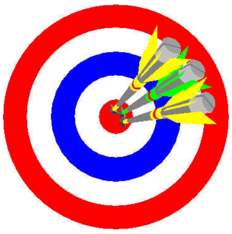
Operations with Vectors in R ^{3} (6.7)

Math Learning Target:



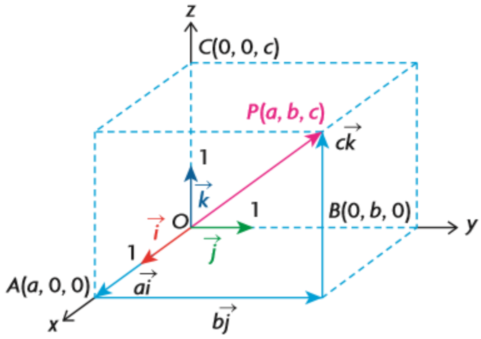
"In any space, I know how to express vectors in geometric, component and algebraic form. I know how to add (and subtract) vectors. I can determine the related position vector created by two points. I can calculate the magnitude of any vector. I can apply all theorems learned today in familiar and unfamiliar settings."

Recall:

	Geometric Form	Component Form	Algebraic Form
R	$\vec{OP}$	a	$a\vec{i}$
R^2	$\vec{OP}$	(a,b)	$a\vec{i}+b\vec{j}$

where $a,b \in R$ and $\vec{i},\vec{j}$ are the standard unit vectors.

Representation of Vectors in R^3



	Geometric Form	Component Form	Algebraic Form
R^3	$\vec{OP}$	(a,b,c)	$a\vec{i}+b\vec{j}+c\vec{k}$

Recall:

Every vector in R^2 can be ***uniquely*** written as $a\vec{i}+b\vec{j}$.
We say that the vectors $\vec{i}$ and $\vec{j}$, form a **standard basis** for R^2.

Standard Basis in R^3

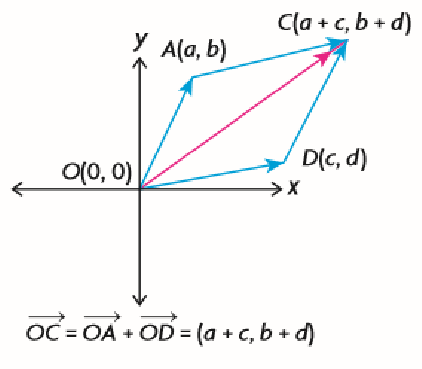
Given: $a,b,c \in R$ and $\vec{i},\vec{j},\vec{k}$ are standard unit vectors.

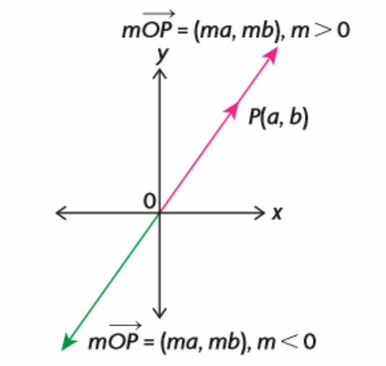
Since every vector in R^3 can be ***uniquely*** written as $a\vec{i}+b\vec{j}+c\vec{k}$ the vectors $\vec{i},\vec{j},\vec{k}$, form a **standard basis** for R^3.

EXAMPLE

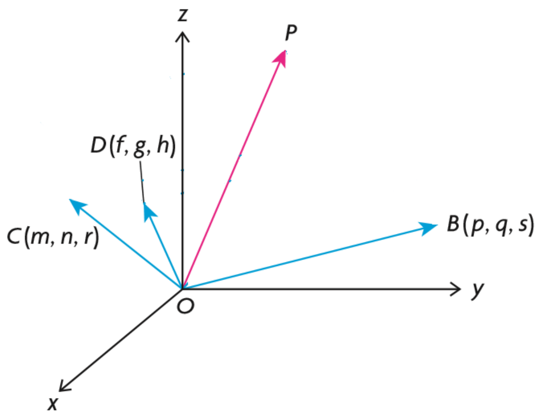
Express in component form: $3\vec{i}-4\vec{k}$

Recall:
R^2





<u>Addition of Three Noncollinear Vectors in R^3</u>



<u>Parallelepiped</u>

A **parallelepiped** is a prism with 6 faces, all of which are parallelograms. The addition of three noncollinear vectors in R^3 always creates a parallelepiped.

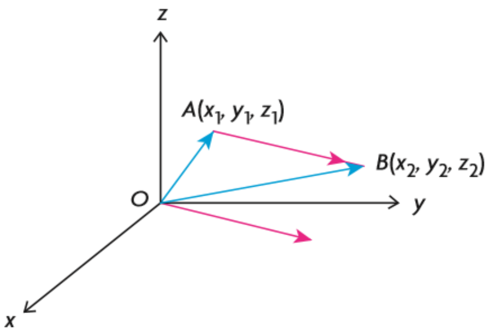
<u>Scalar Multiplication in R^3</u>

Recall:
R^2

Given: R^2 **points** $A(a_1, a_2)$ and $B(b_1, b_2)$
then $\overrightarrow{AB} = (b_1 - a_1, b_2 - a_2)$

<u>Vector Created by</u>

<u>2 Points R^3</u>

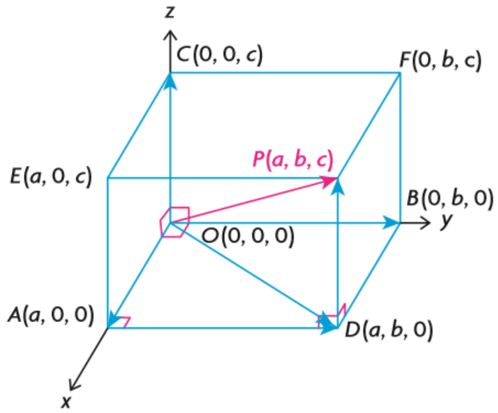


Recall:
R^2

Given: R^2 **points** $A(a_1, a_2)$ and $B(b_1, b_2)$
then $|\overrightarrow{AB}| =$

<u>Magnitude of</u>

<u>a Vector R^3</u>



<u>EXAMPLE</u> If $\overrightarrow{OP} = (3, 4, 12)$ find $\left|\overrightarrow{OP}\right|$

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