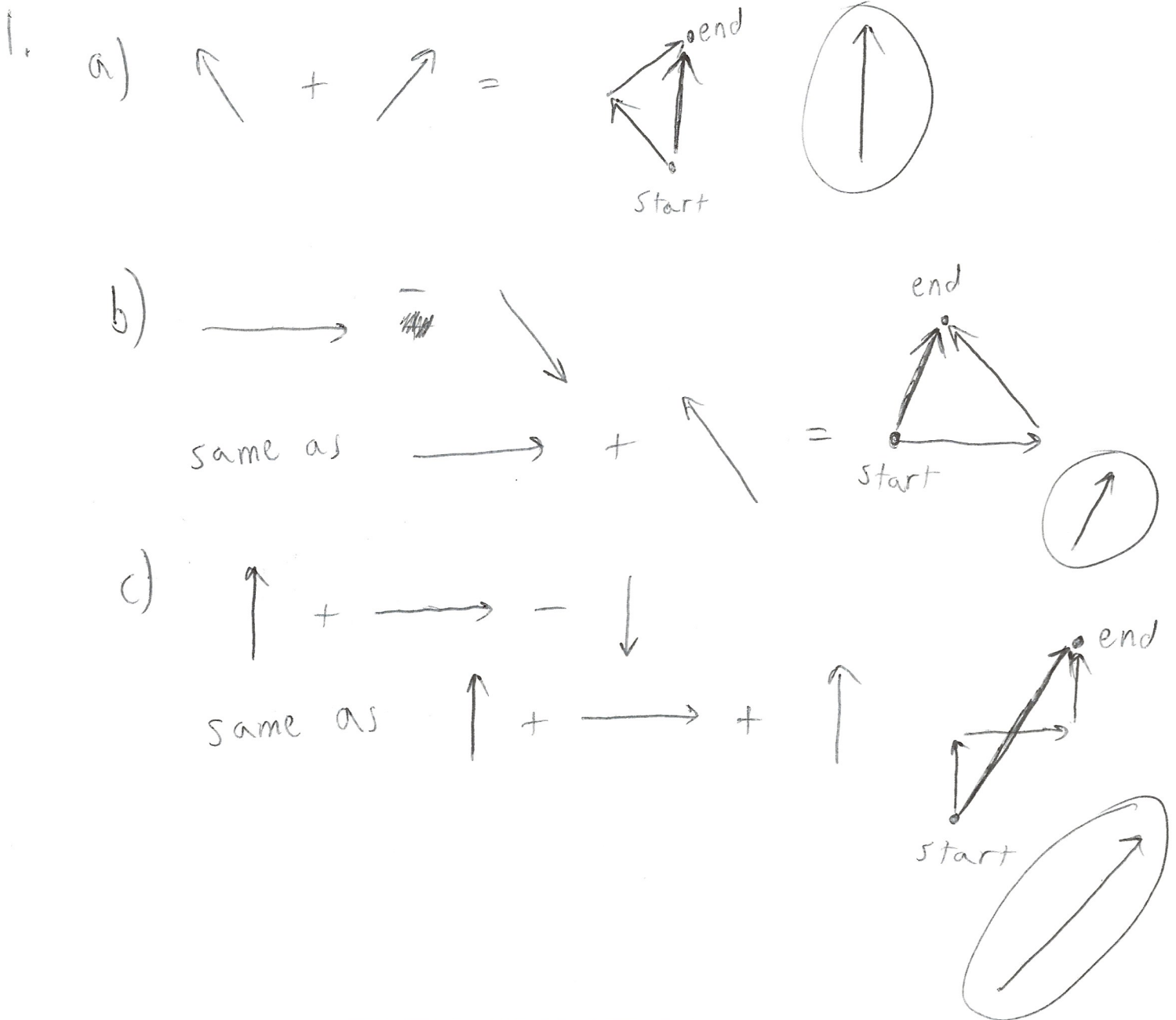


5. Kenny walks to his friend's house. He walks 120 ft North, then 400 ft West. What is his total displacement and direction (in degrees North of West)?

6. A golfer hits his first shot 250 yards directed 20 degrees East of North. His second shot goes 160 yards directed 45 degrees East of North. What is the total displacement and direction (in degrees East of North)?

7. A cruise ship heads 60 miles due South, then 85 miles at 12 degrees West of South, then 28 miles due West. What is the total displacement and direction (in degrees West of South) of the cruise ship?

# Physics Mechanics



2. a)  $(7\hat{x} - 5\hat{x}) + (-2\hat{y} + 2\hat{y}) = 2\hat{x}$

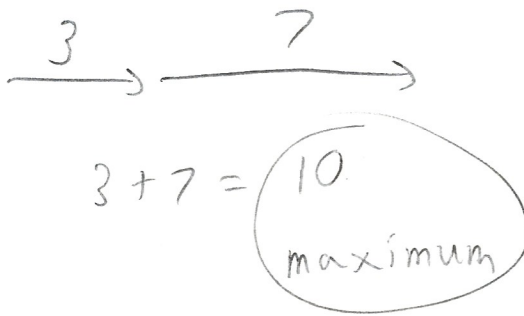
b)  $(-\hat{x} - 4\hat{x}) + (\hat{y} - 4\hat{y}) = -5\hat{x} + 5\hat{y}$

c)  $(9\hat{x} - \hat{x}) + (-4\hat{y} - 3\hat{y}) + (-2\hat{z} - 10\hat{z}) = 8\hat{x} - 7\hat{y} - 12\hat{z}$

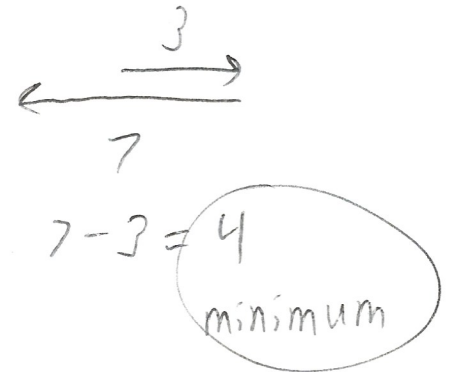
# Physics Mechanics



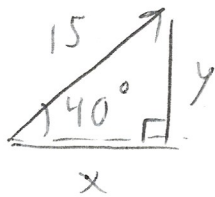
3. Max occurs when vectors point in same direction



Min occurs when vectors point in opposite directions



4. a)



$$\sin 40^\circ = \frac{y}{15}$$

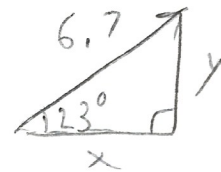
$$\cos 40^\circ = \frac{x}{15}$$

$$y = 15 \sin 40^\circ$$

$$y = 9.64$$

$$x = 15 \cos 40^\circ = 11.5 = x$$

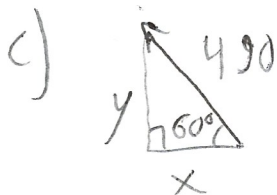
b)



$$\cos 23^\circ = \frac{x}{6.7}$$

$$x = 6.7 \cos 23^\circ = 6.17$$

$$y = 6.7 \sin 23^\circ = 2.62 = y$$



$$\sin 60^\circ = \frac{y}{490}$$

$$\cos 60^\circ = \frac{x}{490}$$

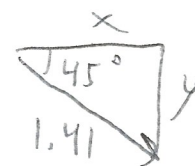
$$y = 490 \sin 60^\circ$$

$$y = 424.4$$

$$x = 490 \cos 60^\circ$$

$$x = 245$$

d)



$$\sin 45^\circ = \frac{y}{1.41}$$

$$\cos 45^\circ = \frac{x}{1.41}$$

$$y = 1.41 \sin 45^\circ$$

$$x = 1.41 \cos 45^\circ$$

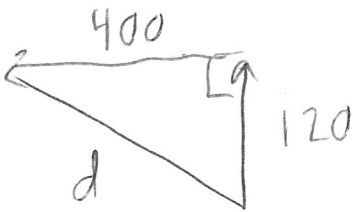
$$y = .997$$

$$x = .997$$

# Physics Mechanics



5.



$$a^2 + b^2 = c^2$$

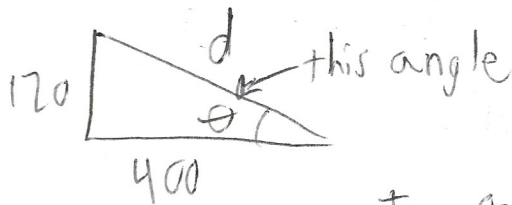
$$120^2 + 400^2 = d^2$$

$$\sqrt{174400} = \sqrt{d^2}$$

"North of West"

$$d = 417.6 \text{ ft}$$

Displacement



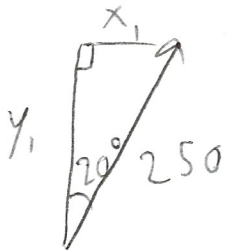
$$\tan \theta = \frac{120}{400}$$

$$\theta = \tan^{-1}\left(\frac{120}{400}\right)$$

$$\theta = 16.7^\circ$$

North of West

6. First Shot



$$x_1 = 250 \sin 20^\circ = 85.5$$

$$y_1 = 250 \cos 20^\circ = 234.9$$

$$x_1 + x_2 = 198.6$$

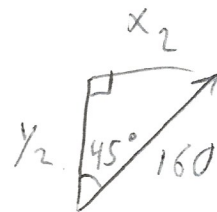
$$y_1 + y_2 = 348$$

$$a^2 + b^2 = c^2$$

$$198.6^2 + 348^2 = d^2$$

$$d = 400.7 \text{ yds}$$

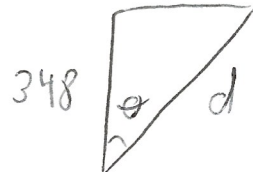
Second Shot



$$x_2 = 160 \sin 45^\circ = 113.1$$

$$y_2 = 160 \cos 45^\circ = 113.1$$

$$198.6$$



$$\tan \theta = \frac{198.6}{348}$$

$$\theta = \tan^{-1}\left(\frac{198.6}{348}\right)$$

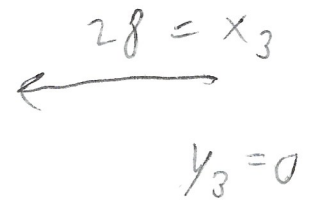
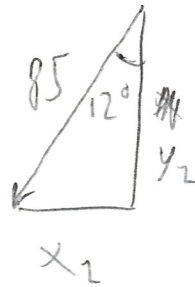
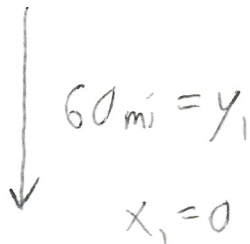
$$\theta = 29.7^\circ$$

East of North

# Physics Mechanics



7. First part      Second part      Third part



$$x_2 = 85 \sin 12^\circ$$

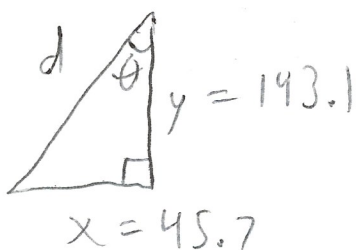
$$x_2 = 17.7$$

$$y_2 = 85 \cos 12^\circ$$

$$y_2 = 83.1$$

$$x = x_1 + x_2 + x_3 = 17.7 + 28 = 45.7$$

$$y = y_1 + y_2 + y_3 = 60 + 83.1 = 143.1$$



$$\tan \theta = \frac{45.7}{143.1}$$

$$\theta = \tan^{-1} \left( \frac{45.7}{143.1} \right)$$

$$d^2 = 45.7^2 + 143.1^2$$

$$d^2 = 22566.1$$

$$d = 150.2 \text{ mi}$$

$$\theta = 17.7^\circ \text{ West of South}$$