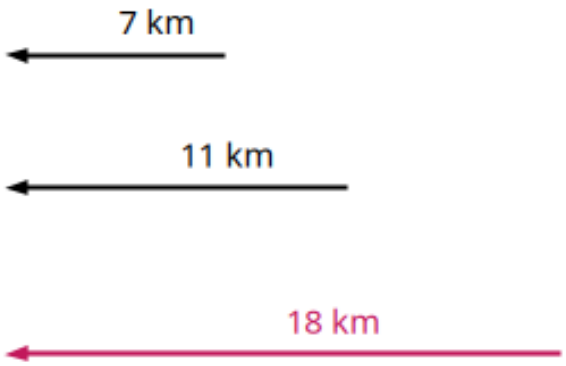
4.2 Vector Addition Worksheet with solutions

This document was composed and formatted by Annie Bernatchez.

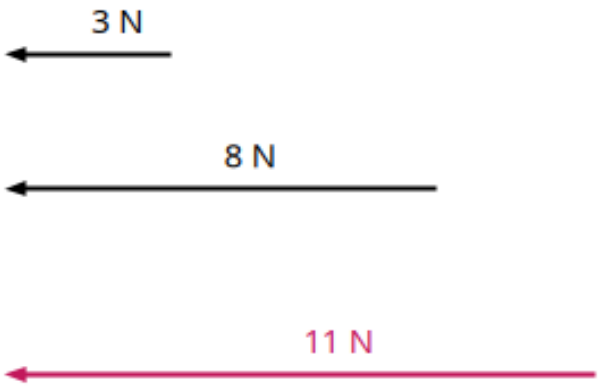
The course material originated from www.jensenmath.ca

1) Draw a diagram to illustrate each vector sum or difference.

a) 7 km + 11 km

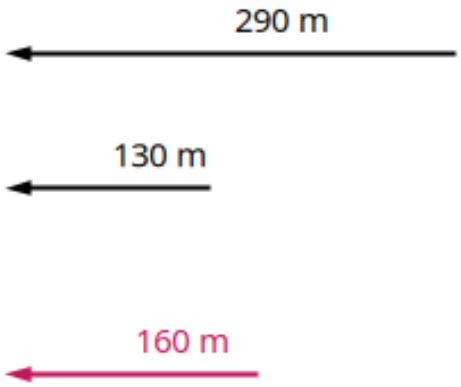


b) 3 N—8 N

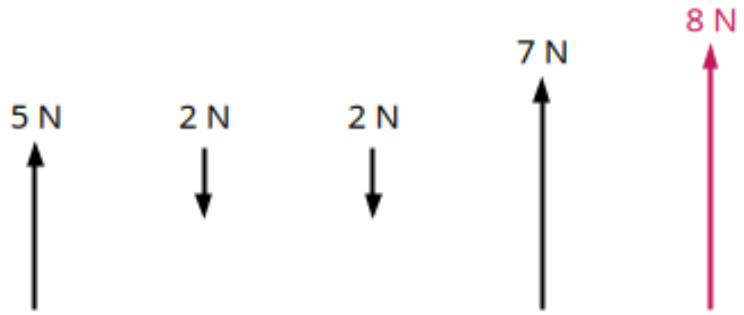


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c) 290 m—130 m

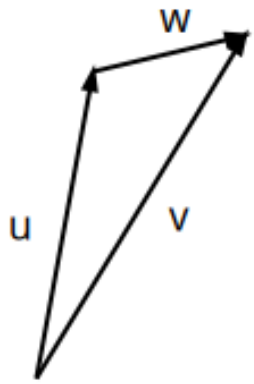


d) 5 N + 2 N + 2 N + 7 N



2) Express the shortest vector in each diagram as the sum or difference of the other two vectors.

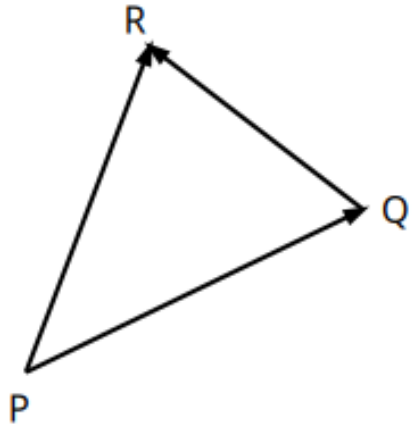
a)



$\vec{w} = \vec{v} - \vec{u}$

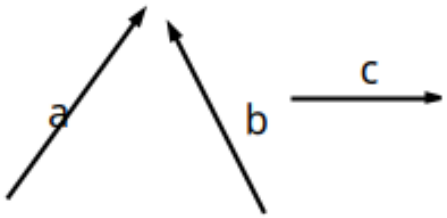
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b)

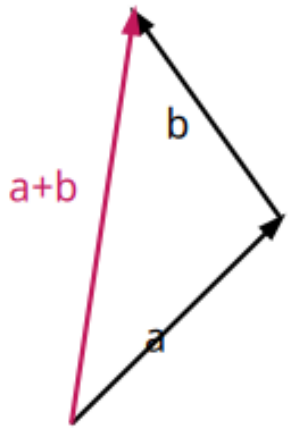


$\overrightarrow{QR} = \overrightarrow{PR} - \overrightarrow{PQ}$

3) Given the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$, construct $\vec{a} + \vec{b}$ and $(\vec{a} + \vec{b}) + \vec{c}$.

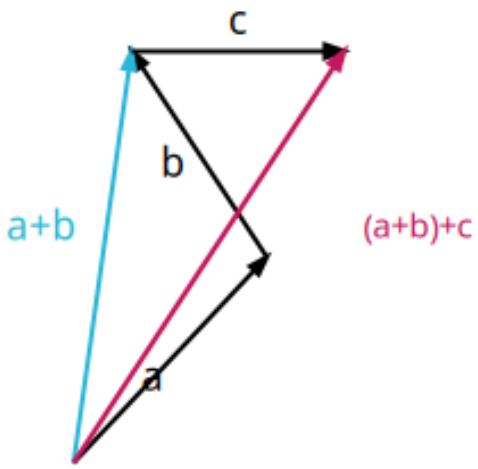


$\vec{a} + \vec{b}$:

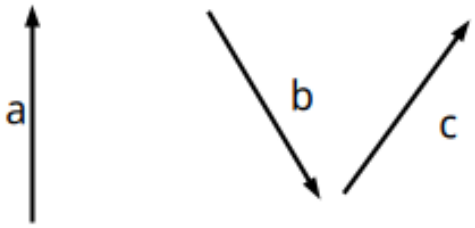


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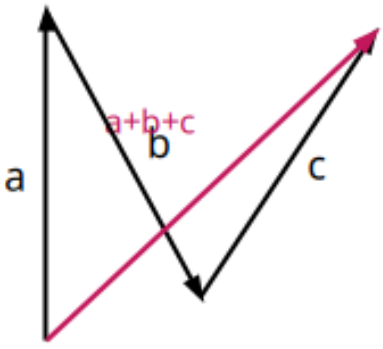
$(\vec{a}+\vec{b})+\vec{c}$:



4) Given the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$, draw a diagram of each expression.

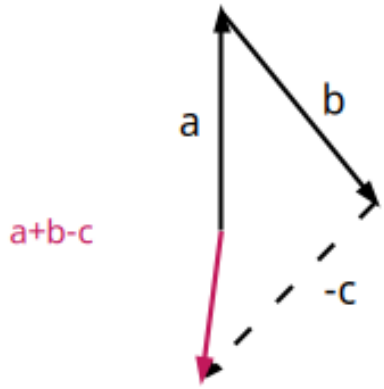


a) $\vec{a}+\vec{b}+\vec{c}$

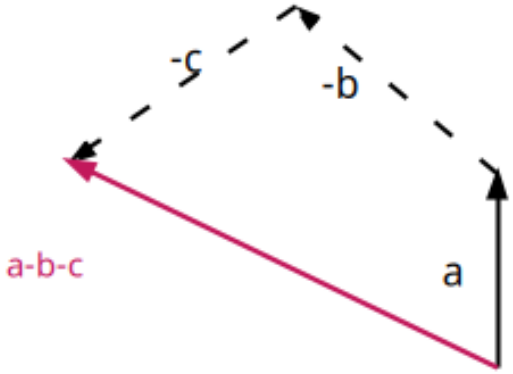


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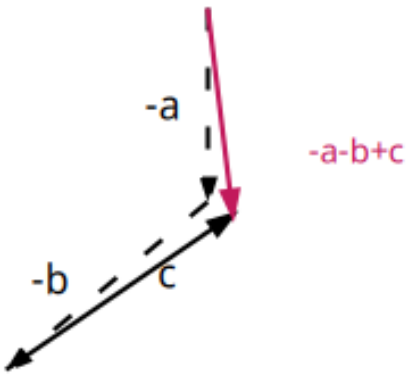
b) $\vec{a} + \vec{b} - \vec{c}$



c) $\vec{a} - \vec{b} - \vec{c}$

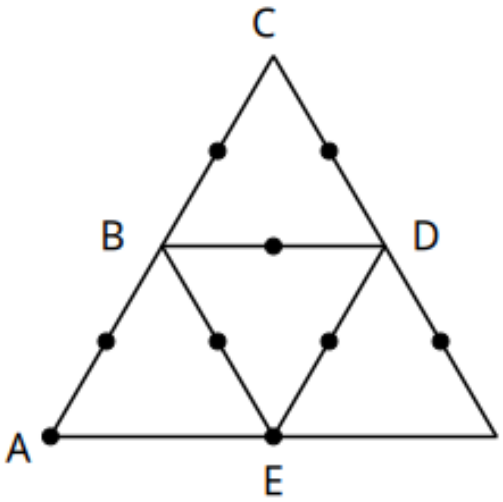


d) $-\vec{a} - \vec{b} + \vec{c}$



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5) The diagram shows three congruent equilateral triangles. Express each difference as a single vector. Show your simplification steps.



a) $\overrightarrow{AB} - \overrightarrow{AE}$

$= \overrightarrow{EB}$

b) $-\overrightarrow{AB} + \overrightarrow{AE} + \overrightarrow{ED}$

$= \overrightarrow{BE} + \overrightarrow{ED}$
$= \overrightarrow{BD}$

c) $\overrightarrow{BD} - \overrightarrow{BE}$

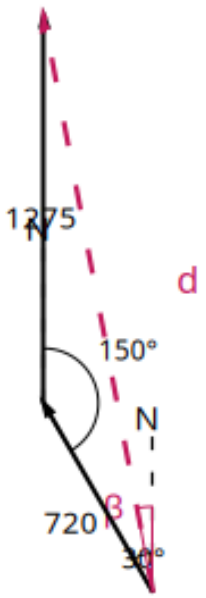
$= \overrightarrow{ED}$

d) $\overrightarrow{CD} - \overrightarrow{BD}$

$= \overrightarrow{CD} + (-\overrightarrow{BD})$
$= \overrightarrow{CD} + \overrightarrow{DB}$
$= \overrightarrow{CB}$

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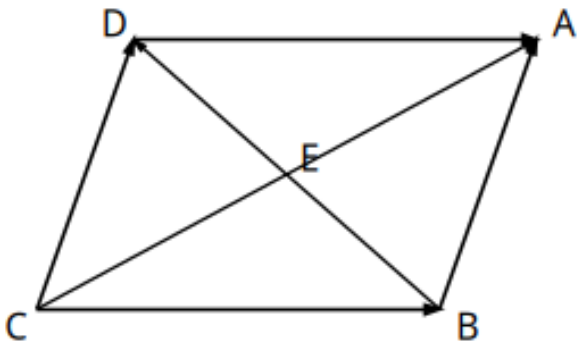
6) An airplane leaves the airport travelling N30°W at 720 km/h. After 1 h, the airplane then turns north and travels another 1.5 h at 850 km/h. What is the displacement of the airplane after 2.5 h?



$$|\vec{d}|^2 = 720^2 + 1275^2 - 2(720)(1275)\cos(150°)$$
$$|\vec{d}| \approx 1932.4 \text{ km}$$
$$\frac{\sin\theta}{1275} = \frac{\sin 150°}{1932.4}$$
$$\theta \approx 19.26°$$
$$\beta = 30° - 19.26°$$
$$\beta \approx 10.74°$$

Answer: 1932.4 km at $N10.74°W$

7) ABCD is a parallelogram, and E is the intersection point of the diagonal AC and BD. Name a single vector equivalent to each expression.



a) $\overrightarrow{AE} + \overrightarrow{EB}$

$\overrightarrow{AB}$

b) $\overrightarrow{BC} + \overrightarrow{BA}$

$\overrightarrow{BD}$

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c) $\overrightarrow{AE} + \overrightarrow{AE}$

$\overrightarrow{AC}$

d) $\overrightarrow{AD} + \overrightarrow{AB}$

$\overrightarrow{AC}$

e) $\overrightarrow{BA} + \overrightarrow{AE} + \overrightarrow{ED} + \overrightarrow{DC}$

$\overrightarrow{BC}$

f) $\overrightarrow{AB} - \overrightarrow{DB} = \overrightarrow{AB} + \overrightarrow{BD}$

$\overrightarrow{AD}$

g) $\overrightarrow{AB} - \overrightarrow{CB} - \overrightarrow{DC}$

$$= \overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD}$$
$$= \overrightarrow{AD}$$

h) $\overrightarrow{AE} - \overrightarrow{EB} - \overrightarrow{BC}$

$$= \overrightarrow{AE} + \overrightarrow{BE} + \overrightarrow{CB}$$
$$= \overrightarrow{AD} + \overrightarrow{CB}$$
$$= \vec{0}$$

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