Welcome Back MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: 10/9 Topic: No HW - Unit 1 Test Friday	0 1 2	
Tuesday Date: _____ Topic: _____	0 1 2	
Wednesday Date: _____ Topic: _____	0 1 2	
Thursday Date: _____ Topic: _____	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

Class Plan:

1. Mathematician Mondays
2. Meet Vector

https://www.youtube.com/watch?v=bOIe0DIMbI8

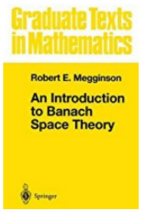
3. What is a vector?
4. Notation
5. Practice

Mathematician Monday!

Robert Eugene Megginson

- Ethnicity: American Indian, Tribe: Oglala Sioux
- Gender: M
- Year of Birth: 1948
- Place of Birth: Washington, IL

Department of Mathematics
University of Michigan
317 West Engineering
Ann Arbor, MI 48109-1092
Voice (313) 936-0155
Fax (313) 763-0937
meggin@math.lsa.umich.edu



Education

- PhD Institution: Univ. of IL - Urbana-Champaign, 1984
- Dissertation Title: The semi-Kadec-Klee Condition and Nearest-Point Properties of Sets in Normed Linear Spaces
- Advisor: Mahlon M. Day
- AM Institution: University of Illinois, 1983
- BS Institution: University of Illinois, 1969

Mathematician Monday!

Biography

Robert Eugene Megginson grew up in a family that enjoyed and valued mathematics, which is certainly one of the reasons for his interest in the field. His maternal Native American grandfather never attended a day of formal school in his life, but was very well self-educated and was fascinated by mathematics. He loved to give Megginson small mathematical problems to work out (e.g., "If you have $2.00 and want to buy 17 stamps of the following denominations, ... "), and his interest in these sorts of problems certainly rubbed off. Megginson's father, whose family is from England, has a bachelor's degree in physics and mathematics, and that also influenced his decision to go into mathematics.

Mathematician Monday!

However, Megginson did not do so immediately after getting his first college degree. After receiving his bachelor's degree in physics in 1969, he worked for eight years as a computer systems software specialist for Roper Corporation in Kankakee, Illinois, a Fortune 500 corporation that at the time primarily manufactured home appliances and lawn tractors. Before leaving to pursue his doctorate in mathematics, he had risen to the position of Lead Systems Software Sp

For the last decade, much of his interest and time have been absorbed by the problem of the serious underrepresentation of minorities in mathematics. One of only about a dozen Native Americans who are known to hold doctorates in mathematics, Megginson has served on and chaired numerous professional and national committees that address this problem. In addition to serving as the co-chair of the Mathematical Association of America (MAA) Committee on Minority Participation in Mathematics, at this time (1998) he also chairs the MAA's Coordinating Council on Human Resources, as well as the Human Resources Advisory Committee of the Mathematical Sciences Research Institute at the University of California at Berkeley. He has been an advisor to many programs of the American Indian Science and Engineering Society and is a Sequoyah Fellow of the organization.

Mathematician Monday!

In addition to his committee and other advisory work on the underrepresentation problem, he has also spent much time working directly with students of color to help them succeed in mathematically-based fields. Since 1992, he has helped design and has worked every summer in programs for precollege students at Turtle Mountain Community College, a tribally controlled college of the Turtle Mountain Chippewa Nation in North Dakota. The purpose of these programs is to keep Native American students in the Educational pipeline leading to college degrees in mathematics and related fields, and the programs are accumulating a record of success in doing exactly that. Megginson has also mentored many undergraduate and graduate students of color from varied backgrounds who have gone on to receive degrees in mathematically-based disciplines.

For his record of mentoring students of color and other work on underrepresentation, he was one of ten individuals who were honored to receive the 1997 U.S. Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring. This award was given in a White House ceremony in September of that year.

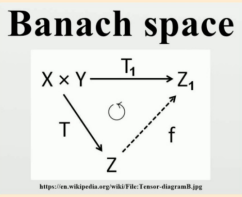
Mathematician Monday!

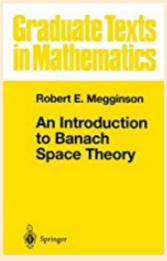
Megginson has been a member of many other committees of professional organizations, primarily the MAA. In 1998, he was a member of the MAA's Presidential Task Force on NCTM Standards, Task Force on Member Services, the Advisory Board of "Math Horizons" magazine, and had just concluded a term as chair of the Committee on Trevor Evans Prizes. He was a candidate for First Vice President of the MAA in 1997 and a candidate for President of the MAA in 1999. Megginson was also the recipient of the 1999 Ely S. Parker Award of the American Indian Science and Engineering Society, AISES's highest honor, which is given each year to one Native American scientist, mathematician, or engineer for lifetime service to the Native American community and contributions to his or her field of study.

Mathematician Monday!

Megginson currently lives in Brighton, Michigan with his wife, Kathleen, to whom he has been married since 1978. Kathy is also a mathematician, holding a bachelor's degree in mathematics as well as a master's degree in computer science and an MBA. She has worked for several corporations as a computer systems analyst, including sixteen years with IBM in Springfield and Decatur, Illinois as a database specialist.

Megginson's most recent publication is a textbook on Banach spaces. His main mathematical area is functional analysis, specifically the geometry of Banach spaces.





Mathematician Monday!

Banach Space ~ Vector Space

Definition [edit]

A Banach space is a vector space X over the field $\mathbf{R}$ of real numbers, or over the field $\mathbf{C}$ of complex numbers, which is equipped with a norm and which is complete with respect to that norm, that is to say, for every Cauchy sequence $\{x_n\}$ in X, there exists an element x in X such that

$$\lim_{n\to\infty} x_n = x,$$

or equivalently:

$$\lim_{n\to\infty} \|x_n - x\|_X = 0.$$

The vector space structure allows one to relate the behavior of Cauchy sequences to that of converging series of vectors. A normed space X is a Banach space if and only if each absolutely convergent series in X converges.[2]

$$\sum_{n=1}^{\infty} \|v_n\|_X < \infty \quad \text{implies that} \quad \sum_{n=1}^{\infty} v_n \text{ converges in } X.$$

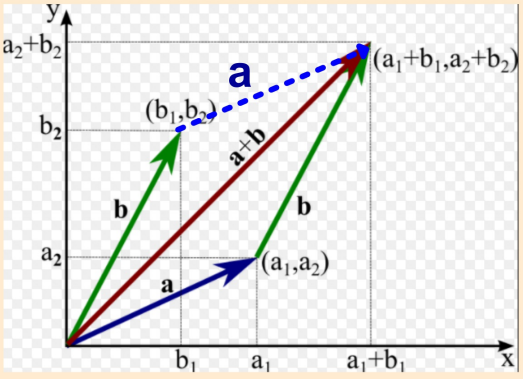
Completeness of a normed space is preserved if the given norm is replaced by an equivalent one.

All norms on a finite-dimensional vector space are equivalent. Every finite-dimensional normed space over $\mathbf{R}$ or $\mathbf{C}$ is a Banach space.[3]

Mathematician Monday!

How are Banach spaces connected to our learning?

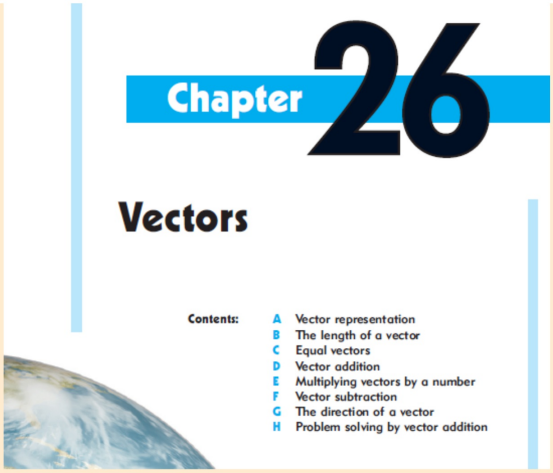
Unit 2: Coordinate Geometry - VECTORS!



2. Meet Vector

https://www.youtube.com/watch?v=bOIe0DIMbI8

A **vector** is a quantity which has both size and direction.



Chapter 26

Vectors

Contents:

A Vector representation
B The length of a vector
C Equal vectors
D Vector addition
E Multiplying vectors by a number
F Vector subtraction
G The direction of a vector
H Problem solving by vector addition

Introduction to Vectors

Throughout your years in math you have studied quantities that have a size.

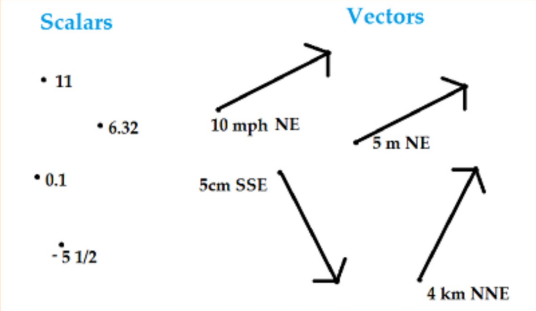
Ex.: Length, Area, Volume, Time, Speed, etc.

We call these quantities that are represented by a single number scalars.

Introduction to Vectors

A vector is a quantity that has both **size** *and* **direction**.

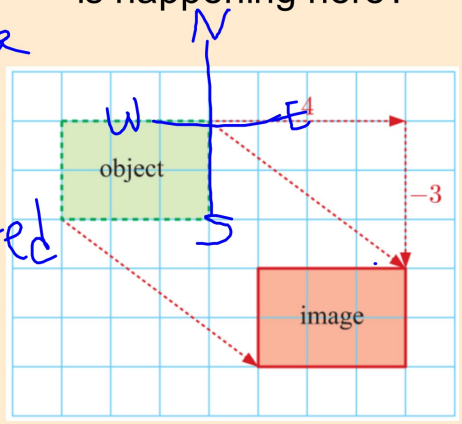
We often represent a vector as an arrow.



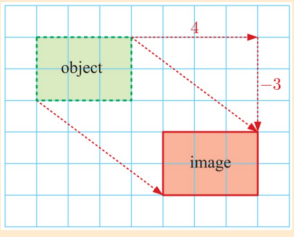
Speed vs. Velocity

Warm-up: How can we describe what is happening here?

distance
right 4
down 3
translated
5SE



A VECTOR REPRESENTATION



What is the connection to vectors?

This object has been translated 4 units right and 3 units down.

We can describe the translation using the **translation vector** $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$ ← horizontal movement ← vertical movement

(4, -3)

A Direction: **VECTOR REPRESENTATION**

Component Form

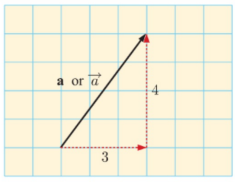
$\mathbf{a}$ or $\vec{a}$ = $\begin{pmatrix} x \\ y \end{pmatrix}$ x: Horizontal Movement; y: Vertical Movement

A **VECTOR REPRESENTATION**

A vector quantity can be represented using a small arrow over a lower case letter.

However, in textbooks we use a bold lower case letter.

For example, in the diagram alongside, the illustrated vector $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ is denoted $\mathbf{a}$ or $\vec{a}$.



$\begin{pmatrix} 3 \\ 4 \end{pmatrix}$

We write $\mathbf{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ or $\vec{a} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$.

An arrowhead is used to show the direction of the vector. The non-arrow end is the **start** of the vector, and the arrowhead end is the **end** of the vector.

Most teachers prefer writing vectors like this: $\vec{a}$

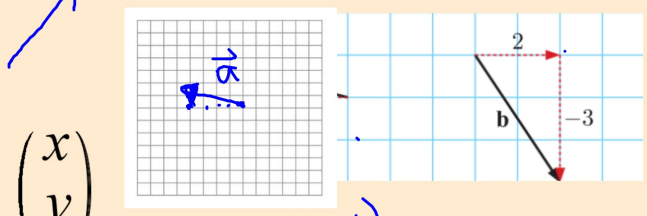
$\begin{pmatrix} x \\ y \end{pmatrix}$ We can think of vectors as a matrix with 2 rows and 1 column (also called a "column matrix").

Graphing Vectors:
Let's Practice Together!

Example 1 — Self Tutor

Represent $\vec{\mathbf{a}} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$ and $\vec{\mathbf{b}} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ on grid paper.

right
down



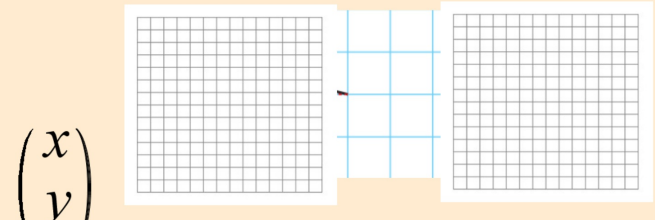
$\begin{pmatrix} x \\ y \end{pmatrix}$

(−4, 1)

Graphing Vectors:
Let's Practice Together!

Example 1 — Self Tutor

Represent $\vec{\mathbf{a}} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$ and $\vec{\mathbf{b}} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ on grid paper.

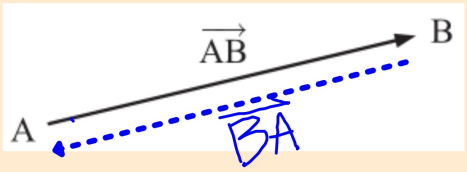


$\begin{pmatrix} x \\ y \end{pmatrix}$

Note:

Another way to represent a vector is by referring to its end points.

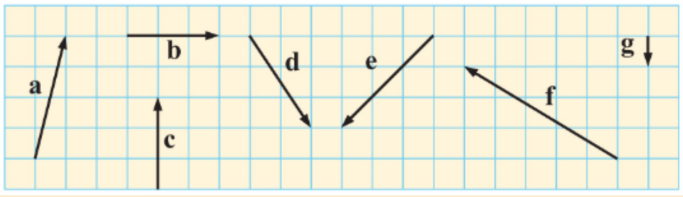
If we label the end points A and B, then $\overrightarrow{AB}$ is the vector from point A to point B.



Notice: $\overrightarrow{AB}$ is different than $\overrightarrow{BA}$!

Group Practice Exercise 26A #2

Write each vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$:

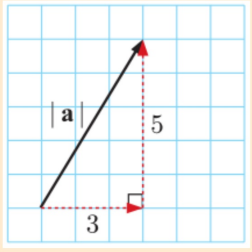


2 $\mathbf{a} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} 0 \\ 3 \end{pmatrix}$, $\mathbf{d} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$,
$\mathbf{e} = \begin{pmatrix} -3 \\ -3 \end{pmatrix}$, $\mathbf{f} = \begin{pmatrix} -5 \\ 3 \end{pmatrix}$, $\mathbf{g} = \begin{pmatrix} 0 \\ -1 \end{pmatrix}$

B Size — THE LENGTH OF A VECTOR

The magnitude of a vector is its "length".

"Magnitude of vector *a*" is written as: $|\vec{a}|$



$|\mathbf{a}|^2 = 3^2 + 5^2$ {Pythagoras}

$\therefore\ |\mathbf{a}| = \sqrt{3^2 + 5^2}$ {as $|\mathbf{a}| > 0$}

$= \sqrt{34}$ units

Group Practice

$d = \sqrt{x^2 + y^2}$

Find the length of: **a** $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$ **b** $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$

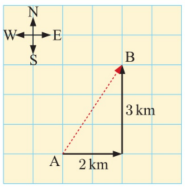
$|\vec{a}| = \sqrt{2^2 + 1^2} = \sqrt{5}$

$|\vec{b}| = \sqrt{5^2 + (-4)^2} = \sqrt{25 + 16} = \sqrt{41}$

$\sqrt{40} = \sqrt{4}\sqrt{10} = 2\sqrt{10}$

DISTANCE AND DISPLACEMENT

A ship starts at point A. It sails to point B which is 2 km to the east and 3 km to the north of A.

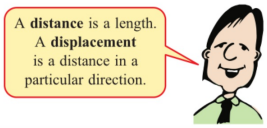


The **displacement vector** of the ship is $\overrightarrow{AB} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$.

Direction

The **distance** travelled by the ship is $|\overrightarrow{AB}| = \sqrt{2^2 + 3^2}$
$= \sqrt{13}$ km.

Size (magitude)



Exercises...

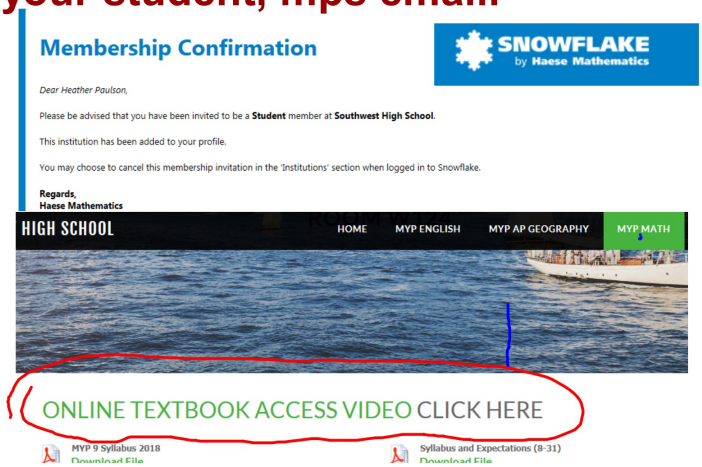
26A: #'s 1(a, c, g, h), 3

Graph paper needed!

26B: #'s 1(a, f, h, k), 2, 3

Chapter 26 is online only!
(printed pdfs available at 3 **if needed**...)

Textbook access: Login to your student, mps email.



EXERCISE 26A

1 On grid paper, draw these vectors:

a $\mathbf{a} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ **b** $\mathbf{b} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ **c** $\mathbf{c} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$ **d** $\mathbf{d} = \begin{pmatrix} 0 \\ -3 \end{pmatrix}$

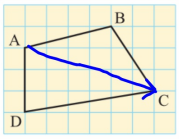
e $\mathbf{e} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$ **f** $\mathbf{f} = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$ **g** $\mathbf{g} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$ **h** $\mathbf{h} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}$

(All)

3 For the given figure, write the following as column vectors:

a $\overrightarrow{AB}$ **b** $\overrightarrow{BC}$ **c** $\overrightarrow{CD}$ **d** $\overrightarrow{DA}$

e $\overrightarrow{BA}$ **f** $\overrightarrow{AC}$ **g** $\overrightarrow{BD}$ **h** $\overrightarrow{AA}$



EXERCISE 26B

1 Find the length of:

a $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ **b** $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ **c** $\begin{pmatrix} -4 \\ -2 \end{pmatrix}$ **d** $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$

e $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ **f** $\begin{pmatrix} 0 \\ -6 \end{pmatrix}$ **g** $\begin{pmatrix} 5 \\ 12 \end{pmatrix}$ **h** $\begin{pmatrix} -6 \\ 9 \end{pmatrix}$

i $\begin{pmatrix} 4 \\ -5 \end{pmatrix}$ **j** $\begin{pmatrix} -3 \\ -6 \end{pmatrix}$ **k** $\begin{pmatrix} 10 \\ -1 \end{pmatrix}$ **l** $\begin{pmatrix} 8 \\ -2 \end{pmatrix}$

2 Find the length of:

a $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ **b** $\begin{pmatrix} -3 \\ 4 \end{pmatrix}$ **c** $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ **d** $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$

Comment on your answers.

3 Brigitta enjoys hiking. One day on a hike, she finishes 4 km east and 6 km south of her starting point.

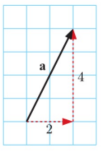
a Write Brigitta's displacement vector.

b In a straight line, how far is Brigitta from her starting point?

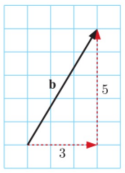
Answers

EXERCISE 26A

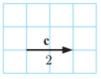
1 a



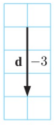
b



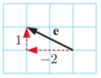
c



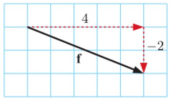
d



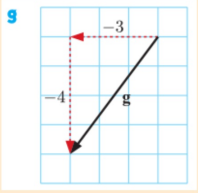
e



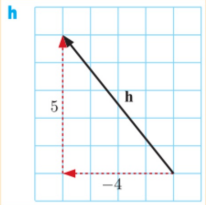
f



g



h



3 **a** $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ **b** $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ **c** $\begin{pmatrix} -6 \\ -1 \end{pmatrix}$ **d** $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$

e $\begin{pmatrix} -4 \\ -1 \end{pmatrix}$ **f** $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$ **g** $\begin{pmatrix} -4 \\ -4 \end{pmatrix}$ **h** $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$

EXERCISE 26B

1 **a** $\sqrt{29}$ units **b** $\sqrt{10}$ units **c** $\sqrt{20}$ units **d** 3 units

e $\sqrt{34}$ units **f** 6 units **g** 13 units **h** $\sqrt{117}$ units

i $\sqrt{41}$ units **j** $\sqrt{45}$ units **k** $\sqrt{101}$ units **l** $\sqrt{68}$ units

2 **a** 5 units **b** 5 units **c** 5 units **d** 5 units

Regardless of a vector's direction, if its components involve ± 3 and ± 4, its length is 5.

3 **a** $\begin{pmatrix} 4 \\ -6 \end{pmatrix}$ **b** $\sqrt{52}$ km ≈ 7.21 km