5.1 Cartesian Vectors Worksheet

This document was composed and formatted by Annie Bernatchez.

The course material originated from www.jensenmath.ca

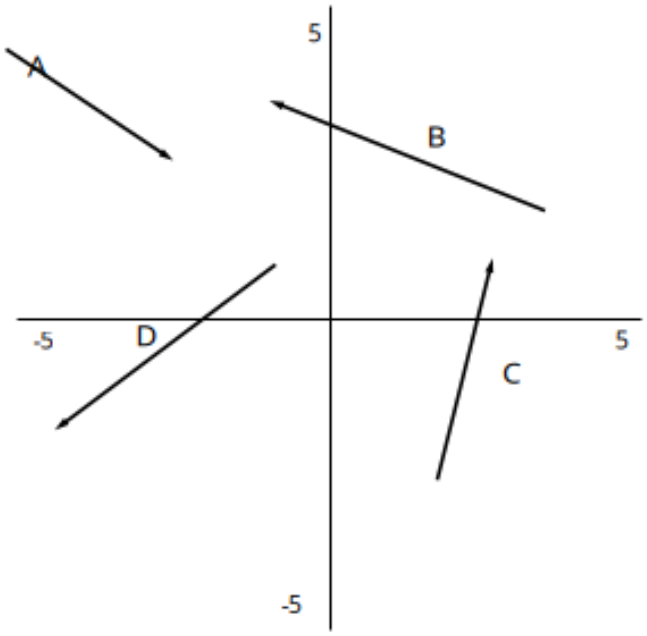
1) Express each vector in terms of the unit vectors $\vec{i}$ and $\vec{j}$.

a) $[-2, 0]$	b) $[0, 3]$	c) $[3, 2]$	d) $[-1, 6]$

2) Express each vector as a position vector $[a, b]$.

a) $3\vec{i} + 2\vec{j}$	b) $4\vec{j}$	c) $-7\vec{i} + 3\vec{j}$	d) $-9\vec{i}$

3) Write the coordinates of each Cartesian vector and determine the magnitude.



$\vec{A} =$	$\vec{B} =$
$\vec{C} =$	$\vec{D} =$

4) Given the vector $\vec{v} = [2, -5]$.

a) State the vertical and horizontal vector components of $\vec{v}$.

b) Find two vectors that are collinear with $\vec{v}$.

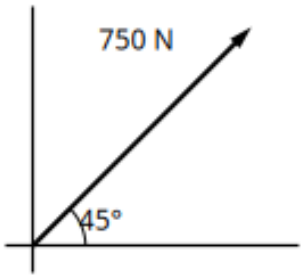
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5) If $\vec{u} = [-3, 5]$ and $\vec{v} = [2, 9]$.

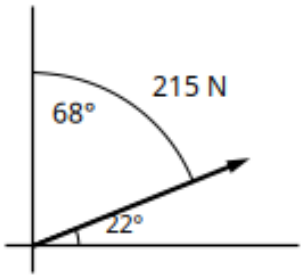
a) $\vec{u} + \vec{v}$	b) $\hat{u}$	c) $-3\vec{u} + 4\vec{v}$
d) $7\vec{u} + 6\vec{i} - 8\vec{j} - 3\vec{v}$	e) $\lvert\vec{v}\rvert$	f) $\lvert -3\vec{u} - 2\vec{v}\rvert$

6) Write each force as a Cartesian vector.

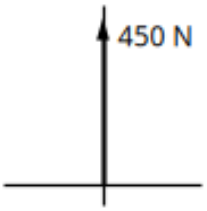
a) 750 N applied 45° to the horizontal



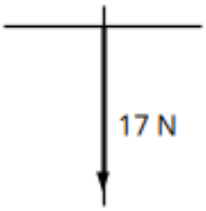
b) 215 N applied 68° to the vertical



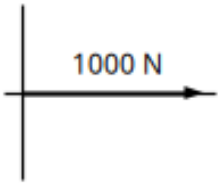
c) 450 N applied upwards



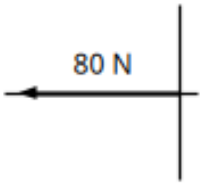
d) 17 N applied downwards



e) 1000 N east

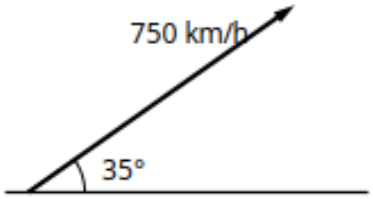


f) 80 N west

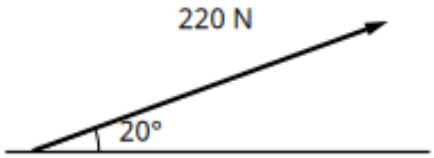


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7) An aircraft is travelling at 750 km per hour at an angle of 35° to the level ground below. Find the force in component form as a Cartesian vector.



8) A mom is pulling a sled exerting a force of 220 N along a rope that makes an angle of 20° to the horizontal. Write this force in component form as a Cartesian vector.

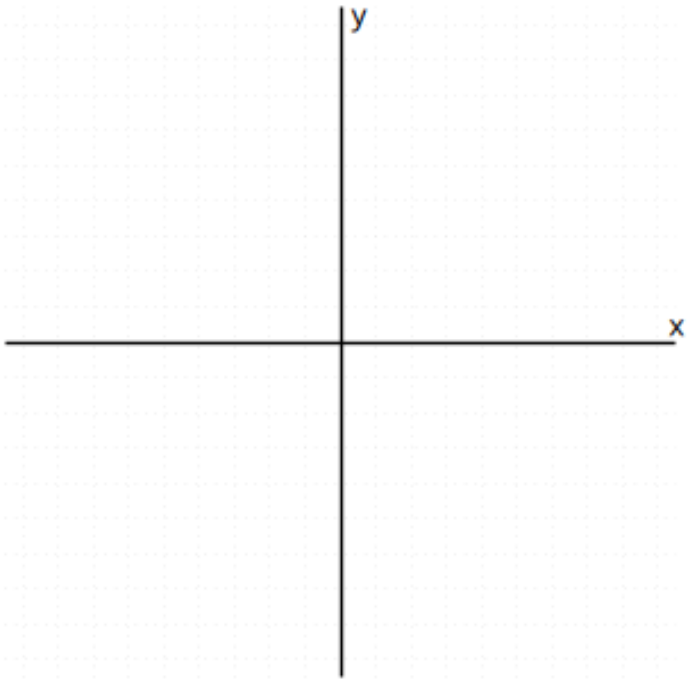


9) Let $\vec{a} = [-2, 5]$ and $\vec{b} = [5, -7]$.

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9) Let $\vec{a} = [-2, 5]$ and $\vec{b} = [5, -7]$.

a) Plot the two vectors.



b) Which is greater: $|\vec{a} + \vec{b}|$ or $|\vec{a}| + |\vec{b}|$?

10) Given the points $P(-6, 1)$, $Q(-2, -1)$, and $R(-3, 4)$, find…

a) $\overrightarrow{QP}$	b) $\lvert\overrightarrow{RP}\rvert$	c) perimeter of $\triangle PQR$

11) Which vector is NOT collinear with $\vec{a} = [6, -4]$?

$\vec{b} = [3, -2]$, $\vec{c} = [-6, -4]$, $\vec{d} = [-6, 4]$, or $\vec{e} = [-9, 6]$

Answer Key

1) a) $-2\vec{i}$ b) $3\vec{j}$ c) $3\vec{i} + 2\vec{j}$ d) $-\vec{i} + 6\vec{j}$

2) a) $[3, 2]$ b) $[0, 4]$ c) $[-7, 3]$ d) $[-9, 0]$

3) a) $[3, -2]$; $\sqrt{13}$ b) $[-5, 2]$; $\sqrt{29}$ c) $[1, 4]$; $\sqrt{17}$ d) $[-4, -3]$; 5

4) a) vertical: 2; horizontal: -5 b) e.g., $[4, -10]$, $[-6, 15]$

5) a) $[-1, 14]$ b) $\left[\frac{-3}{\sqrt{34}}, \frac{5}{\sqrt{34}}\right]$ c) $[17, 21]$ d) $[-21, 0]$ e) $\sqrt{85}$ f) $\sqrt{1114}$

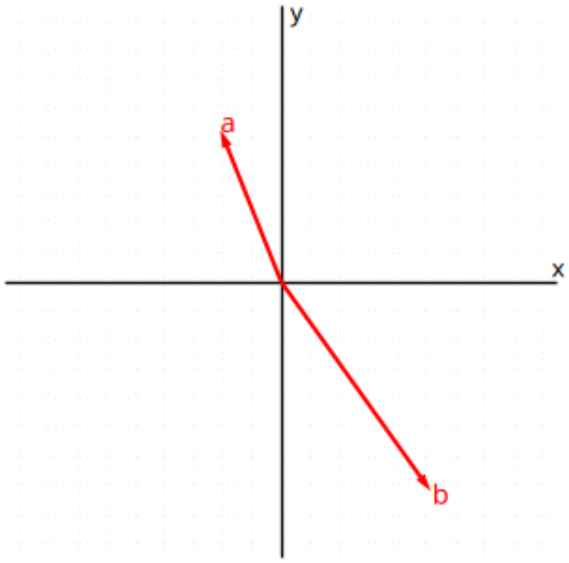
6) a) $[530.3, 530.33]$ b) $[199, 80.5]$ c) $[0, 450]$ d) $[0, -17]$ e) $[1000, 0]$ f) $[-80, 0]$

7) $[614.36, 430.18]$

8) $[206.7, 75.2]$

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9)



b) $|\vec{a}| + |\vec{b}|$ is greater

10) a) $[-4, 2]$ b) $3\sqrt{2}$ units c) 13.8 units

11) $\vec{c}$

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