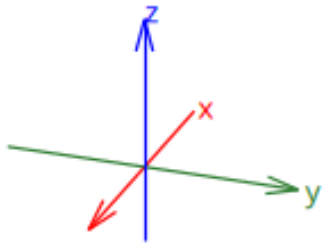
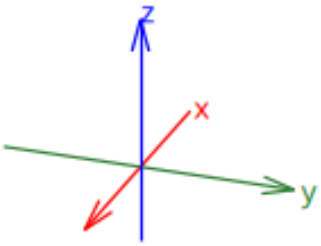
5.4 Vectors in 3-Space Worksheet

This document was composed and formatted by Annie Bernatchez.

The course material originated from www.jensenmath.ca

1) Draw the position vectors.

a) $[-2,\ 3,\ -4]$	b) $[2,\ -3,\ 1]$
	

2) Express each vector as the sum of $\vec{i}$, $\vec{j}$ and $\vec{k}$.

a) $[2,\ -1,\ 7]$	b) $[-4,\ -6,\ 5]$

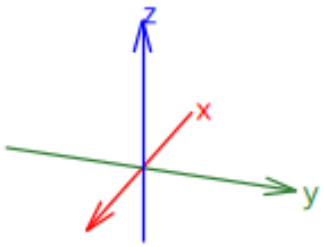
3) Express each vector in the form $[a,\ b,\ c]$.

a) $3\vec{i} - 4\vec{j} + 5\vec{k}$	b) $2\vec{i} + 3\vec{k}$
c) $-8\vec{i} + 9\vec{j} - 4\vec{k}$	d) $-8\vec{j} - 7\vec{k}$

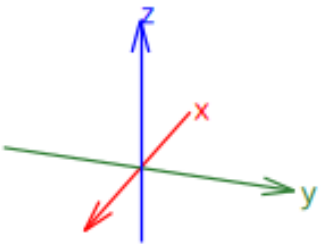
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4) Draw vector $\overrightarrow{AB}$ joining each pair of points. Then write the vector in the form $[a, b, c]$.

a) $A(2, -1, 7)$ and $B(0, 2, -1)$

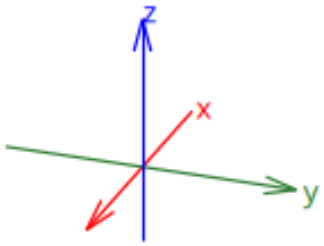


b) $A(0, -4, -2)$ and $B(-3, -1, 0)$

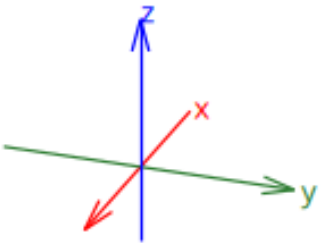


5) Draw each position vector. Then find its magnitude.

a) $[-1, 5, -2]$



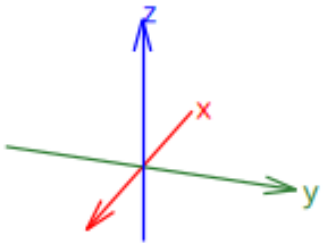
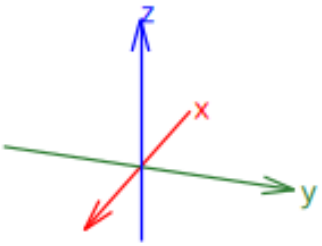
b) $[-2, 0, 4]$



6) Find a and b such that $\vec{u} = [a, 3, 6]$ and $\vec{v} = [-8, 12, b]$ are collinear.

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7) Draw the vector $\overrightarrow{AB}$ joining each pair of points. Write the vector in the form $[x, y, z]$. Then determine the exact magnitude of the vector.

a) $A(2, 1, 3)$ and $B(5, 7, 1)$	b) $A(3, -4, 1)$ and $B(6, -1, 5)$
	

8) Evaluate each given the vectors $\vec{a} = [-2, 1, 8]$, $\vec{b} = [3, 1, -2]$, and $\vec{c} = [2, -3, 4]$.

a) $3\vec{b}$	b) $\vec{b} - \vec{c}$	c) $2\vec{a} - 3\vec{c} + 4\vec{b}$
d) $(\vec{a} + \vec{b}) - (\vec{a} + \vec{c})$	e) $\vec{b} \cdot \vec{c}$	f) $\vec{a} \cdot \vec{b} - \vec{c} \cdot \vec{b}$

9) Let $\vec{a} = 3\vec{i} - 2\vec{j} + 4\vec{k}$, $\vec{b} = 7\vec{i} + 4\vec{j} - \vec{k}$ and $\vec{c} = -2\vec{i} + 5\vec{j} + 9\vec{k}$.

a) $(\vec{a} + \vec{b}) \cdot \vec{c}$	b) $2\vec{a} \cdot (4\vec{b} - 3\vec{c})$

10) Determine the values of k such that $\vec{u}$ and $\vec{v}$ are orthogonal.

a) $\vec{u} = [2, k, -1]$ and $\vec{v} = [3, -2, 7]$	b) $\vec{u} = [-3, 1, k]$ and $\vec{v} = [4, -k, k]$

11) Find a vector orthogonal to each vector.

a) $[2, -1, 7]$	b) $[8, -3, 4]$

12) Consider the vectors $\vec{u} = [3, -5, 8]$ and $\vec{v} = [3, 1, -2]$.

a) Find $\vec{u} \cdot \vec{v}$.

b) Calculate the angle between $\vec{u}$ and $\vec{v}$.

13) Determine the projection of $\vec{a}$ on $\vec{b}$.

a) $\vec{a} = [2, 1, -3]$ and $\vec{b} = [1, 7, 6]$	b) $\vec{a} = [3, 4, 7]$ and $\vec{b} = [2, -1, 1]$

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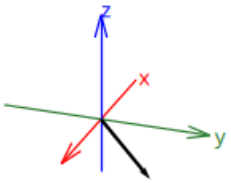
14) The initial point of vector $\overrightarrow{CD} = [2, -9, 1]$ is $C(-3, 2, 2)$ determine the coordinates of D.

15) Find 2 unit vectors that are parallel to $\vec{a} = [9, -7, 2]$.

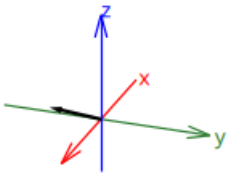
16) A triangle has vertices at the points $D = (3, -2, -3)$, $E(7, 0, 1)$ and $F(1, 2, 1)$. What type of triangle is $\triangle DEF$? Explain.

Answer Key

1. a)



b)

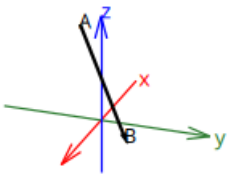


2. a) $2\vec{i} - \vec{j} + 7\vec{k}$ b) $-4\vec{i} - 6\vec{j} + 5\vec{k}$

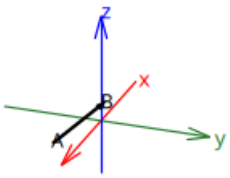
3. a) $[3, -4, 5]$ b) $[2, 0, 3]$ c) $[-8, 9, -4]$ d) $[0, -8, -7]$

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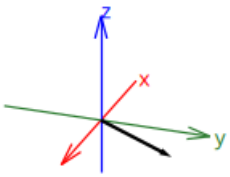
4. a) $[-2, 3, -8]$



b) $[-3, 3, 2]$

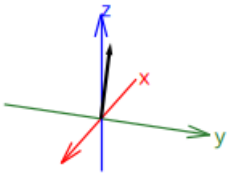


5) a) $\sqrt{30}$



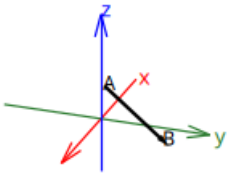
b) $2\sqrt{5}$

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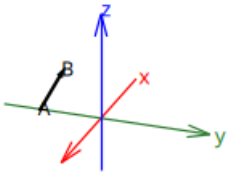


6) $a = -2,\ b = 24$

7)a) $[3,\ 6,\ -2],\ 7$



b) $[3,\ 3,\ 4],\ \sqrt{34}$



8) a) $[9,\ 3,\ -6]$ b) $[1,\ 4,\ -6]$ c) $[2,\ 15,\ -4]$ d) $[1,\ 4,\ -6]$ e) -5 f) -16

9) a) 17 b) -48

10) a) $k = -0.5$ b) $k = 4,\ k = -3$

11) a) $[4,\ 8,\ 0]$ b) $[1,\ 0,\ -2]$

12) a) -12 b) $108.9°$

13) a) $\left[\frac{-9}{86},\ \frac{-63}{86},\ \frac{-27}{43}\right]$ b) $\left[3,\ \frac{-3}{2},\ \frac{3}{2}\right]$

14) $D(-1,\ -7,\ 3)$

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15) $\left[\frac{9}{\sqrt{134}}, \frac{-7}{\sqrt{134}}, \frac{2}{\sqrt{134}}\right]$ and $\left[\frac{-9}{\sqrt{134}}, \frac{7}{\sqrt{134}}, \frac{-2}{\sqrt{134}}\right]$

16) This is a non-right isosceles triangle because 2 sides of the triangle are the same length but no 2 vectors that make up the sides of the triangle dot to 0, this tells us there are no perpendicular vectors and therefore no right angles.

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