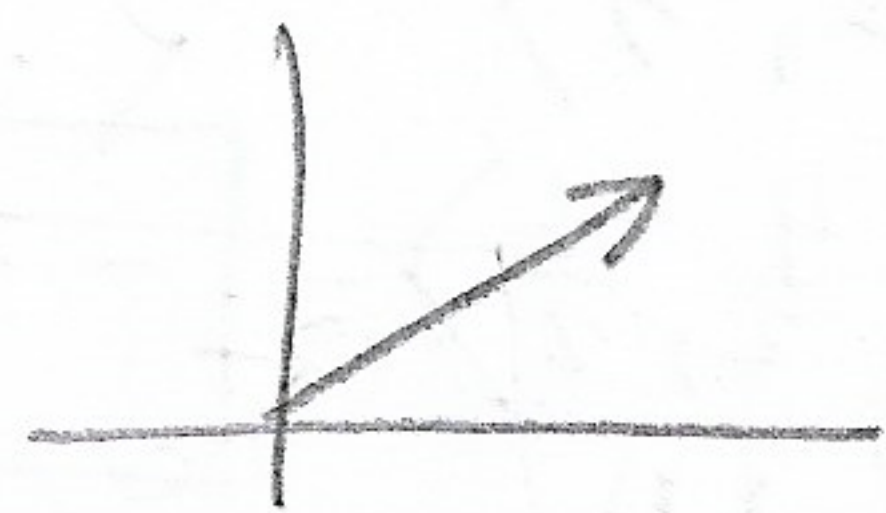
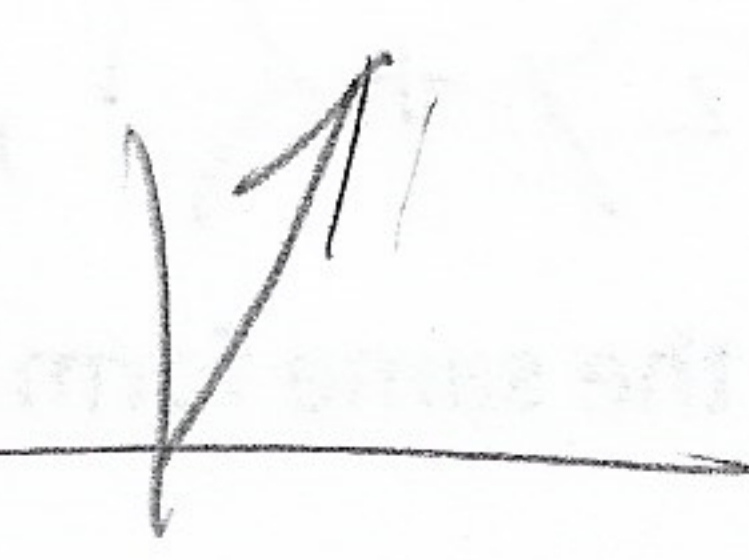


Write each of the following as the sum of unit vectors; also, find the magnitude and the direction of the vector. Round your answers to the nearest hundredth.

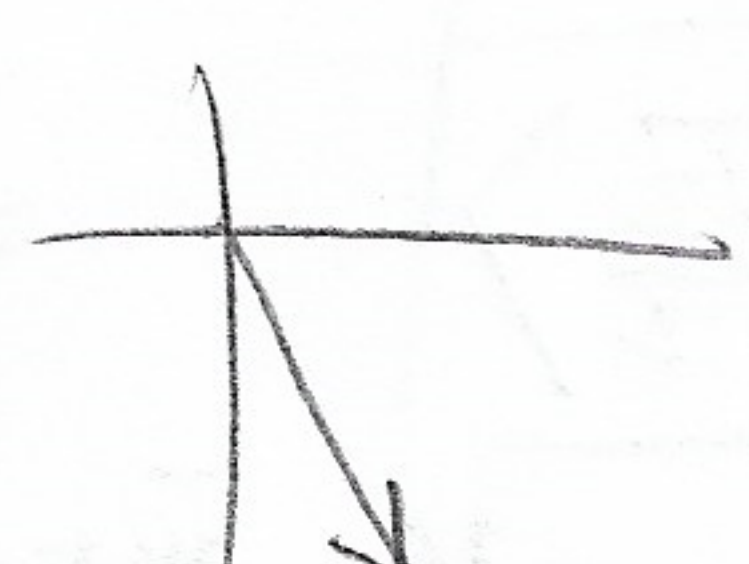
1. Initial point:  $(-3, -5)$ ; Terminal point:  $(5, 1)$

<p><b>Vector as sum of unit vectors:</b></p> $\langle 5 - (-3), 1 - (-5) \rangle$ $\langle 8, 6 \rangle$ $8\vec{i} + 6\vec{j}$ 	<p><b>Magnitude:</b></p> $\sqrt{64 + 36}$ $= \sqrt{100} = \boxed{10}$	<p><b>Direction:</b></p> $\theta' = \tan^{-1}\left(\frac{6}{8}\right) = 36.87^\circ$ $\theta = \boxed{36.87^\circ}$
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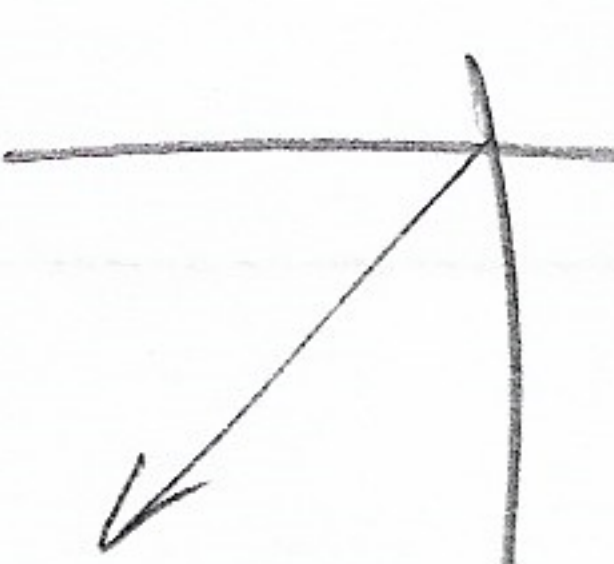
2. Initial point:  $(-3, 11)$ ; Terminal point:  $(9, 40)$

<p><b>Vector as sum of unit vectors:</b></p> $\langle 9 - (-3), 40 - 11 \rangle$ $\langle 12, 29 \rangle$ $\boxed{12\vec{i} + 29\vec{j}}$ 	<p><b>Magnitude:</b></p> $\sqrt{144 + 841}$ $= \sqrt{985} = \boxed{31.38}$	<p><b>Direction:</b></p> $\theta' = \tan^{-1}\left(\frac{29}{12}\right) = 67.52^\circ$ $\theta = \boxed{67.52^\circ}$
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3. Initial point:  $(-4.2, 5)$ ; Terminal point:  $(3.7, -12.9)$

<p><b>Vector as sum of unit vectors:</b></p> $\langle 3.7 - (-4.2), -12.9 - 5 \rangle$ $\langle 7.9, -17.9 \rangle$ $\boxed{7.9\vec{i} - 17.9\vec{j}}$ 	<p><b>Magnitude:</b></p> $\sqrt{7.9^2 + (-17.9)^2}$ $= \sqrt{382.62} = \boxed{19.57}$	<p><b>Direction:</b></p> $\theta' = \tan^{-1}\left(\frac{17.9}{7.9}\right) = 66.19^\circ$ $\theta = 360^\circ - 66.19^\circ$ $= \boxed{293.81^\circ}$
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4. Initial point:  $(1.64, 7.21)$ ; Terminal point:  $(-2.33, 3.86)$

<p><b>Vector as sum of unit vectors:</b></p> $\langle -2.33 - 1.64, 3.86 - 7.21 \rangle$ $\langle -3.97, -3.35 \rangle$ $\boxed{-3.97\vec{i} - 3.35\vec{j}}$ 	<p><b>Magnitude:</b></p> $\sqrt{(-3.97)^2 + (-3.35)^2}$ $= \sqrt{26.9839} = \boxed{5.19}$	<p><b>Direction:</b></p> $\theta' = \tan^{-1}\left(\frac{3.35}{3.97}\right) = 40.16^\circ$ $\theta = 180^\circ + 40.16^\circ$ $= \boxed{220.16^\circ}$
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Answers:

- 1)  $8\vec{i} + 6\vec{j}$ ;  $\|\vec{v}\| = 10$ ;  $\theta = 36.87^\circ$       2)  $12\vec{i} + 29\vec{j}$ ;  $\|\vec{v}\| = 31.38$ ;  $\theta = 67.52^\circ$   
 3)  $7.9\vec{i} - 17.9\vec{j}$ ;  $\|\vec{v}\| = 19.57$ ;  $\theta = 293.81^\circ$       4)  $-3.97\vec{i} - 3.35\vec{j}$ ;  $\|\vec{v}\| = 5.19$ ;  $\theta = 220.16^\circ$

For each of the following, find:

(a)  $-5\vec{u} + 2\vec{v}$

(b)  $\frac{1}{2}\vec{u} - \vec{v}$

Write answers in the form of the original vectors.

5.  $\vec{u} = \langle 5, 3 \rangle, \vec{v} = \langle -4, 0 \rangle$

(a)  $-5\langle 5, 3 \rangle + 2\langle -4, 0 \rangle$   
 $= \langle -25, -15 \rangle + \langle -8, 0 \rangle = \langle -33, -15 \rangle$

(b)  $\frac{1}{2}\langle 5, 3 \rangle - \langle -4, 0 \rangle$   
 $= \langle \frac{5}{2}, \frac{3}{2} \rangle + \langle 4, 0 \rangle = \langle \frac{13}{2}, \frac{3}{2} \rangle$

7.  $\vec{u} = -9\vec{j}, \vec{v} = -6\vec{i} + 10\vec{j}$

(a)  $-5\langle 0, -9 \rangle + 2\langle -6, 10 \rangle$   
 $= \langle 0, 45 \rangle + \langle -12, 20 \rangle = \langle -12, 65 \rangle$

(b)  $\frac{1}{2}\langle 0, -9 \rangle - \langle -6, 10 \rangle$   
 $= \langle 0, -\frac{9}{2} \rangle + \langle 6, -\frac{20}{2} \rangle = \langle 6, -\frac{29}{2} \rangle$

6.  $\vec{u} = \vec{i} + \vec{j}, \vec{v} = 2\vec{i} - 3\vec{j}$

(a)  $-5\langle 1, 1 \rangle + 2\langle 2, -3 \rangle$   
 $= \langle -5, -5 \rangle + \langle 4, -6 \rangle = \langle -1, -11 \rangle$

(b)  $\frac{1}{2}\langle 1, 1 \rangle - \langle 2, -3 \rangle$   
 $= \langle \frac{1}{2}, \frac{1}{2} \rangle - \langle 2, -3 \rangle = \langle -\frac{3}{2}, \frac{7}{2} \rangle$

8.  $\vec{u} = \langle 2, -1 \rangle, \vec{v} = \langle -1, 1 \rangle$

(a)  $-5\langle 2, -1 \rangle + 2\langle -1, 1 \rangle$   
 $= \langle -10, 5 \rangle + \langle -2, 2 \rangle = \langle -12, 7 \rangle$

(b)  $\frac{1}{2}\langle 2, -1 \rangle - \langle -1, 1 \rangle$   
 $= \langle 1, -\frac{1}{2} \rangle + \langle 1, -2 \rangle = \langle 2, -\frac{5}{2} \rangle$

Find a unit vector in the direction of the given vector. Write your answer in the same form as the original vector.

9.  $\vec{v} = \langle 6, 0 \rangle$

$\|\vec{v}\| = \sqrt{36+0} = \sqrt{36} = 6$

$\vec{u} = \frac{\langle 6, 0 \rangle}{6} = \langle 1, 0 \rangle$

10.  $\vec{v} = \langle -4, 4 \rangle$

$\|\vec{v}\| = \sqrt{16+16} = \sqrt{32} = 4\sqrt{2}$

$\vec{u} = \frac{\langle -4, 4 \rangle}{4\sqrt{2}} = \langle \frac{-4}{4\sqrt{2}}, \frac{4}{4\sqrt{2}} \rangle$   
 $= \langle -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \rangle = \langle -\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \rangle$

11.  $\vec{t} = \langle 5, -12 \rangle$

$\|\vec{t}\| = \sqrt{25+144} = \sqrt{169} = 13$

$\vec{u} = \frac{\langle 5, -12 \rangle}{13} = \langle \frac{5}{13}, -\frac{12}{13} \rangle$

12.  $\vec{m} = 4\vec{i} - 3\vec{j}$

$\|\vec{m}\| = \sqrt{16+9} = \sqrt{25} = 5$

$\vec{u} = \frac{\langle 4, -3 \rangle}{5} = \langle \frac{4}{5}, -\frac{3}{5} \rangle$   
 $= \langle \frac{4}{5}\vec{i} - \frac{3}{5}\vec{j} \rangle$

13.  $\vec{w} = \vec{i} - 2\vec{j}$

$\|\vec{w}\| = \sqrt{1+4} = \sqrt{5}$

$\vec{u} = \frac{\langle 1, -2 \rangle}{\sqrt{5}} = \langle \frac{1}{\sqrt{5}}, -\frac{2}{\sqrt{5}} \rangle$   
 $= \langle \frac{\sqrt{5}}{5}\vec{i} - \frac{2\sqrt{5}}{5}\vec{j} \rangle$

14.  $\vec{w} = -3\vec{i}$

$\|\vec{w}\| = \sqrt{9+0} = \sqrt{9} = 3$

$\vec{u} = \frac{\langle -3, 0 \rangle}{3} = \langle -1, 0 \rangle$   
 $= -\vec{i}$

5) a)  $\langle -33, -15 \rangle$  b)  $\langle 6.5, 1.5 \rangle$

6) a)  $-\vec{i} - 11\vec{j}$  b)  $-1.5\vec{i} + 3.5\vec{j}$

7) a)  $-12\vec{i} + 65\vec{j}$  b)  $6\vec{i} - 14.5\vec{j}$

8) a)  $\langle -12, 7 \rangle$  b)  $\langle 2, -1.5 \rangle$

9)  $\langle 1, 0 \rangle$  10)  $\langle -\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \rangle$  11)  $\langle \frac{5}{13}, -\frac{12}{13} \rangle$  12)  $\frac{4}{5}\vec{i} - \frac{3}{5}\vec{j}$  13)  $\frac{\sqrt{5}}{5}\vec{i} - \frac{2\sqrt{5}}{5}\vec{j}$  14)  $-\vec{i}$