Key Study Materials

- Your CAPAs.
- Your Tutorials and Lab.
- Your written HWs.
- Prepare your information sheet.
- Old practice exam on the course web site.
- Dr. Michael Dubson's Chapter Notes.

Tomorrow evening at 7:30 PM:

- Bring a #2 pencil, an eraser, and a calculator.
- Prepare your 8.5” x 11” hand written information sheet.
- No cell phones!

- Exam given in G1B30 and G1B20:

G1B30:
Marino - sections 202, 209
Shen - 217,212
Yelk - 207,211
Hu - 208

G1B20:
Nauenburg - 201, 213
Zhang - 205, 210
Ycas - 203, 204

Review ….

Math Skills:

- Unit conversion
- Algebra
- Trigonometry:

  sin, cos, tan, inverse trig functions, Pythagorean Theorem

- Vectors:

  finding components from a vector's length and direction.
  finding a vector's length and direction from its components.
  adding vectors: graphically & with components.

Given:

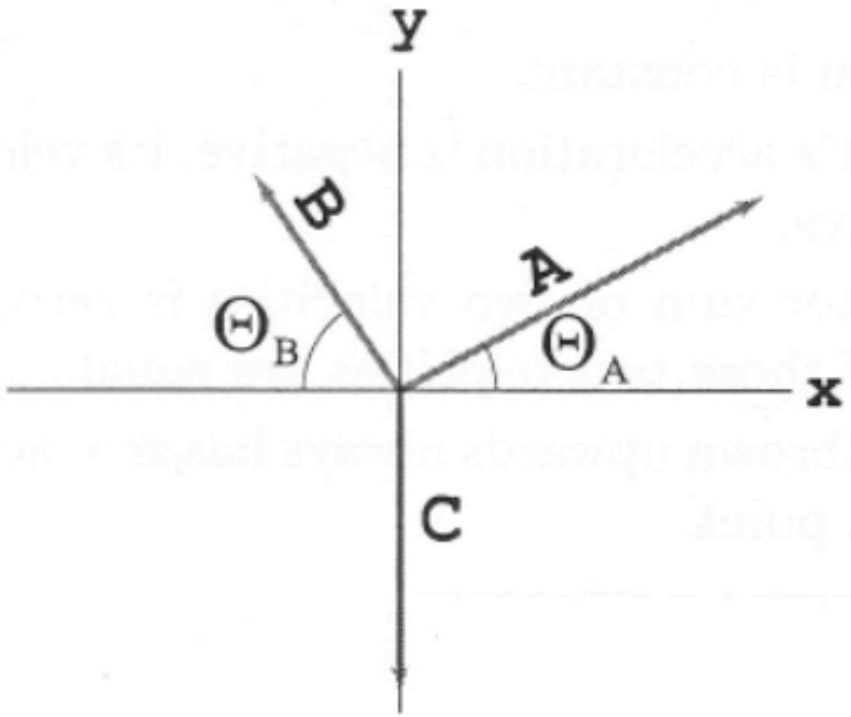
$A = 2$

$B = 1$

$C = 3$

$\theta_A = 30^\circ$

$\theta_B = 45^\circ$



Determine the length of the vector **A** - **C**.

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12. [1pt] Determine the length of the vector **A** - **B** + **C**.

---

13. [1pt] Calculate the angle of the vector **A** - **B** + **C** with respect to the x-axis. (Always choose angles less than 180°. Above the x-axis the angles are positive (+), and below the x-axis they are negative (-). Enter the units of angles as "deg".)

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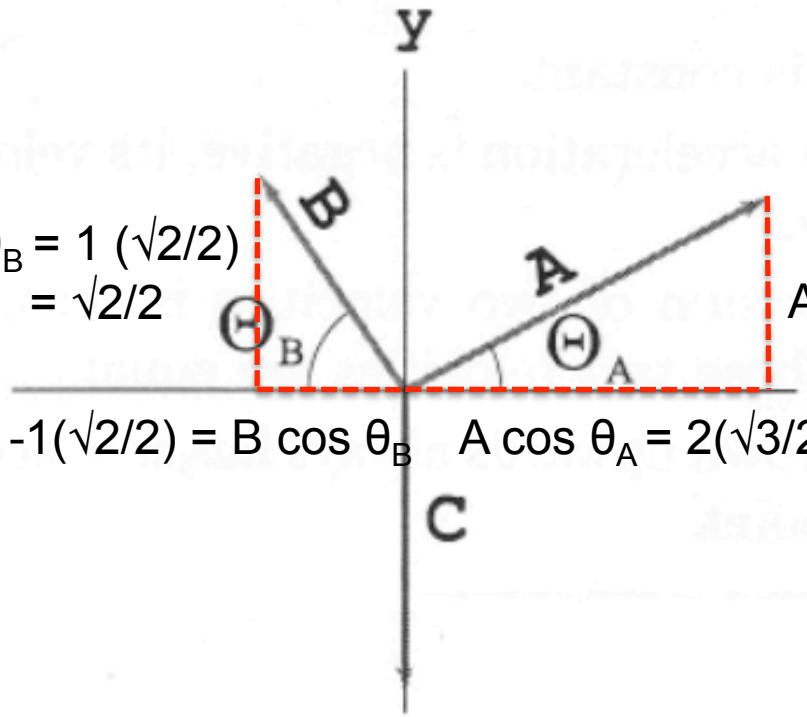

B sin θ_B = 1 (√2/2) = √2/2

A sin θ_A = 2(1/2) = 1

-√2/2 = -1(√2/2) = B cos θ_B

A cos θ_A = 2(√3/2)=√3

Determine the length of the vector **A** - **C**.

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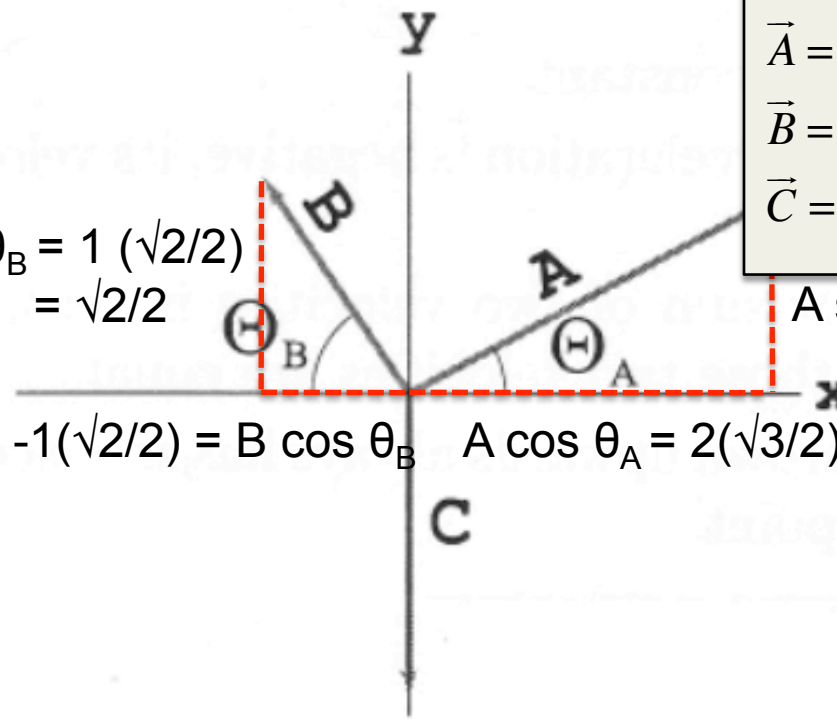

$\vec{A} = (\sqrt{3},1) = (1.7,1)$

$\vec{B} = (-\sqrt{2}/2,\sqrt{2}/2) = (-.71,.71)$

$\vec{C} = (0,-3)$

B sin θ_B = 1 ($\sqrt{2}$/2)
= $\sqrt{2}$/2

A sin θ_A = 2(1/2) = 1

-$\sqrt{2}$/2 = -1($\sqrt{2}$/2) = B cos θ_B

A cos θ_A = 2($\sqrt{3}$/2)=$\sqrt{3}$

Determine the length of the vector **A** - **C**.

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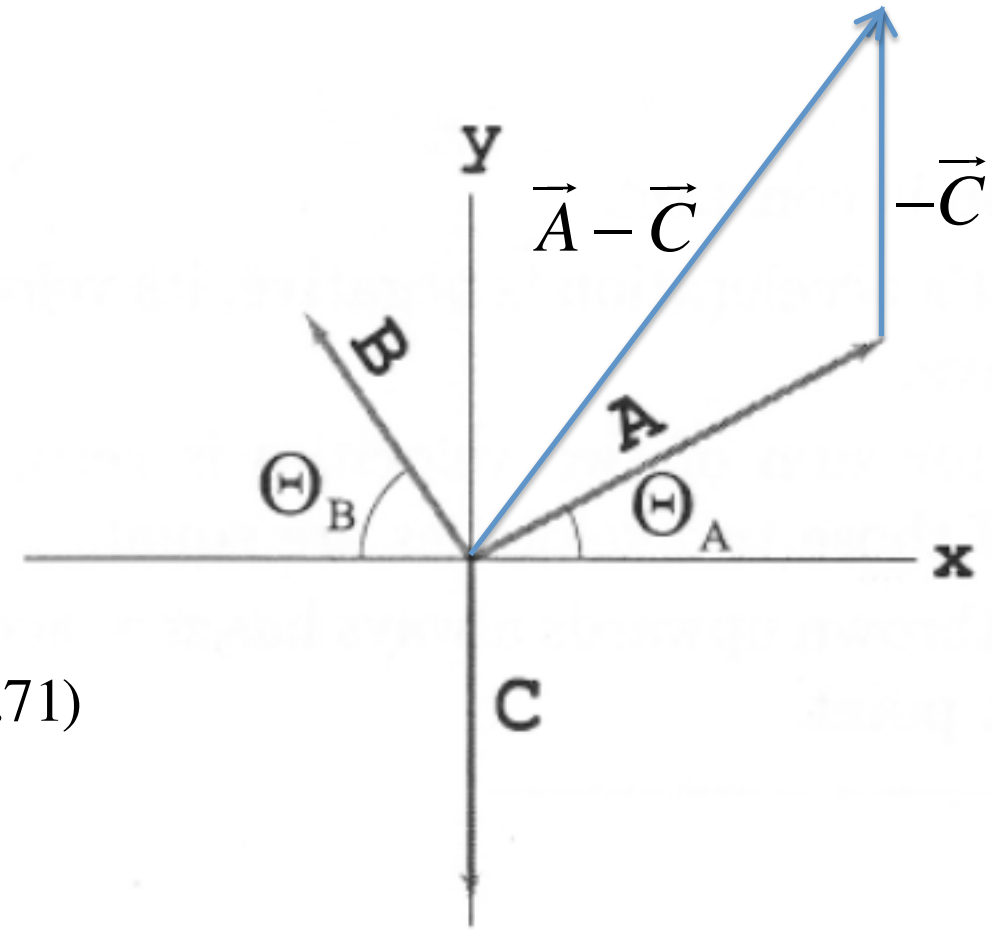

$$\vec{A} = (\sqrt{3},1) = (1.7,1)$$

$$\vec{B} = (-\sqrt{2}/2,\sqrt{2}/2) = (-.71,.71)$$

$$\vec{C} = (0,-3)$$

$$\vec{A} - \vec{C} = (1.7,4)$$

$$|\vec{A} - \vec{C}| = \sqrt{1.7^2 + 4^2} = 4.3$$

Given:

$A = 2$

$B = 1$

$C = 3$

$\theta_A = 30^\circ$

$\theta_B = 45^\circ$

$\vec{A} = (\sqrt{3},1) = (1.7,1)$

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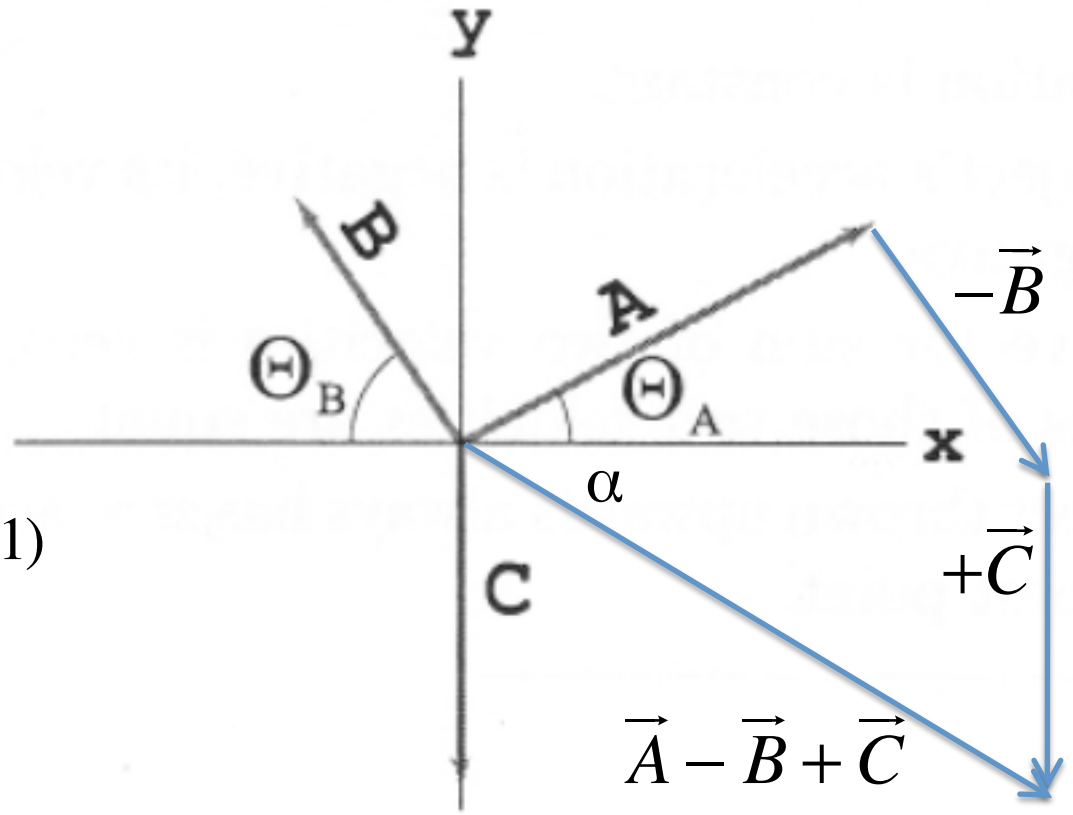

$\vec{A} - \vec{B} + \vec{C} = (2.4,-2.7)$

$|\vec{A} - \vec{B} + \vec{C}| = \sqrt{2.4^2 + (-2.7)^2} = 3.6$

Given:

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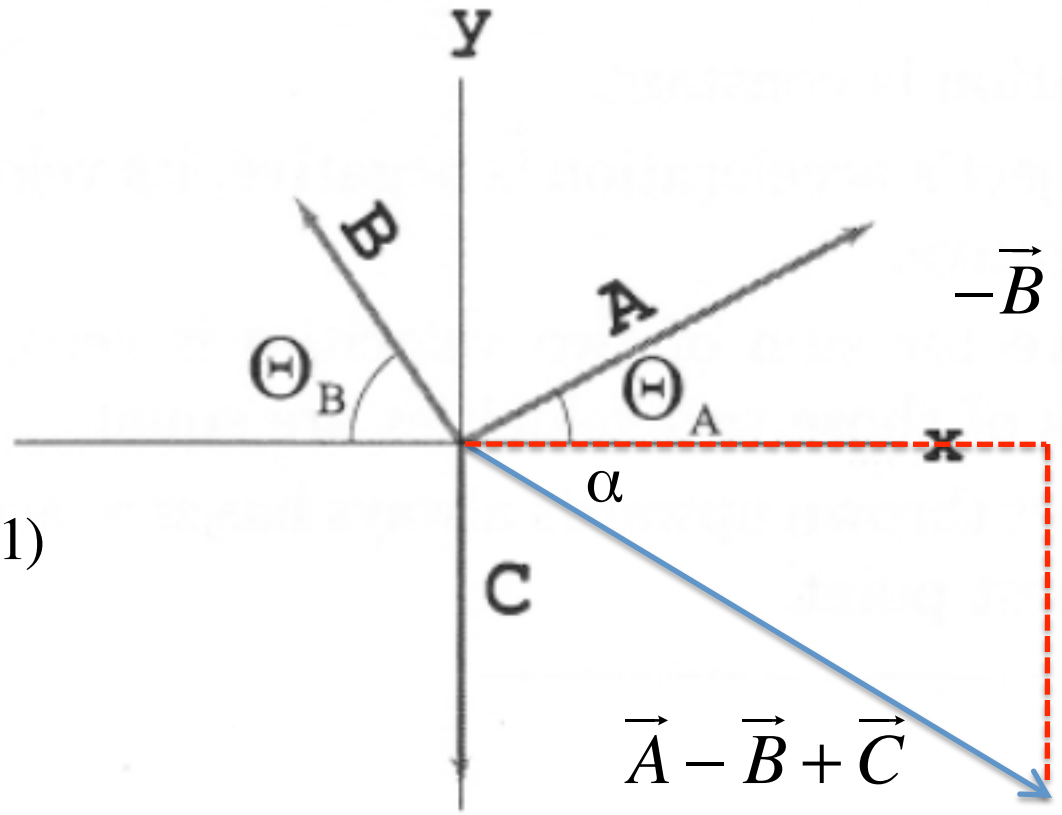

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$|\vec{A} - \vec{B} + \vec{C}| = \sqrt{2.4^2 + (-2.7)^2} = 3.6$

$\alpha = \tan^{-1}(-2.7/2.4) = -48^\circ$

Motion in 1D

- graphing: x vs. t, v vs. t, a vs. t
- $v = \frac{\Delta x}{\Delta t}$ = slope of a graph of x vs. t
- $a = \frac{\Delta v}{\Delta t}$ = slope of graph of v vs. t
- average vs. instantaneous value of velocity, acceleration
- "acceleration is not velocity, …."

An elevator is going up at a constant speed. Near the top floor, it starts to slow to a stop. While it's slowing, its acceleration is

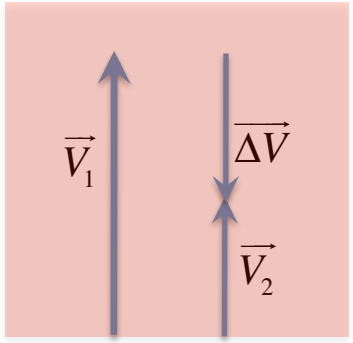
A) Downward

B) Upward

C) In some other direction.

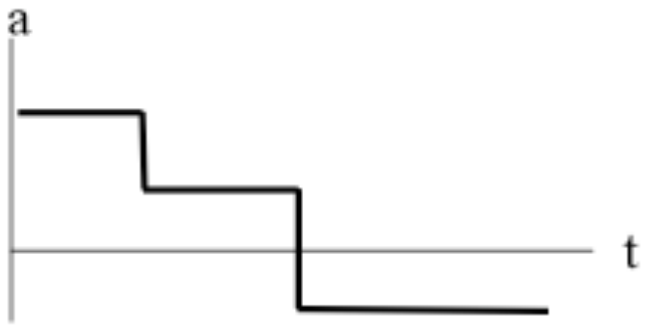
To slow down, its acceleration must oppose its velocity.

This can also be seen from the following vector diagram:

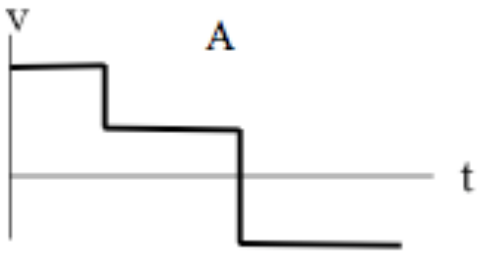


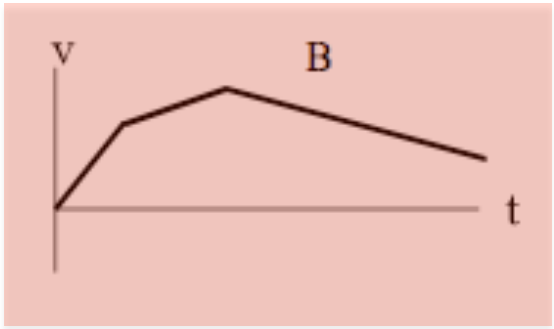
$$\vec{V}_2 = \vec{V}_1 + \vec{\Delta V}$$

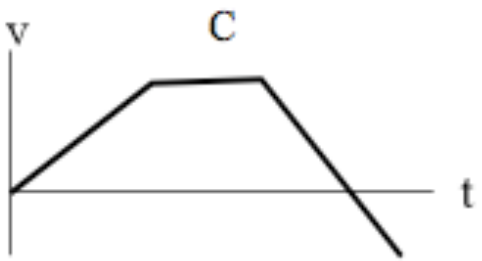
An object's acceleration vs. time is:

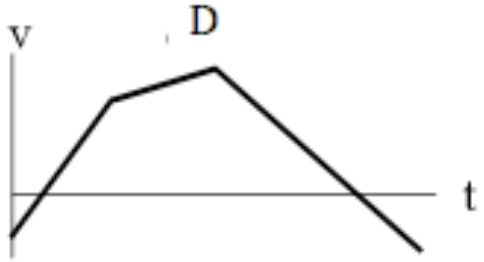


Which graph best represents the object's velocity vs. time?

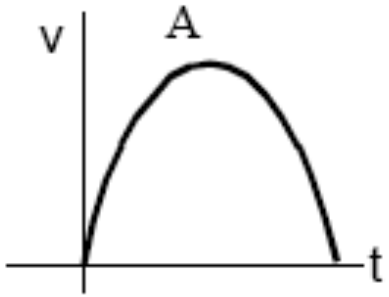


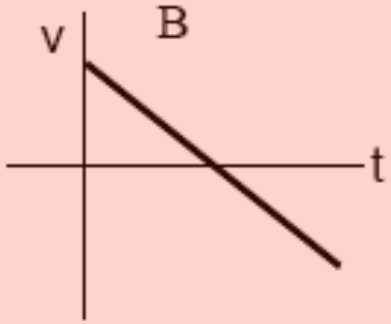


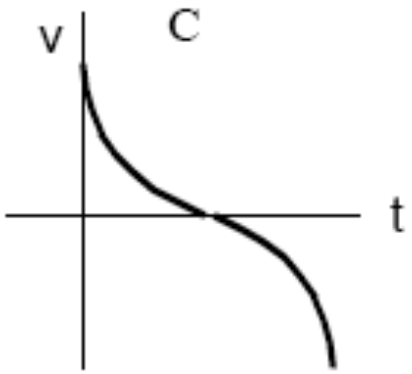


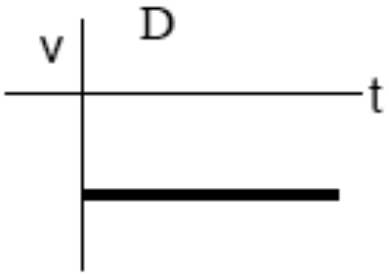


At t = 0, a projectile is fired straight upward from a cannon. It goes up and then comes down. Assume that there is **no** air resistance. Upward is chosen as the positive y-direction. Which of the following graphs most accurately shows velocity vs. time for the projectile during its flight?









$v = v_0 - gt$

Motion in 1D

- Constant acceleration (a = const) in 1D:

(a) $$v = v_o + a\,t$$

(b) $$x = x_o + v_o\,t + (1/2)\,a\,t^2$$

(c) $$v^2 = v_o^{\,2} + 2\,a\,(x - x_o)$$

(d) $$\bar{v} = \frac{v_o + v}{2}$$

A student is asked the following question on an exam: A car is moving at 90mph and suddenly brakes with a constant acceleration a = –2g to a full stop. How many second does the car take to stop?
Which equation can be used to answer the question?

A) $v = v_o + a\,t$ v(t)

B) $x = x_o + v_o t + \frac{1}{2} a\,t^2$ x(t)

C) $v^2 = v_o^{\,2} + 2a(x - x_o)$ v(x)

$0 = v = v_0 + at$

$t = -v_0/a = v_0/2g$

Motion in >1D

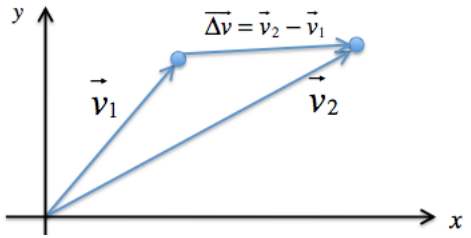
• Position, displacement, velocity, and acceleration vectors. Distance traveled is a scalar.

• Addition and subtraction of vectors – needed to define velocity and acceleration:

$$s = \frac{\text{distance traveled}}{\text{elapsed time}} \qquad \vec{v} = \frac{\overrightarrow{\Delta R}}{\Delta t} = \frac{\text{displacement}}{\text{elapsed time}} \qquad \vec{a} = \frac{\overrightarrow{\Delta v}}{\Delta t} = \frac{\text{change in velocity}}{\text{elapsed time}}$$

Speed | Velocity | Acceleration

$$\overrightarrow{\Delta R} = \vec{R}_2 - \vec{R}_1 \qquad \overrightarrow{\Delta v} = \vec{v}_2 - \vec{v}_1$$

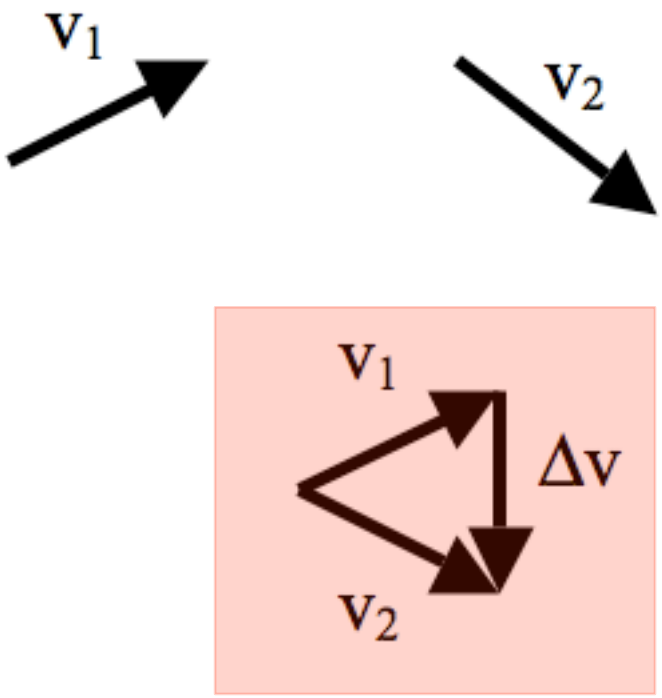


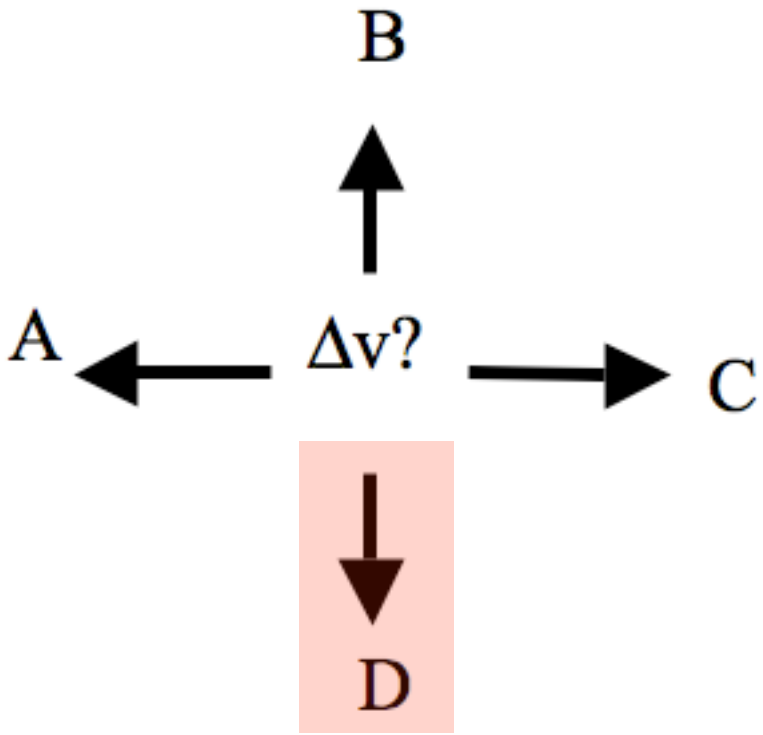
Suppose you know the velocity vector of a particle at a particular instant of time and it is parallel to the ground. What do you know about the acceleration **a** of the particle?

A) The velocity vector and the acceleration vector are always either in the same direction or in opposite directions.
B) The acceleration vector is straight down.
C) You know nothing at all about the acceleration vector.
D) The acceleration must be zero.

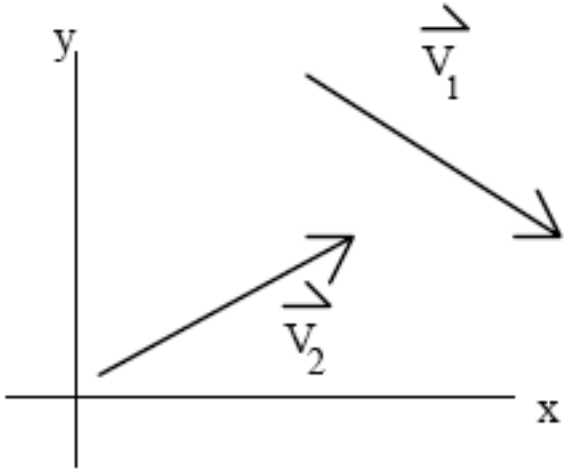
Consider the vectors $\mathbf{V}_1$ and $\mathbf{V}_2$ shown.

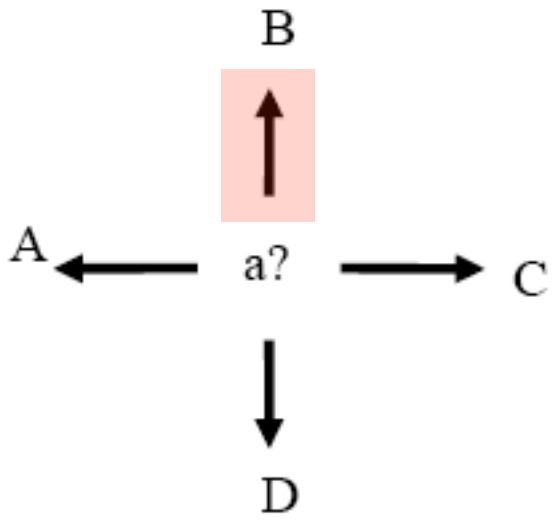
Which is the direction of the vector is $\Delta\mathbf{V} = \mathbf{V}_2 - \mathbf{V}_1$ $\mathbf{V}_1 + \Delta\mathbf{V} = \mathbf{V}_2$?

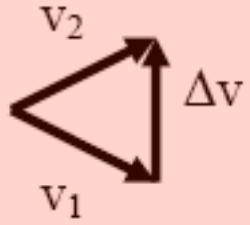


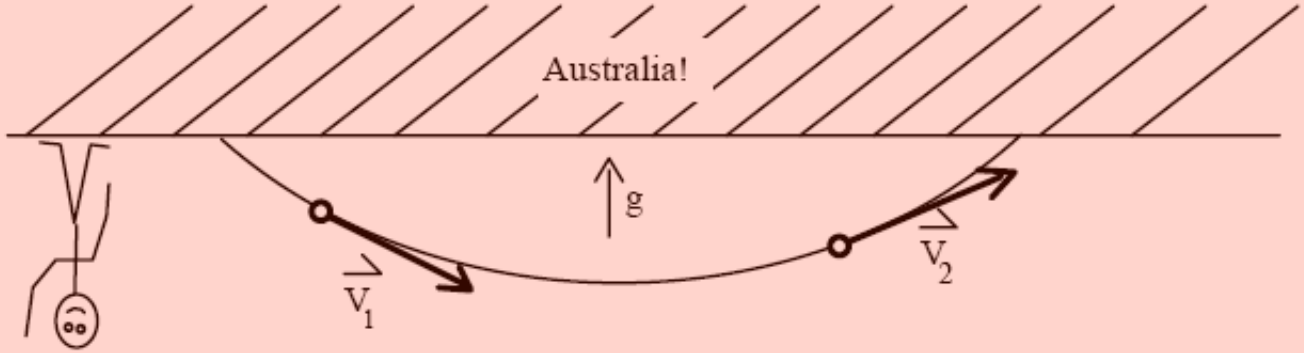


A particle is moving with constant acceleration. Its velocity vector at two different times is shown below. What is the direction of the acceleration?









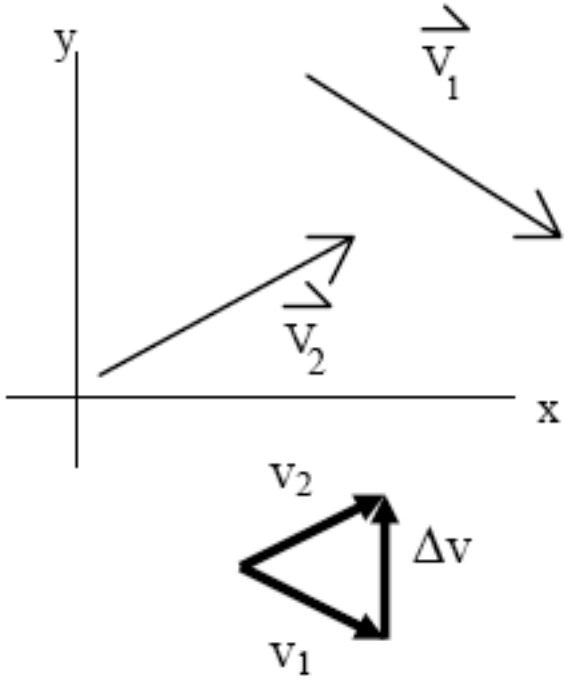
Motion in >1D

• Position, displacement, velocity, and acceleration vectors. Distance traveled is a scalar.

• Addition and subtraction of vectors – needed to define velocity and acceleration.

• Be able to deal with velocity and acceleration as vectors:

find its components from its length and direction.
find its length and direction from its components.
add and subtract them: graphically & using components.



If $\vec{V}_2 = (1,1)$ and $\vec{V}_1 = (1,-1)$.
Find the acceleration vector if the acceleration took place over 2 seconds.

A) $\vec{a}$ = (0,1) m/s^2

B) $\vec{a}$ = (0,2) m/s^2

C) $\vec{a}$ = (1,0) m/s^2

D) $\vec{a}$ = (2,0) m/s^2

$$\vec{a} = \frac{\Delta \vec{V}}{t} = \frac{\vec{V}_2 - \vec{V}_1}{t} = \frac{(1,1) - (1,-1)}{2} = \frac{(0,2)}{2} = (0,1)$$

Remember

In addition to tomorrow's exam…..

- Finish reading Ch. 3.
- **Tutorial this week**: Vectors – print and bring Tutorial to Lab session.
- **CAPA assignment #4** is due Friday evening at 10 PM, to be done on-line.