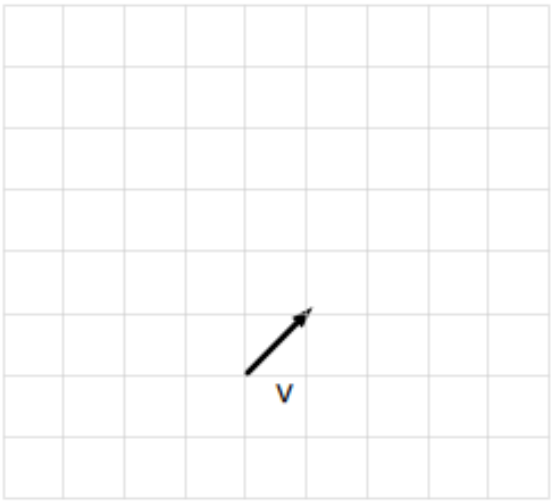
4.3 Multiplication of a Vector by a Scalar Worksheet with solutions

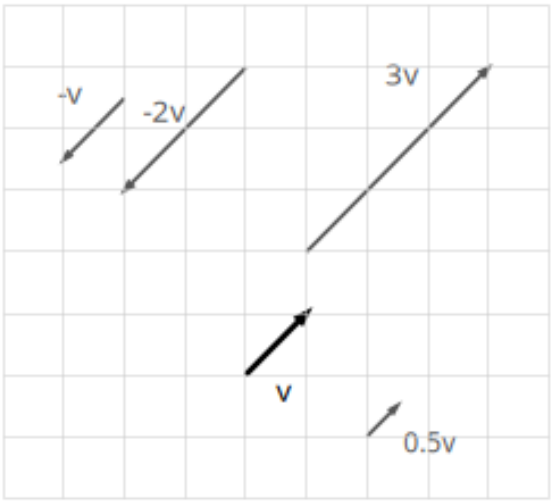
This document was composed and formatted by Annie Bernatchez.

The course material originated from www.jensenmath.ca

1) Draw representatives of the following vectors on the grid provided.

a) $3\vec{v}$ b) $0.5\vec{v}$ c) $-2\vec{v}$ d) $-\vec{v}$





2) Simplify each of the following algebraically.

a) $\vec{a} + 2\vec{a} + 4\vec{a}$

$= 7\vec{a}$

b) $7\vec{u} + 5\vec{v} - 2\vec{u} + 8\vec{v}$

$= 5\vec{u} + 13\vec{v}$

c) $2(\vec{u} + \vec{v}) - 3(\vec{u} - 2\vec{v})$

$= 2\vec{u} + 2\vec{v} - 3\vec{u} + 6\vec{v}$

$= -\vec{u} + 8\vec{v}$

d) $7\vec{u} + 5\vec{v} - 2(\vec{u} - \vec{v}) + 2\vec{u}$

$= 7\vec{u} + 5\vec{v} - 2\vec{u} + 2\vec{v} + 2\vec{u}$

$= 7\vec{u} + 7\vec{v}$

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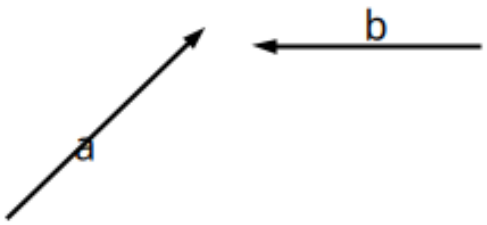
e) $-3(\vec{u}+\vec{v})+2(\vec{u}-\vec{v})$

$$= -3\vec{u}-3\vec{v}+2\vec{u}-2\vec{v}$$
$$= -\vec{u}-5\vec{v}$$

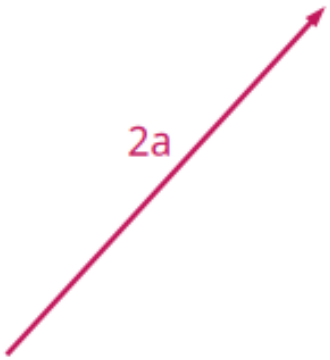
f) $6(\vec{u}+2\vec{v})-5(\vec{u}-3\vec{v})$

$$= 6\vec{u}+12\vec{v}-5\vec{u}+15\vec{v}$$
$$= \vec{u}+27\vec{v}$$

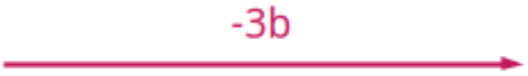
3) For the vectors $\vec{a}$ and $\vec{b}$ shown, draw and label…



a) $2\vec{a}$

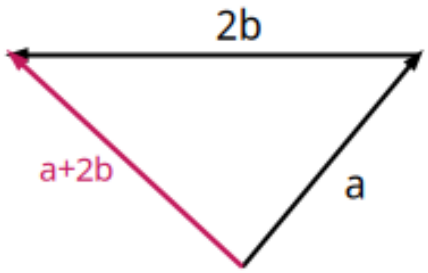


b) $-3\vec{b}$

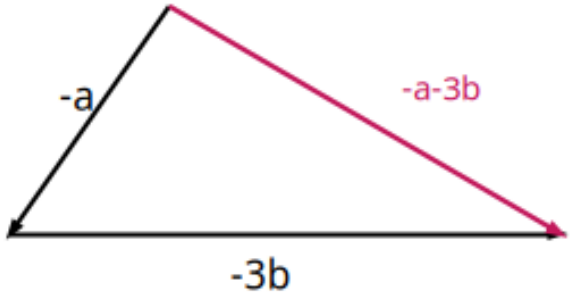


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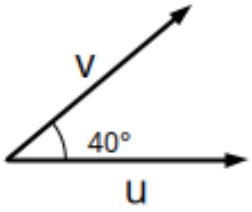
c) $\vec{a} + 2\vec{b}$



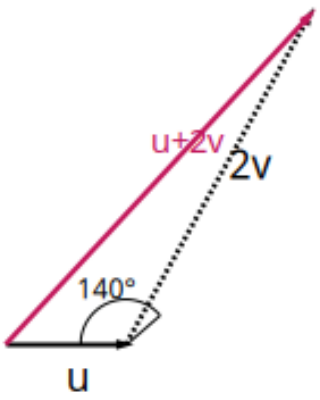
d) $-\vec{a} - 3\vec{b}$



4) Two vectors $\vec{u}$ and $\vec{v}$ make an angle of 40° with each other. Construct each vector sum or difference.

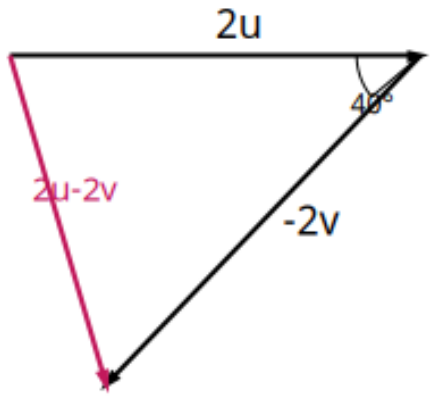


a) $\vec{u} + 2\vec{v}$

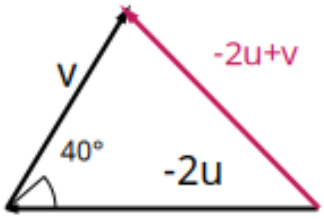


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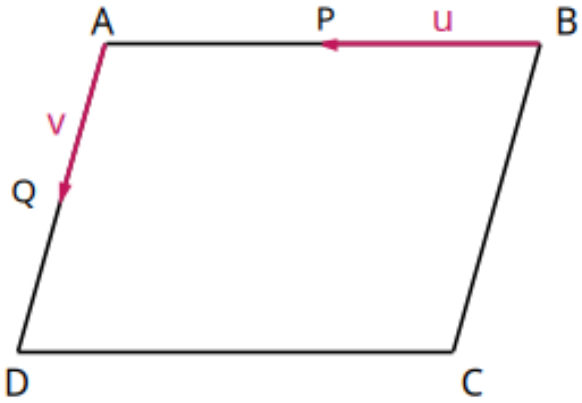
b) $2\vec{u} - 2\vec{v}$



c) $-2\vec{u} + \vec{v}$



5) In parallelogram ABCD, opposite sides are parallel and equal, $\overrightarrow{BP} = \overrightarrow{PA}$, and $\overrightarrow{AQ} = \overrightarrow{QD}$. Let $\overrightarrow{BP} = \vec{u}$ and $\overrightarrow{AQ} = \vec{v}$. Express the following vectors in terms of $\vec{u}$ and $\vec{v}$.



a) $\overrightarrow{AD} =$ $2\vec{v}$

b) $\overrightarrow{PA} =$ $\vec{u}$

c) $\overrightarrow{CD} =$ $2\vec{u}$

d) $\overrightarrow{PQ} =$ $\vec{u} + \vec{v}$

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a) $\overrightarrow{AD} = 2\vec{v}$

b) $\overrightarrow{PA} = \vec{u}$

c) $\overrightarrow{CD} = 2\vec{u}$

d) $\overrightarrow{PQ} = \vec{u} + \vec{v}$

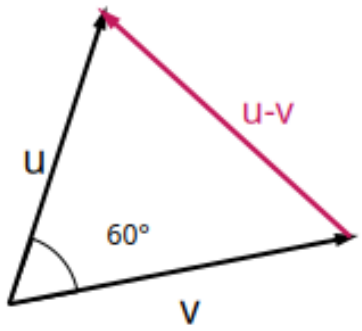
e) $\overrightarrow{BD} = 2\vec{v} + 2\vec{u}$

f) $\overrightarrow{PD} = \vec{u} + 2\vec{v}$

g) $\overrightarrow{AC} = 2\vec{v} - 2\vec{u}$

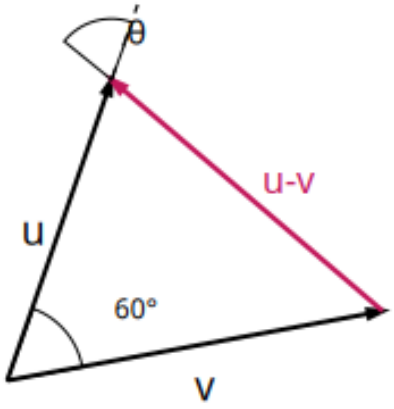
6) Given that $|\vec{u}| = 8$ and $|\vec{v}| = 10$ and the angle between $\vec{u}$ and $\vec{v}$ is 60°, determine:

a) $|\vec{u} - \vec{v}|$



$$|\vec{u} - \vec{v}|^2 = 8^2 + 10^2 - 2(8)(10)\cos(60°)$$
$$|\vec{u} - \vec{v}| = \sqrt{84}$$
$$|\vec{u} - \vec{v}| = 2\sqrt{21}$$

b) the direction of $\vec{u} - \vec{v}$ relative to $\vec{u}$

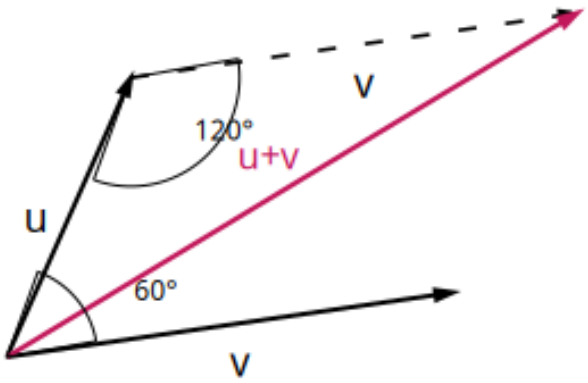


$$\frac{\sin\theta}{10} = \frac{\sin 60°}{2\sqrt{21}}$$
$$\theta \approx 70.9°$$

70.9° between $\vec{u}$ and $\vec{u} - \vec{v}$

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c) the unit vector in the direction of $\vec{u} + \vec{v}$



$$|\vec{u} + \vec{v}|^2 = 8^2 + 10^2 - 2(8)(10)\cos(120°)$$
$$|\vec{u} + \vec{v}| = \sqrt{244}$$
$$|\vec{u} + \vec{v}| = 2\sqrt{61}$$

unit vector: $\frac{1}{2\sqrt{61}}(\vec{u} + \vec{v})$

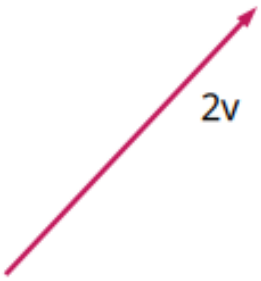
d) $|5\vec{u} + 2\vec{v}|$

$$|5\vec{u}| = 40, \quad |2\vec{v}| = 20$$
$$|5\vec{u} + 2\vec{v}|^2 = 40^2 + 20^2 - 2(40)(20)\cos(120°)$$
$$|5\vec{u} + 2\vec{v}| = \sqrt{2800}$$
$$|5\vec{u} + 2\vec{v}| = 20\sqrt{7}$$

7) $|\vec{v}| = 2$. Draw the following vectors and express each of them as a scalar multiple of $\vec{v}$.



a) A vector in the same direction as $\vec{v}$ with twice its magnitude

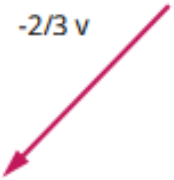


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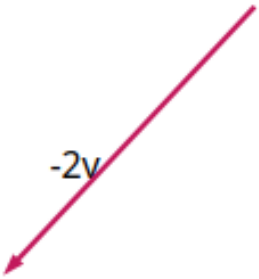
b) a vector in the same direction as $\vec{v}$ with one half its magnitude



c) a vector in the opposite direction as $\vec{v}$ with two-thirds its magnitude



d) a vector in the opposite direction as $\vec{v}$ with twice its magnitude



e) a unit vector in the same direction as $\vec{v}$



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