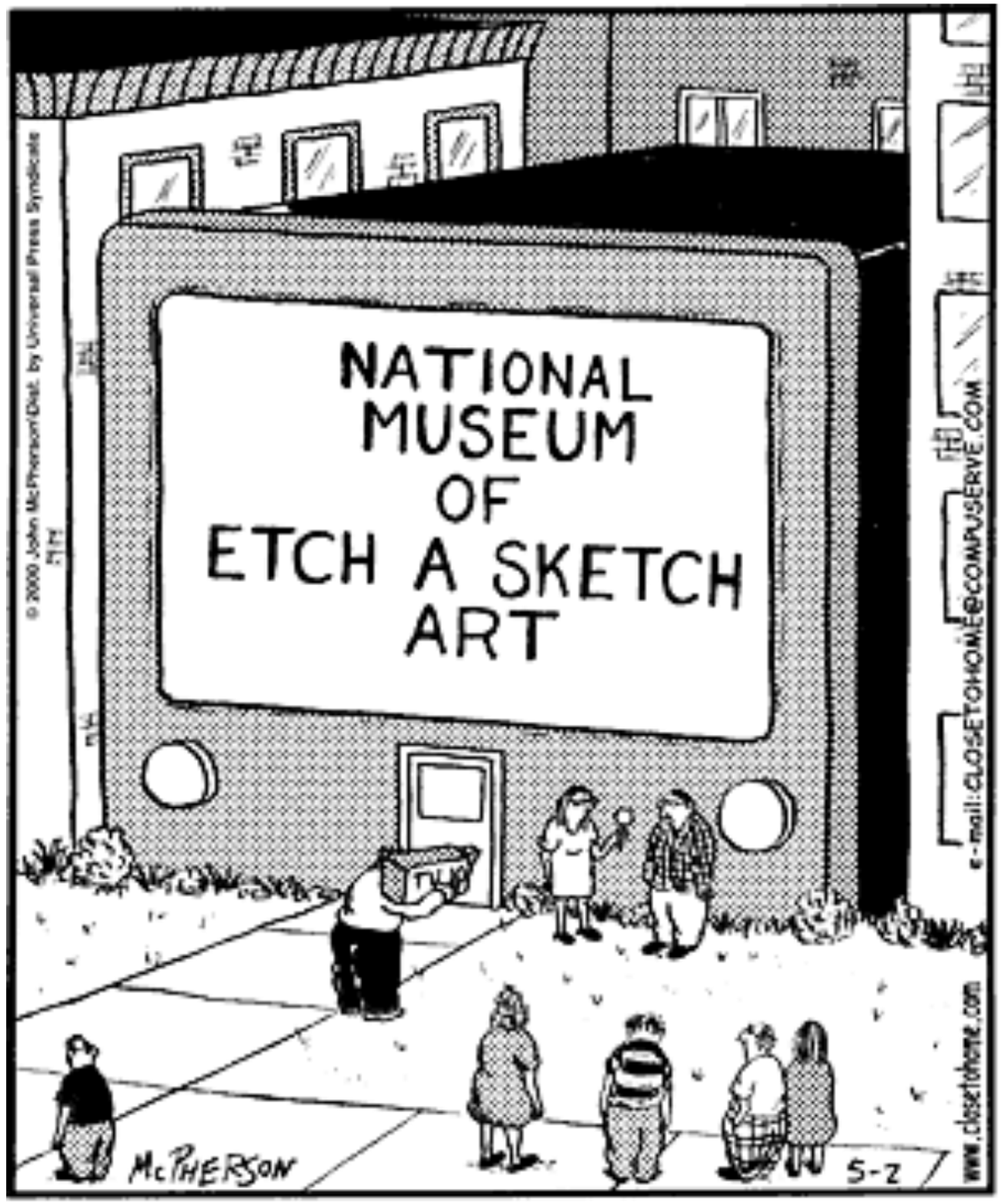
# Physics 121

On the 3 x 5 card, please write

1. Preferred name
2. Your hometown
3. Interests, hobbies, major
4. Title of the last book you read (or a favorite)
5. Some interesting/funny fact about yourself to help me remember you

Hand your card in before you leave.




"Structurally, the building is fine. But sadly, the earthquake destroyed all of our art pieces."

# Physics 121: Principles of Physics

## Who am I?

Lance Nelson

Rigby, Idaho

Computational Physics
Material Physics

"Why things break" by Mark Eberhart

I like to play handball
but I'm not very good.

What's handball?

# The "what to do" of this course...

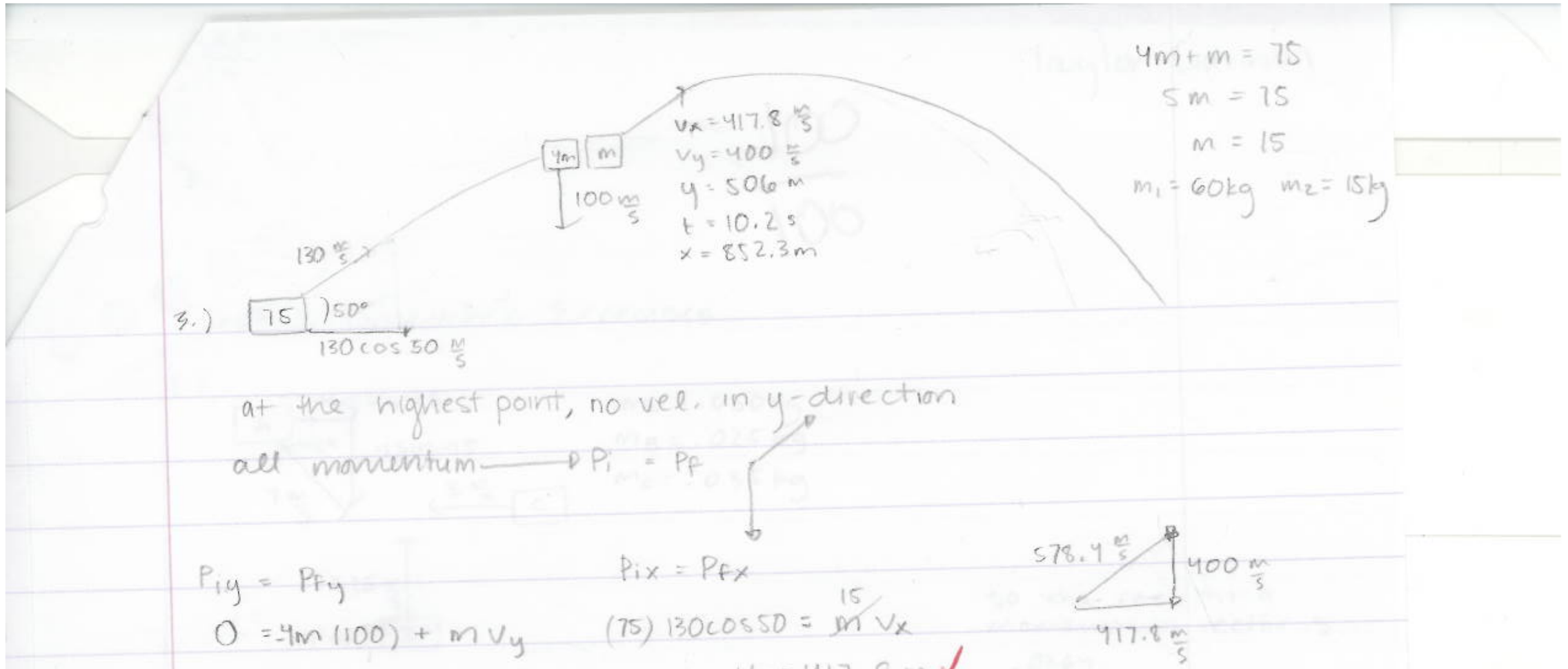
## Syllabus

- Schedule
  - focus on concepts one day, problem solving (math) the next
- Warm-ups
- Participation (Tickets on work days)
- HW
  - Grade your own. You pick the problems.
- Extra Credit??? — Python Python
- Quizzes
- Honor Code
- Getting help

What will be on the quizzes?

2 math questions (current week)
2 conc questions (current week)
1 math question (previous week)
1 conc question (previous week)
1 math/conc question (2 weeks previous)

# 3D-BE-SNUB




at the highest point, no vel. in y-direction

all momentum ⟶ $P_i = P_f$

$P_{iy} = P_{fy}$

$0 = -4m(100) + mv_y$

$(60)(100) = 15v_y$

$v_y = 400 \frac{m}{s}$ ✓

$P_{ix} = P_{fx}$

$(75)\,130\cos 50 = 15 v_x$

$v_x = 417.8 \frac{m}{s}$ ✓

for first interval before explosion:

$v_{fy}^2 = v_{iy}^2 + 2a\Delta y$

$\Delta y = \frac{0 - (130\sin 50)^2}{2(-9.8)} = 506$ ✓

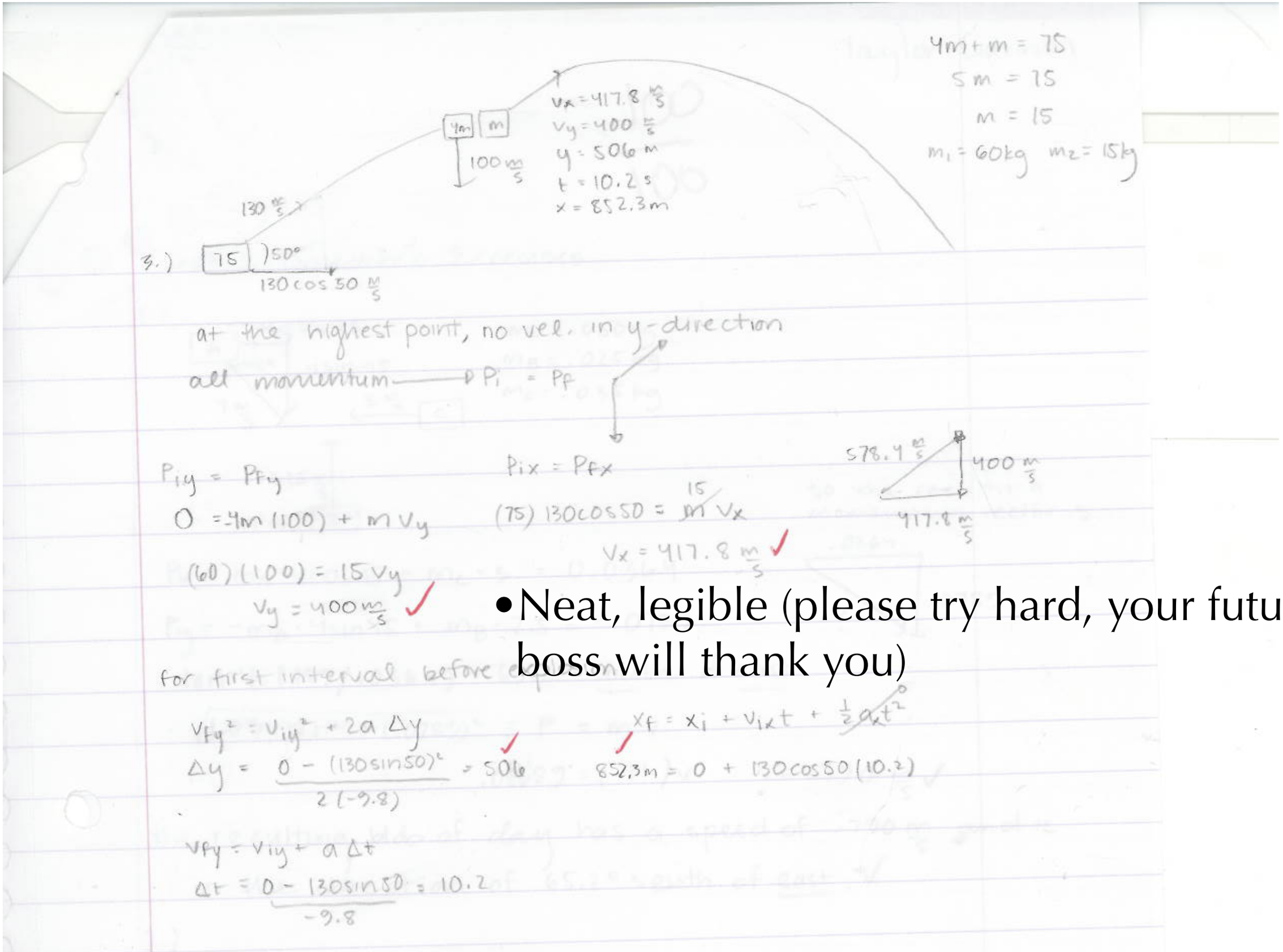
$x_f = x_i + v_{ix}t + \frac{1}{2}a_x t^2$

$852.3\,m = 0 + 130\cos 50\,(10.2)$ ✓

$v_{fy} = v_{iy} + a\Delta t$

$\Delta t = \frac{0 - 130\sin 50}{-9.8} = 10.2$

# 3D-BE-SNUB




- Neat, legible (please try hard, your future boss will thank you)

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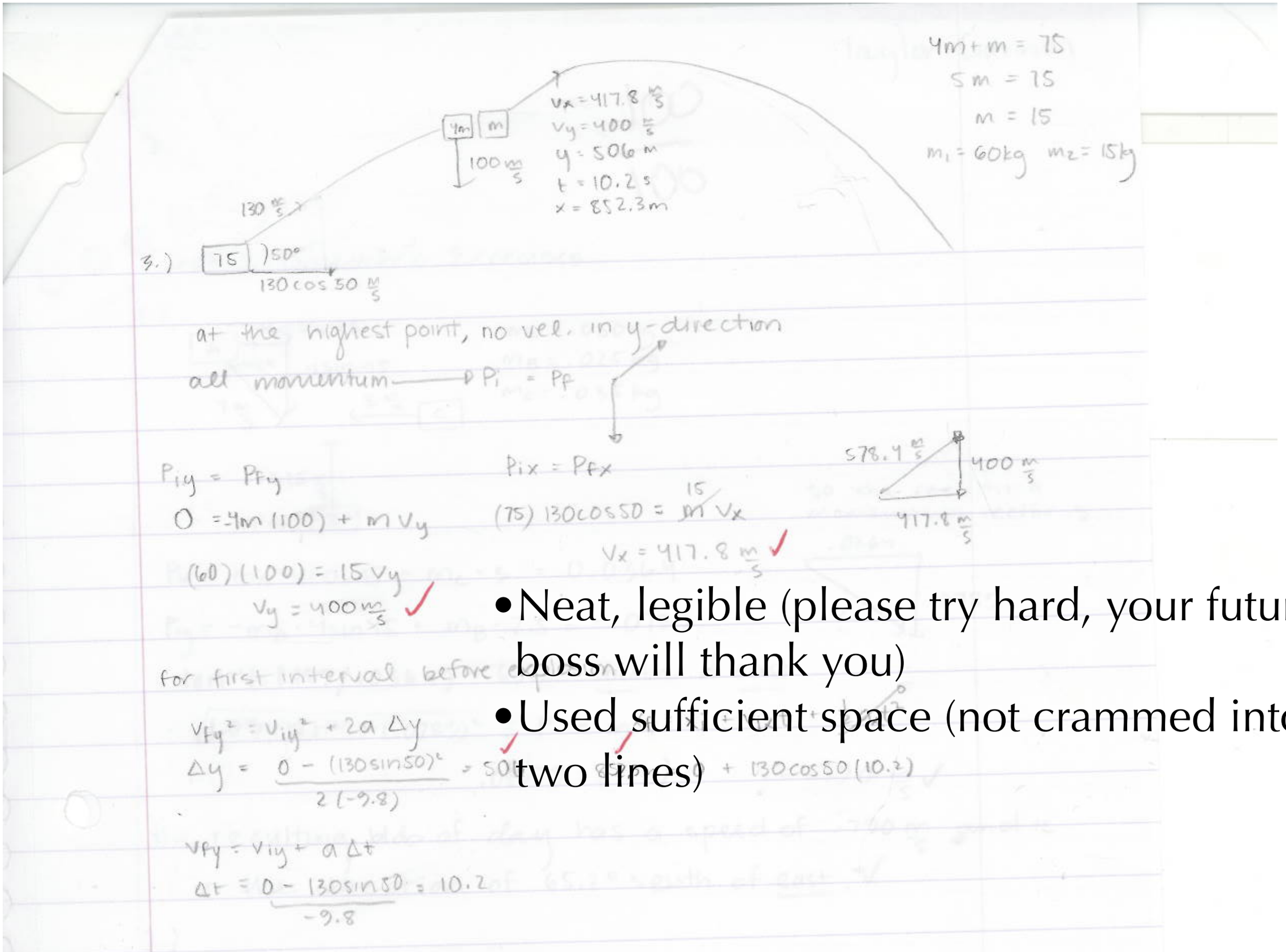


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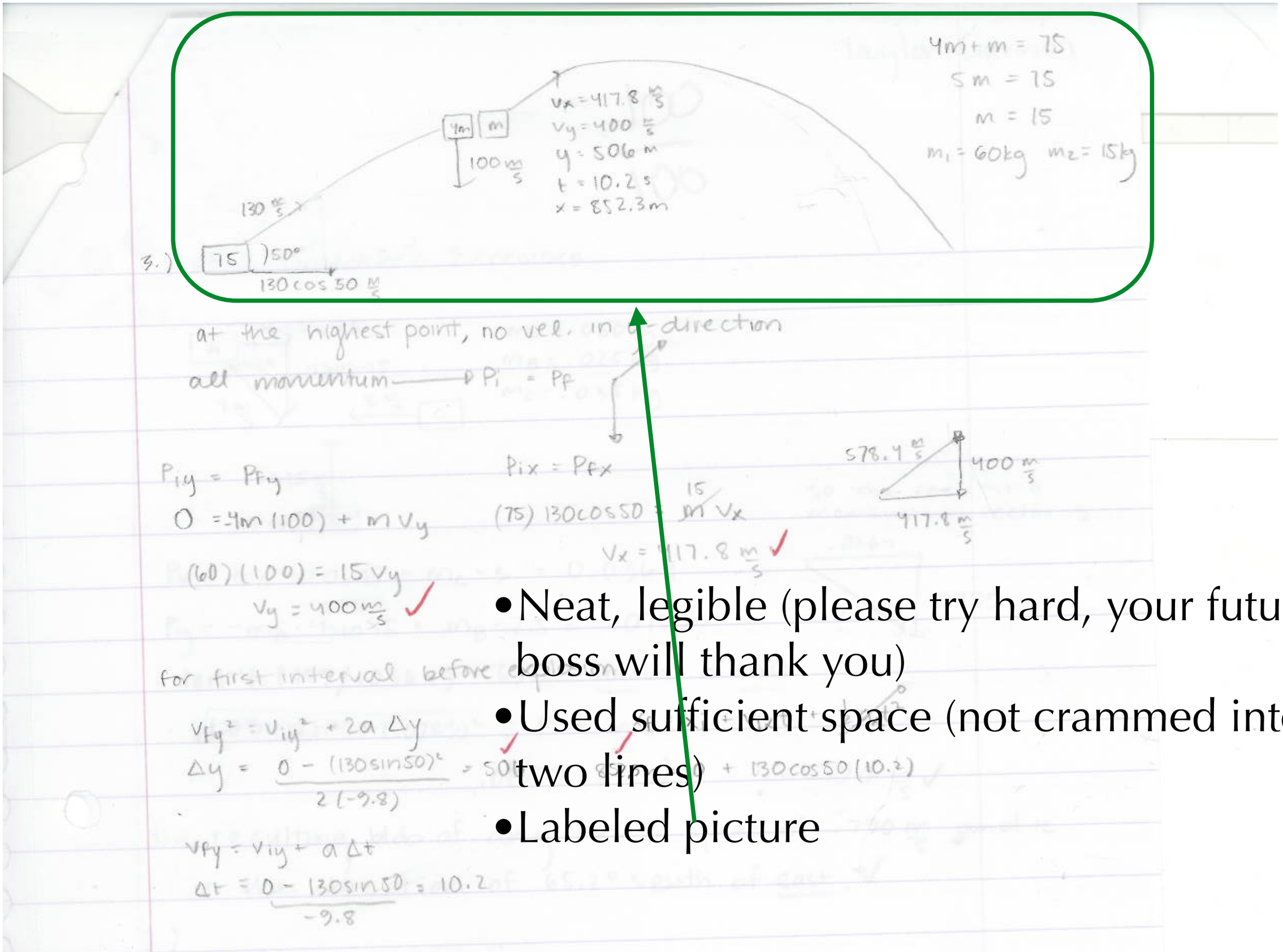


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- Labeled picture

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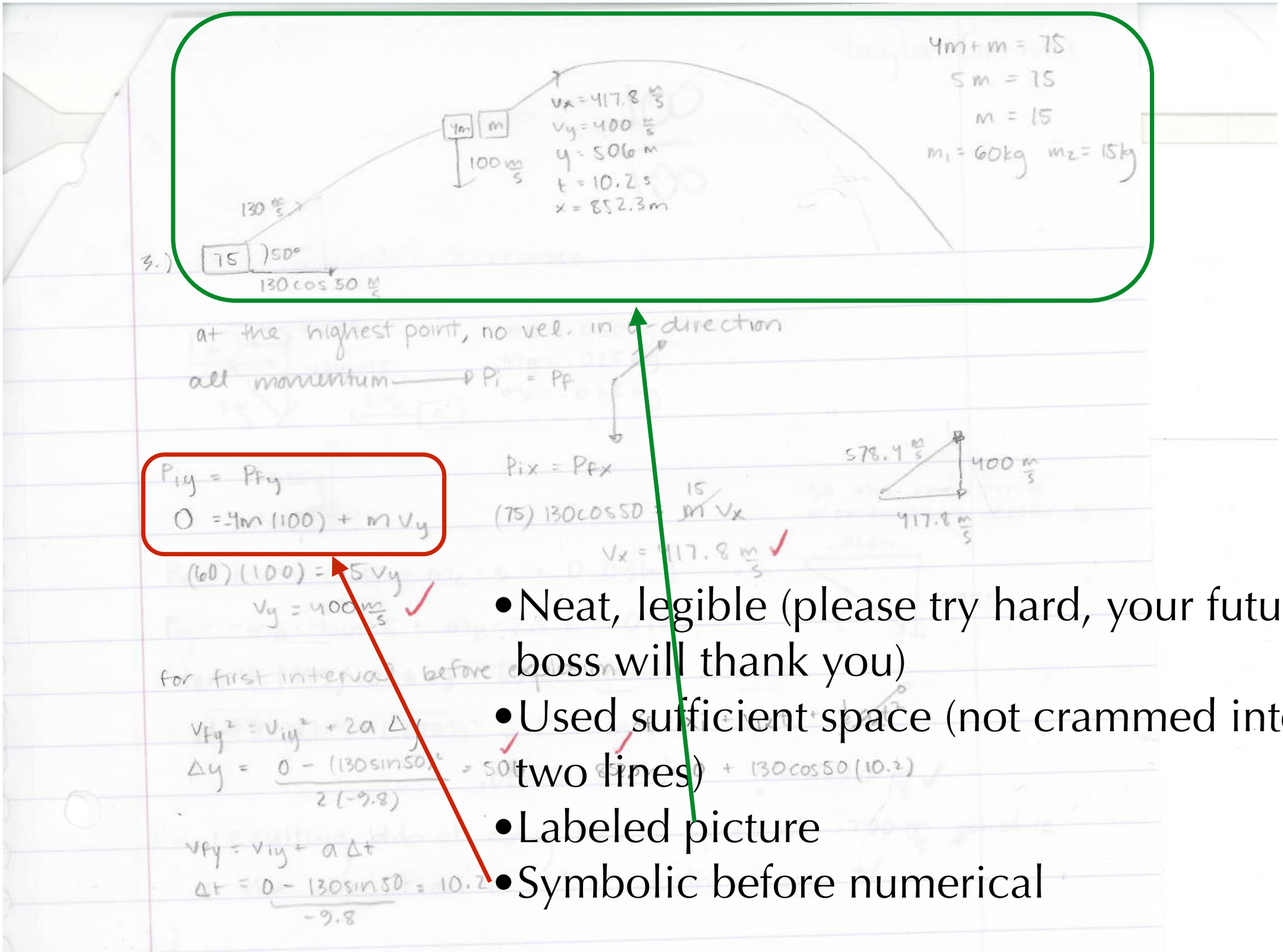


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- Used sufficient space (not crammed into two lines)
- Labeled picture
- Symbolic before numerical

# Main topics for this course

1. Conceptual understanding of Newtonian mechanics
2. Problem-solving skills (math) in context of Newtonian mechanics
3. Numerical/graphical analysis (computers)

Physics majors

Surprising statistic

Want a job?  Learn this.

# Raytheon M982

Video

# Learning (teaching philosophy)

Think of something you do really well (or know a lot about).

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How did you get so good at it?

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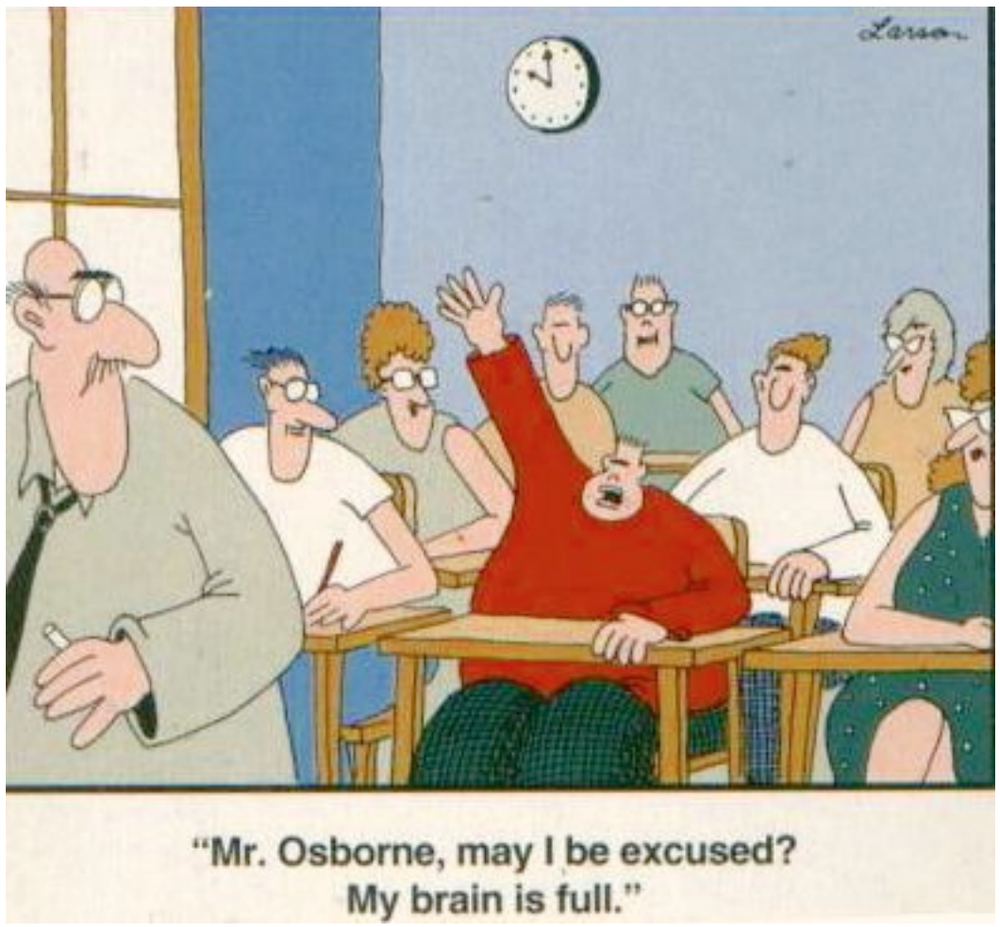

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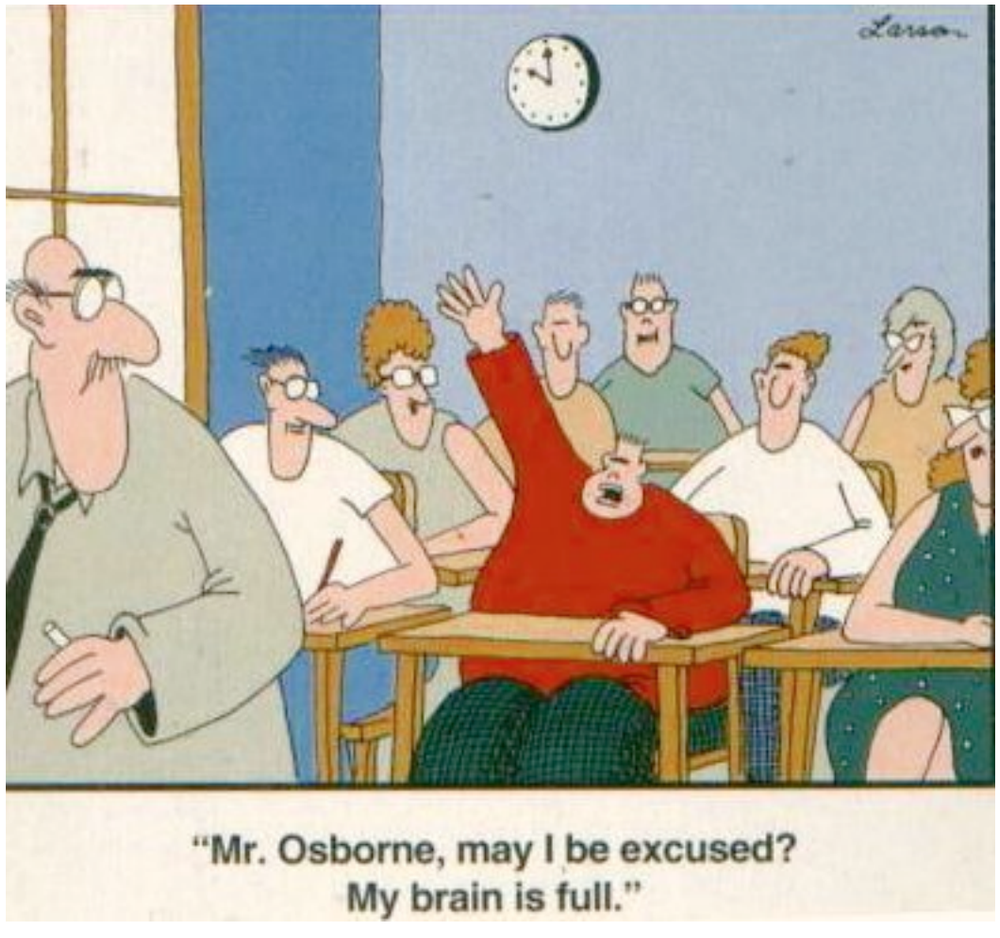


# Learning (teaching philosophy)

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# Why did the Savior teach using parables?

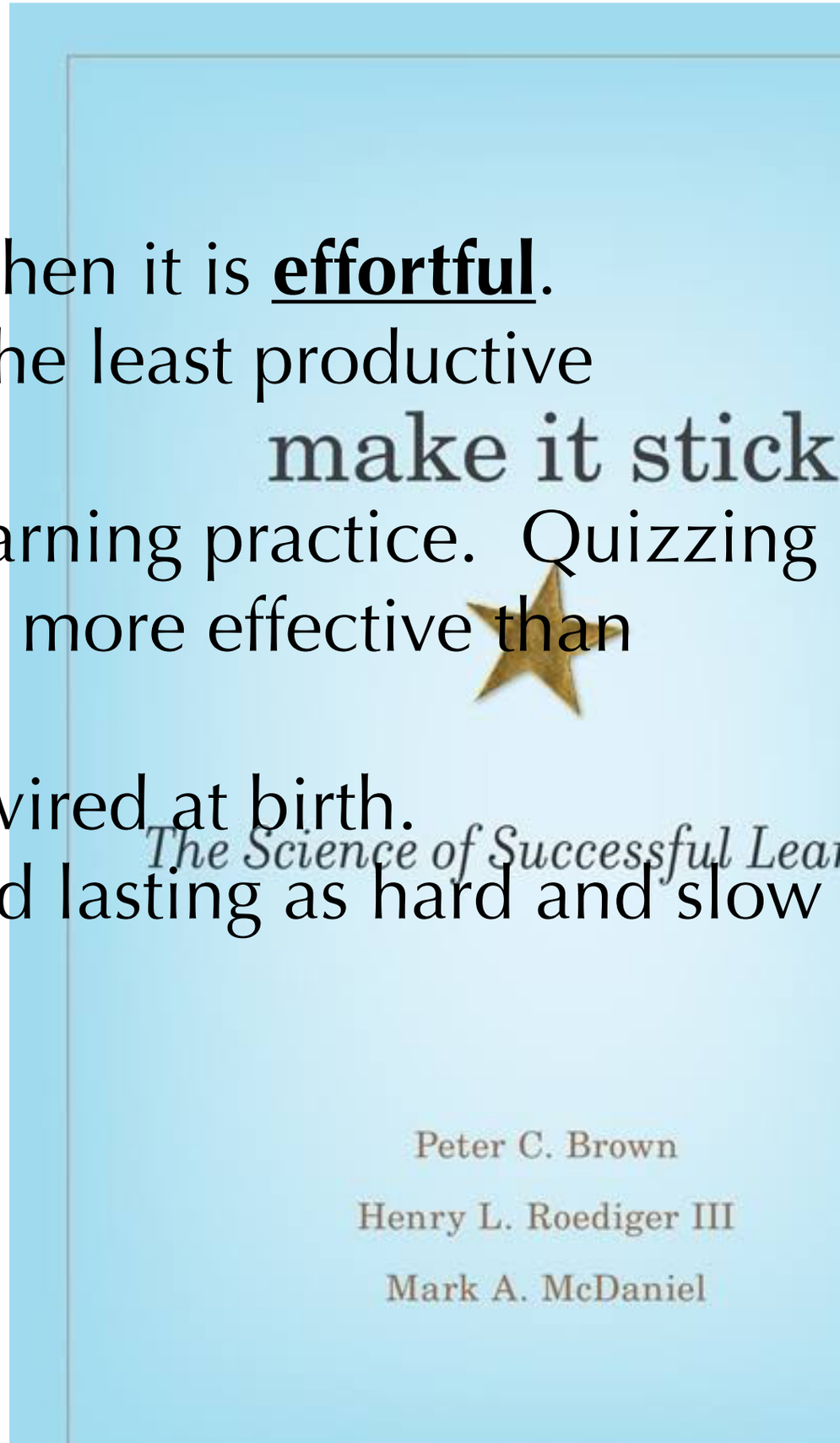
# Why did the Savior teach using parables?

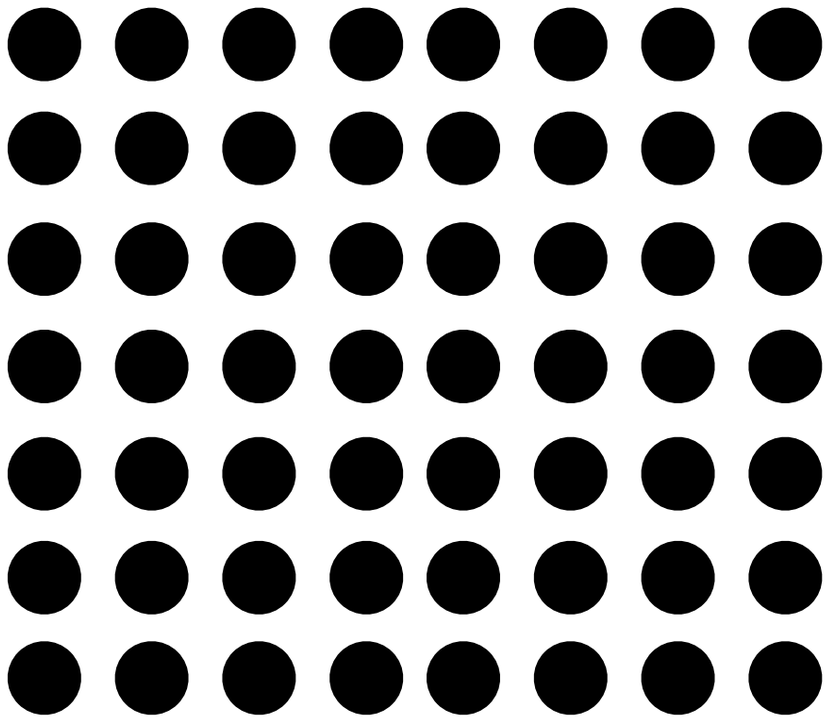
Matt 13:10-11

Alma 12:9-10

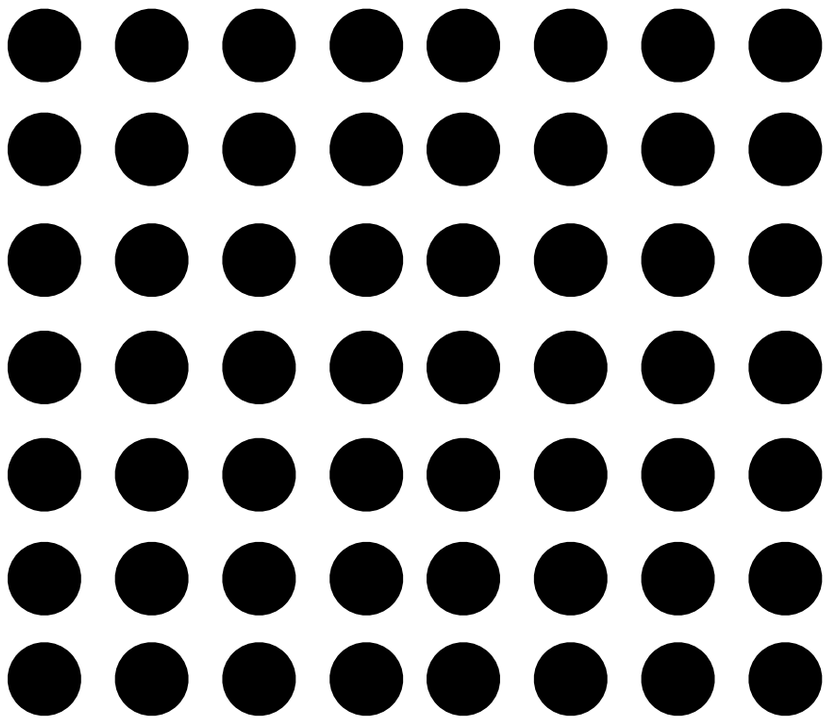
# Facts about learning

- Learning is deeper and more durable when it is **effortful**.
- Rereading text and massed practice is the least productive learning strategy (and most deceptive).
- Retrieval practice is a more effective learning practice. Quizzing yourself on key concepts after lecture is more effective than reviewing the lecture notes or text.
- Your intellectual abilities are not hard-wired at birth.
- Easy and fast learning is not as deep and lasting as hard and slow learning(sorry).

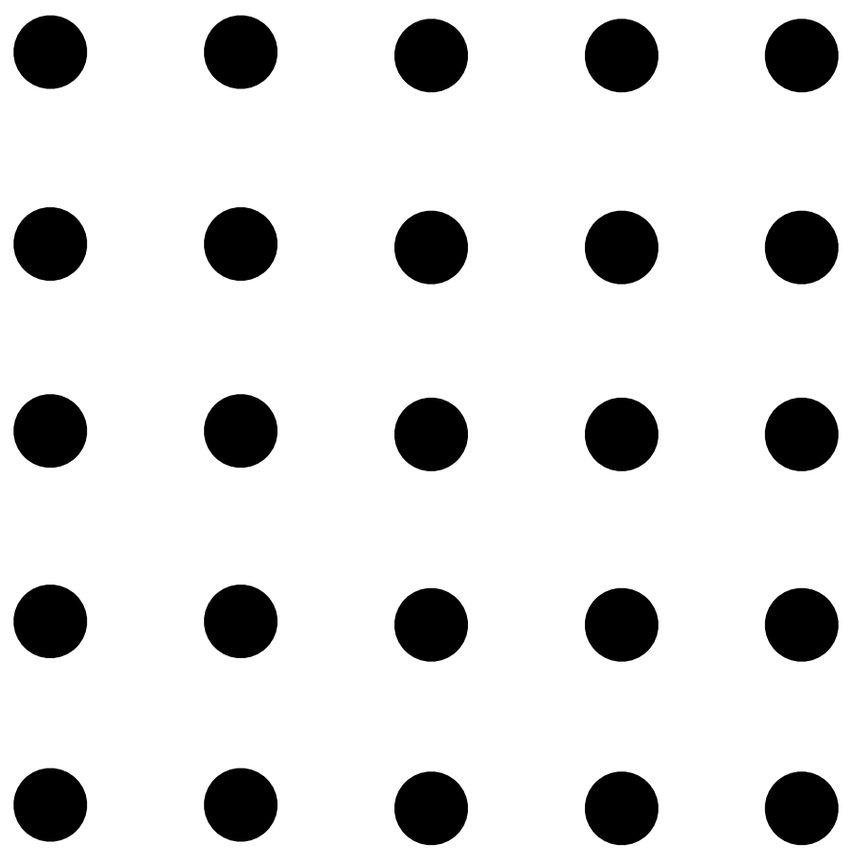




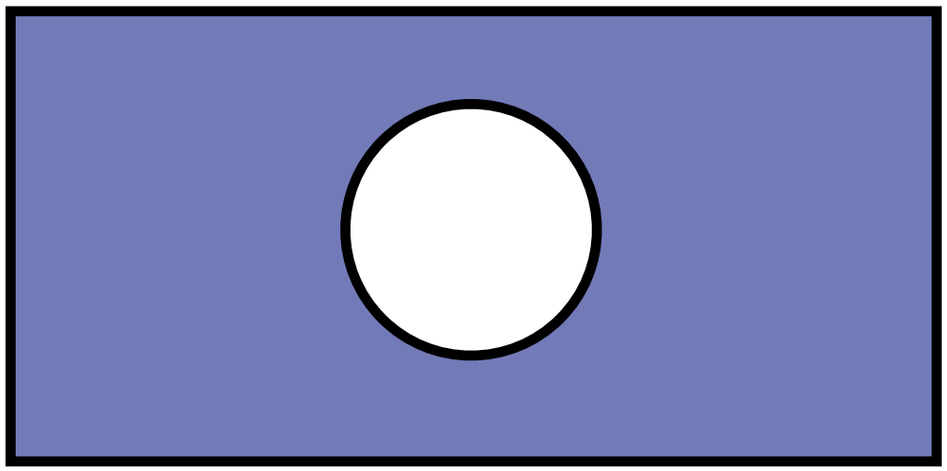
# Cold



Hot

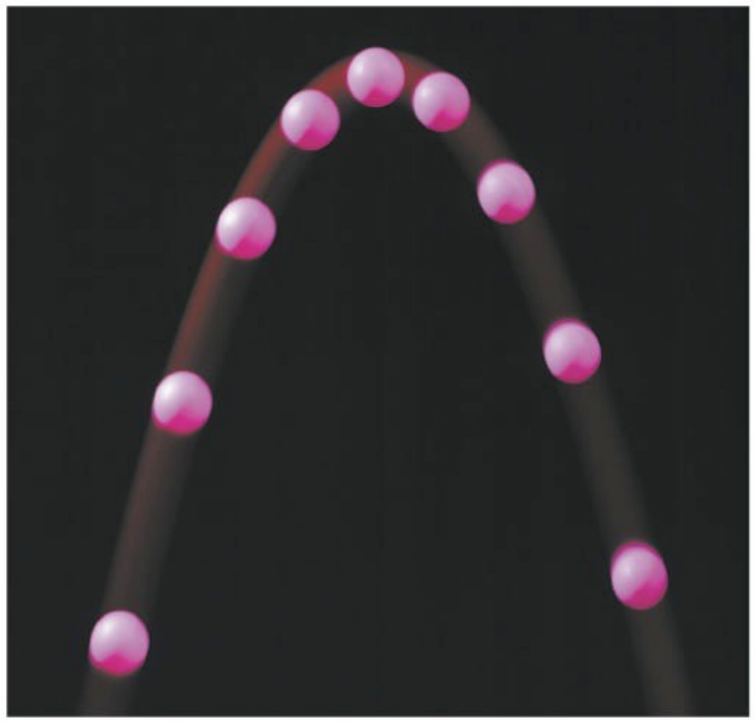


Will the hole get bigger or smaller?



**Linear motion**

**Circular motion**



**Projectile motion**

**Rotational motion**

# How can you describe the motion of an object?

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Mathematical

$$x(t) = 5t^2 - 3t$$

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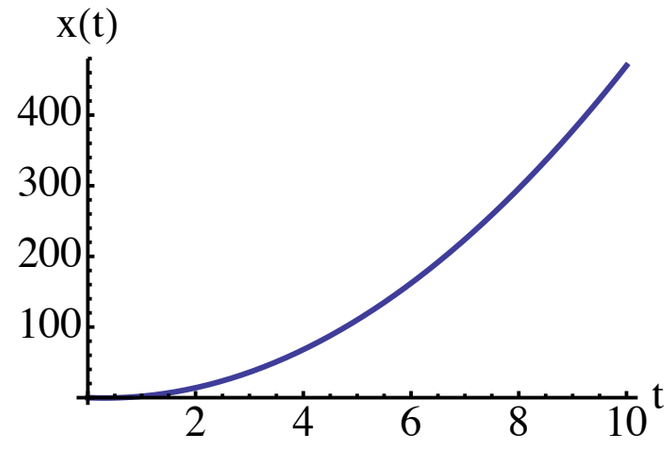
$$x(t) = 5t^2 - 3t$$

## Graphical



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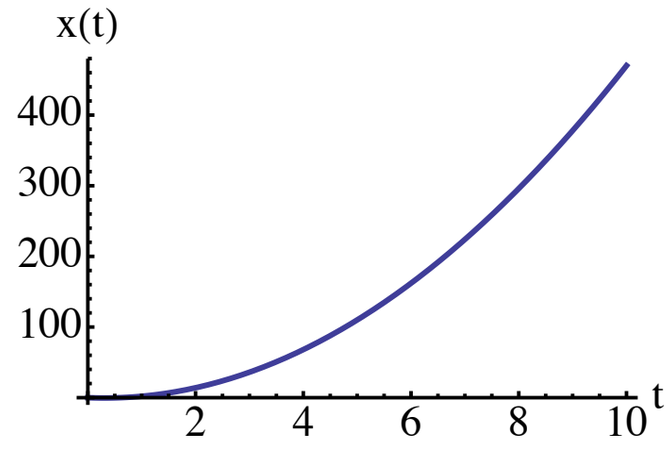


## Verbal

"The car's speed increased for 5 seconds while going up a hill."

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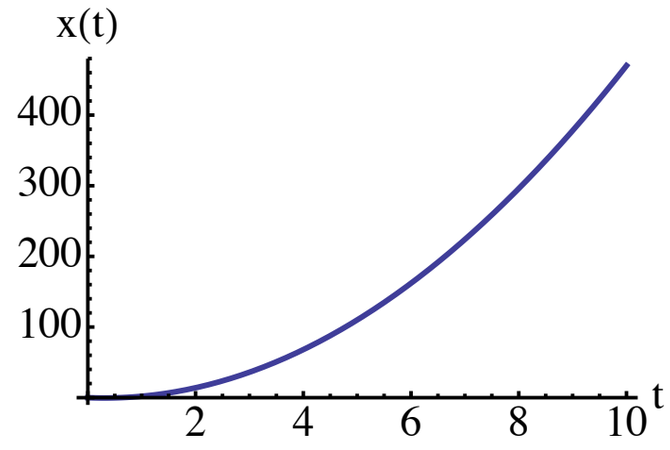
$$x(t) = 5t^2 - 3t$$

## Graphical



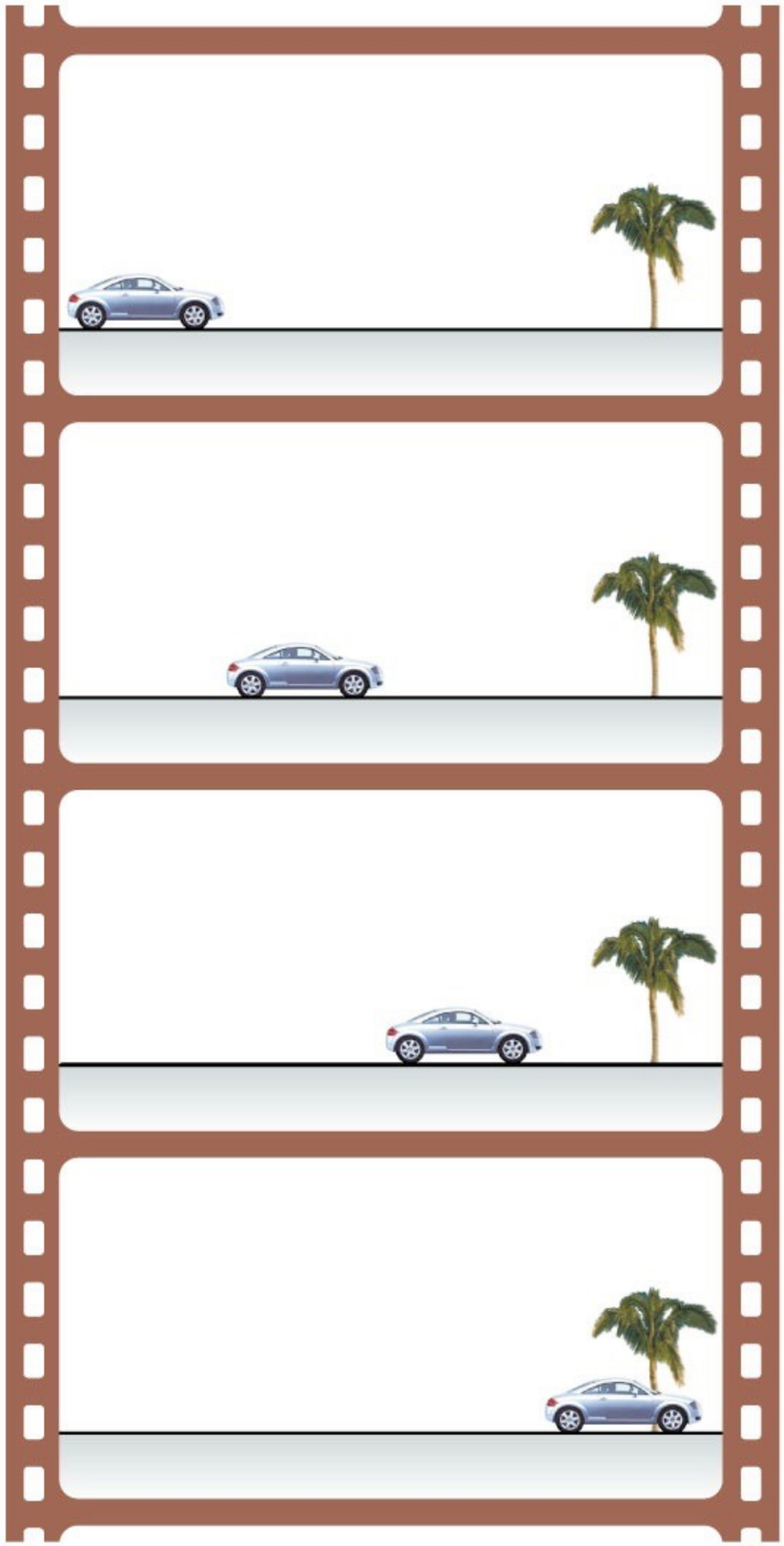

## Verbal

"The car's speed increased for 5 seconds while going up a hill."

## Pictorial

?

# Motion diagrams



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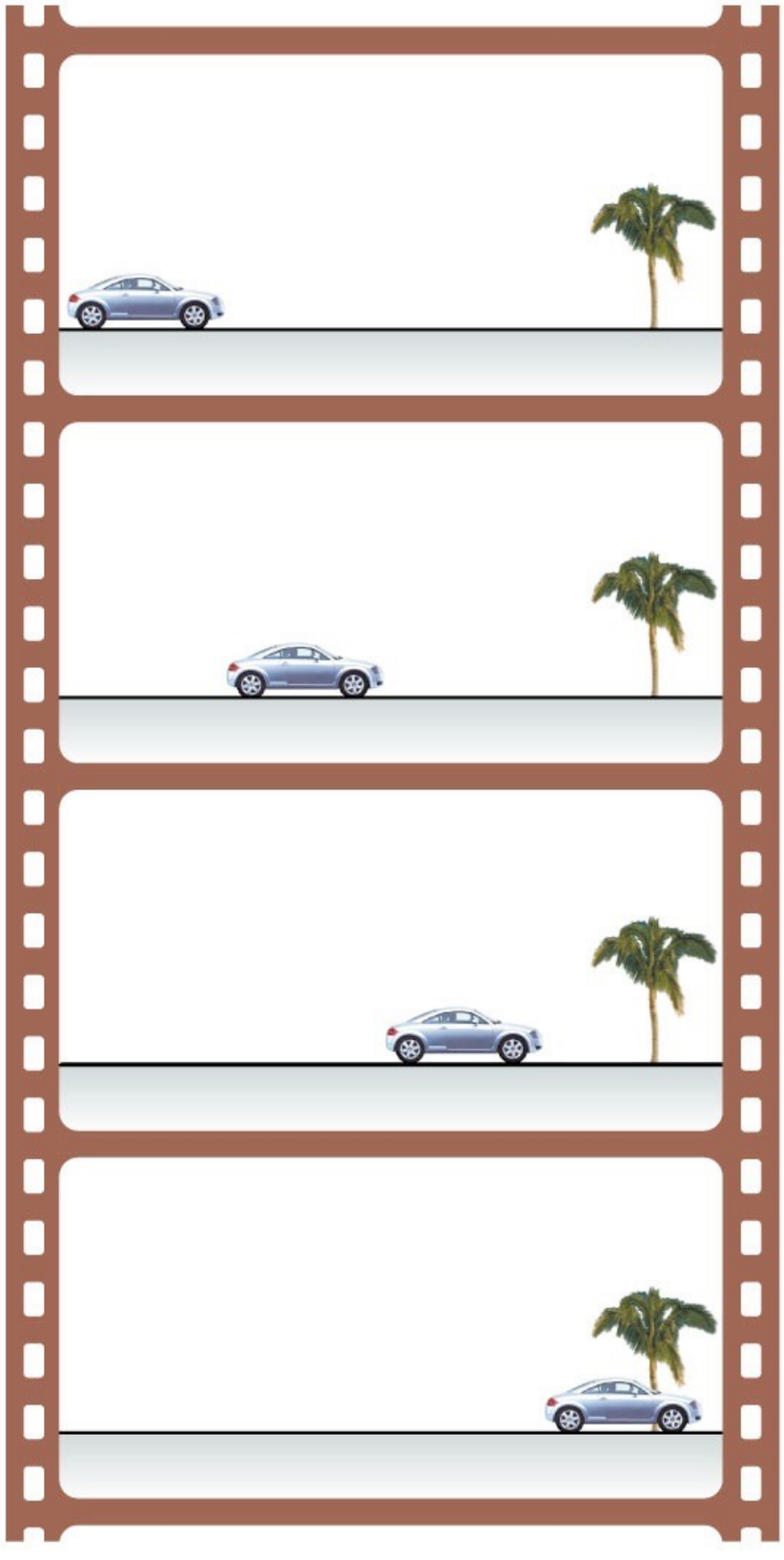
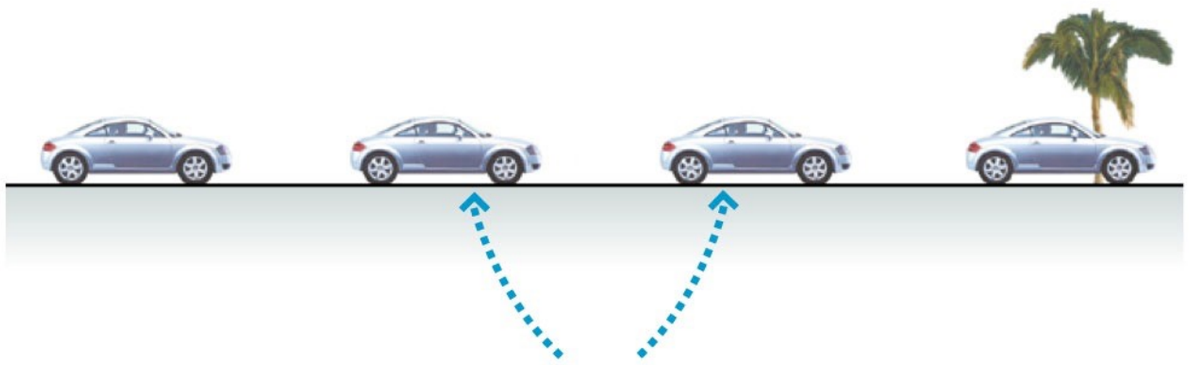
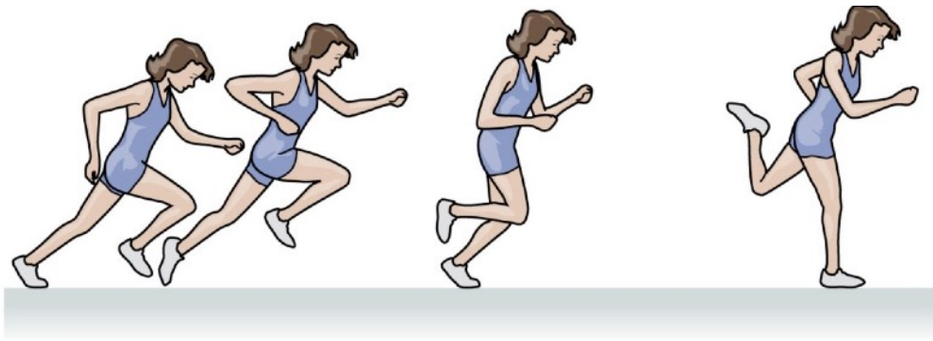
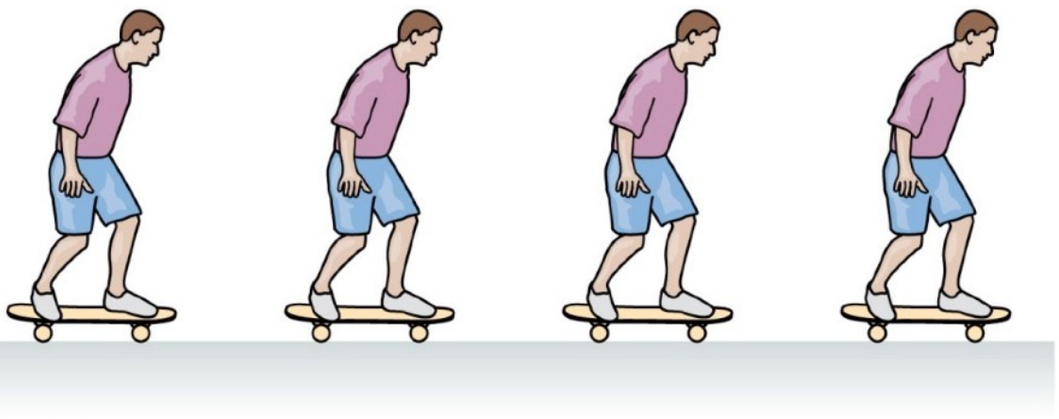




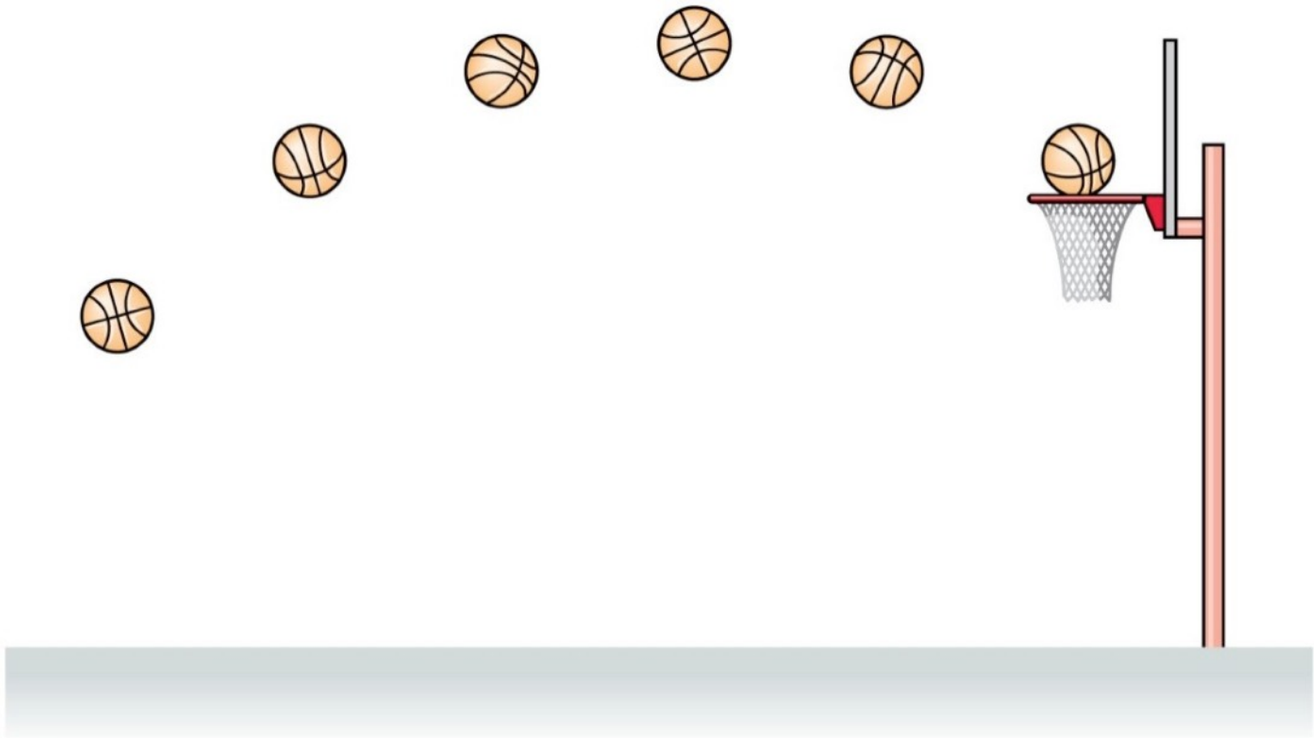
The same amount of time elapses between each image and the next.

# Examples of Motion Diagrams

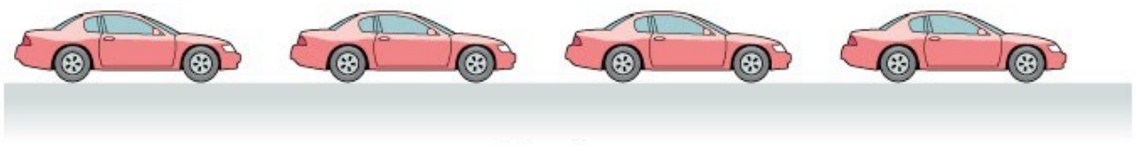




# Examples continued



# clicker quiz



Car A

Car B

Motion diagrams are made of two cars. Both have the same time interval between photos. Which car, A or B, is going faster?

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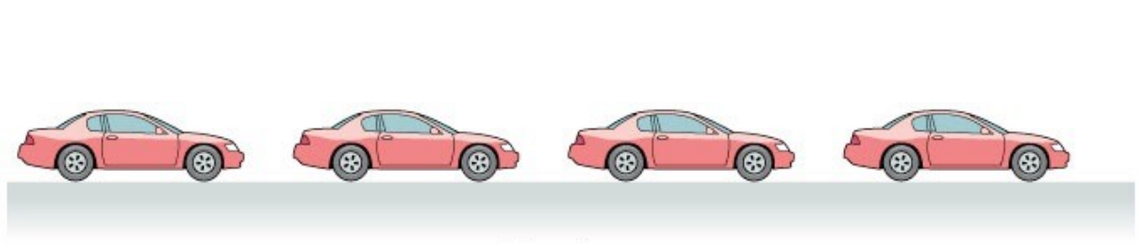

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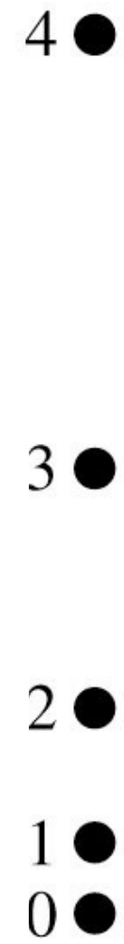
# The Particle Model

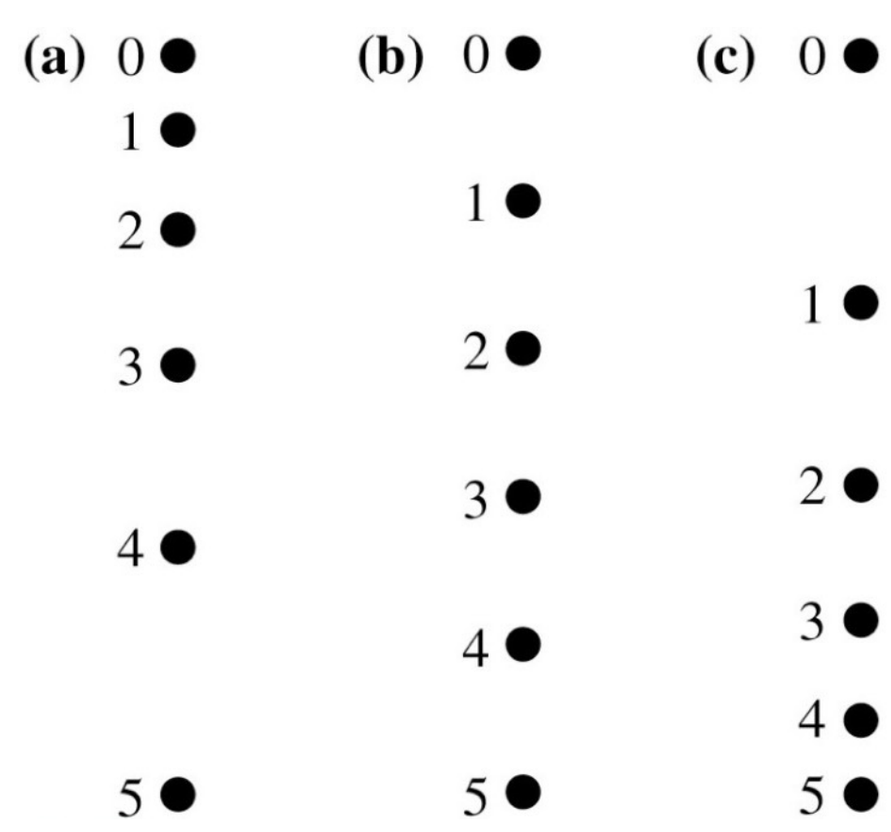
Motion Diagram in which the object is represented as a particle



# Quiz

Three motion diagrams are shown. Which is a dust particle settling to the floor at constant speed, which is a ball dropped from the roof of a building, and which is a descending rocket slowing to make a soft landing on Mars?

A. (a) is dust, (b) is ball, (c) is rocket.
B. (a) is ball, (b) is dust, (c) is rocket.
C. (a) is rocket, (b) is dust, (c) is ball.
D. (a) is rocket, (b) is ball, (c) is dust.
E. (a) is ball, (b) is rocket, (c) is dust.



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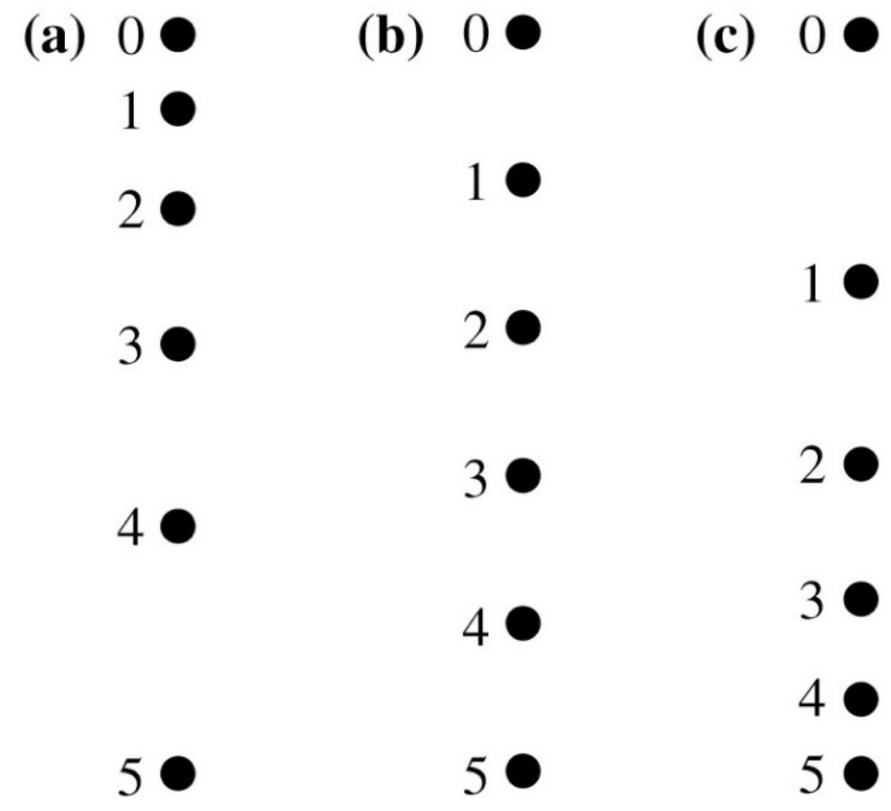
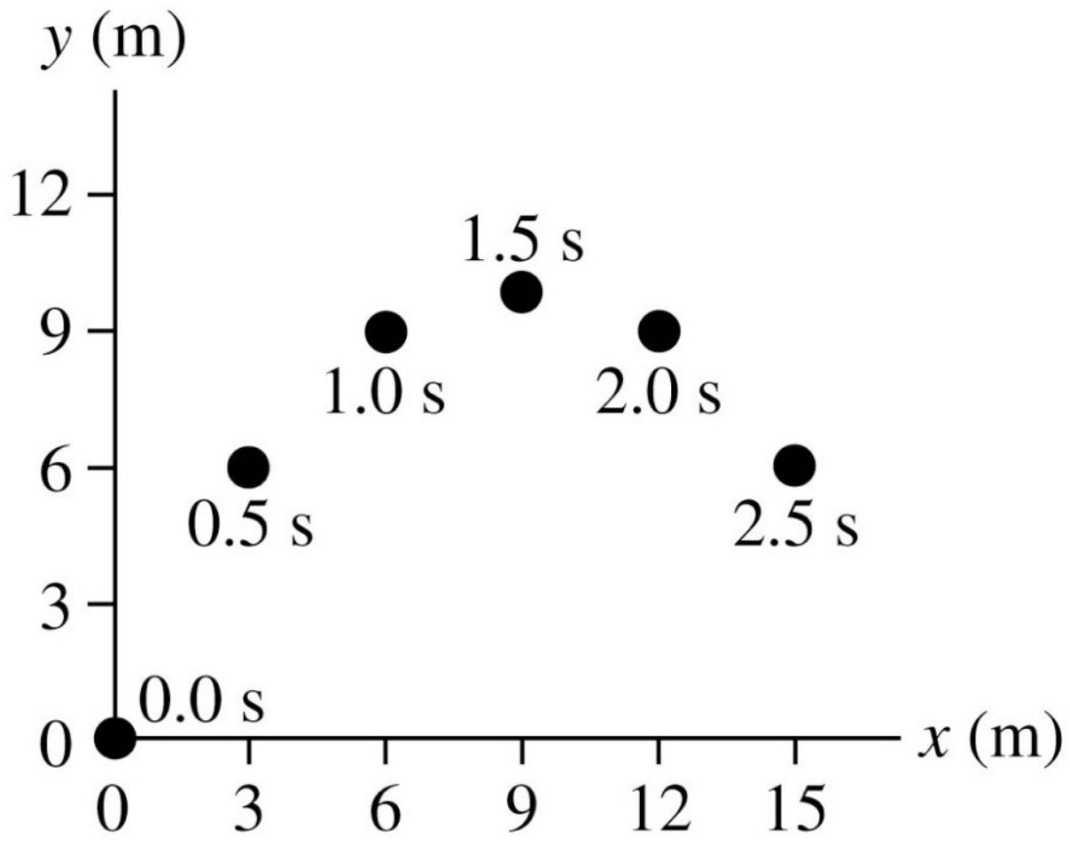


# Position and Time



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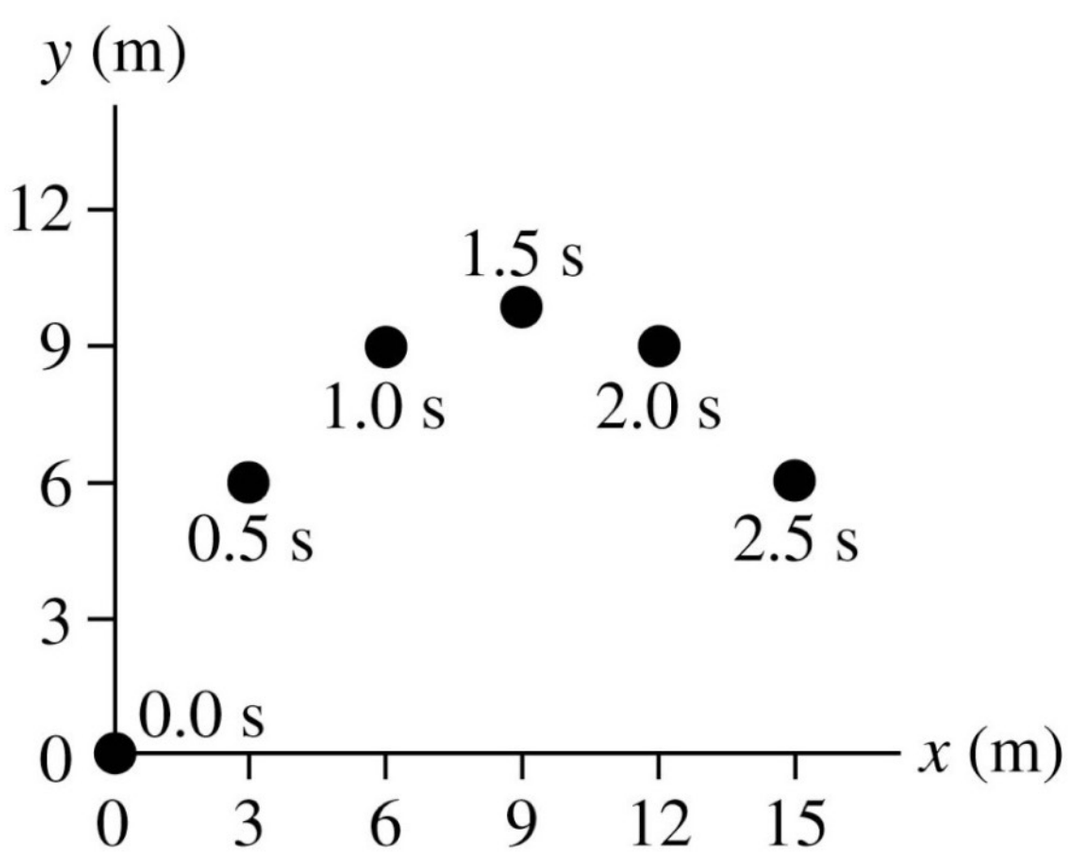


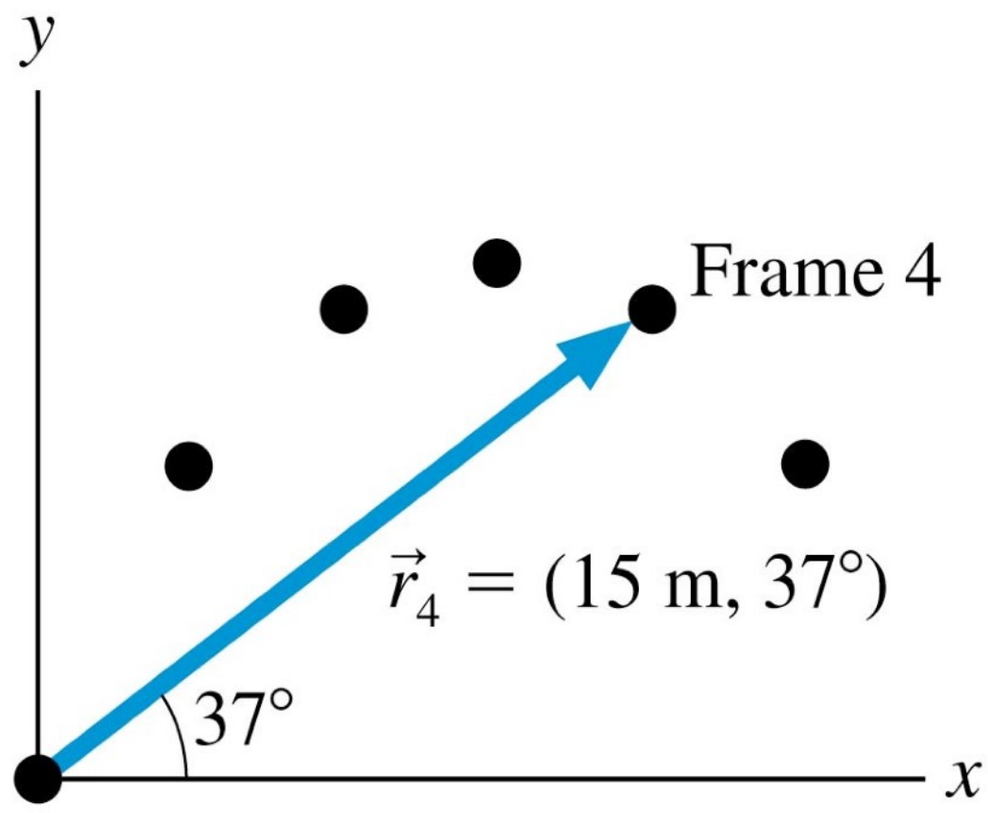

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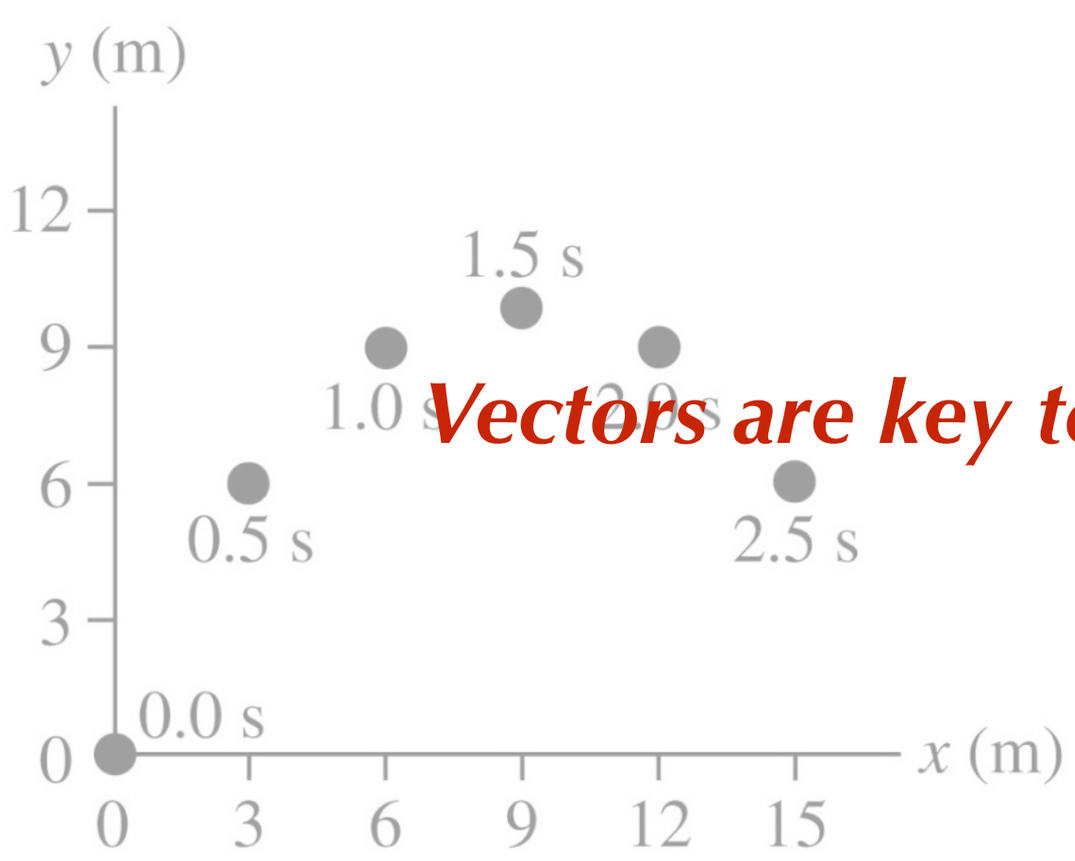
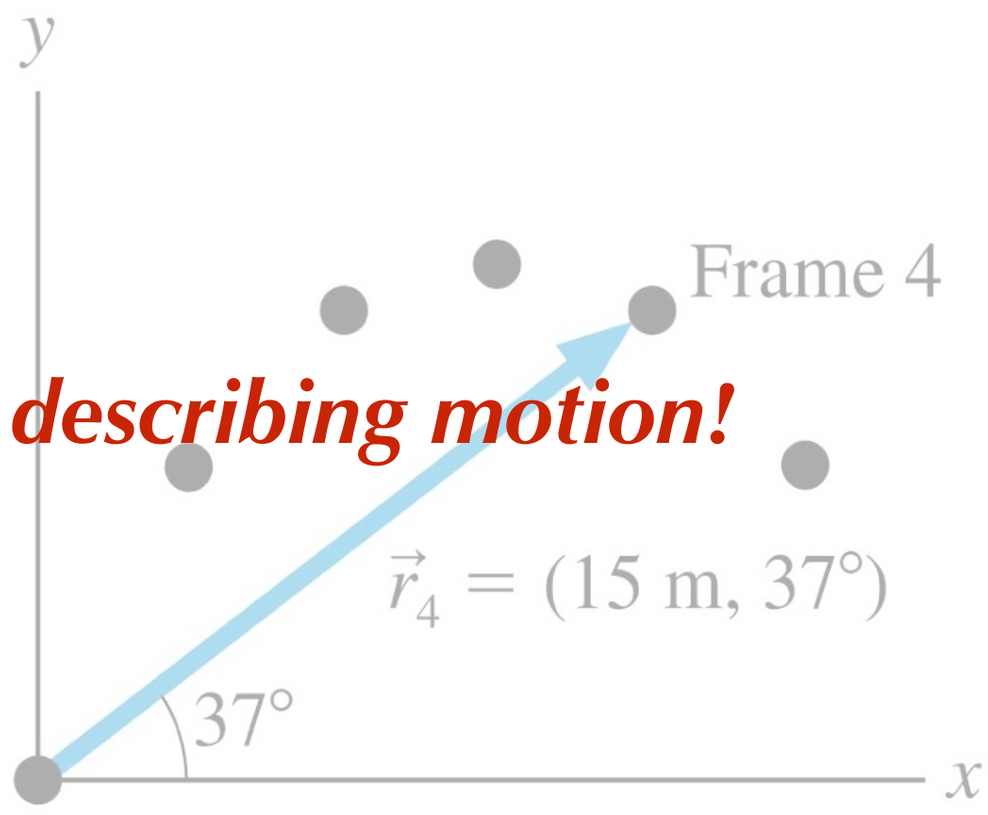
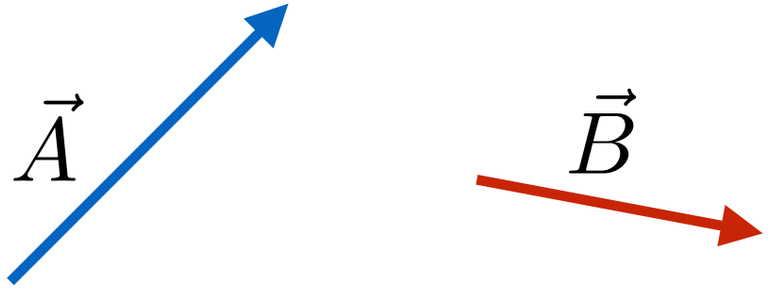



***Vectors are key to describing motion!***

# Vector Addition



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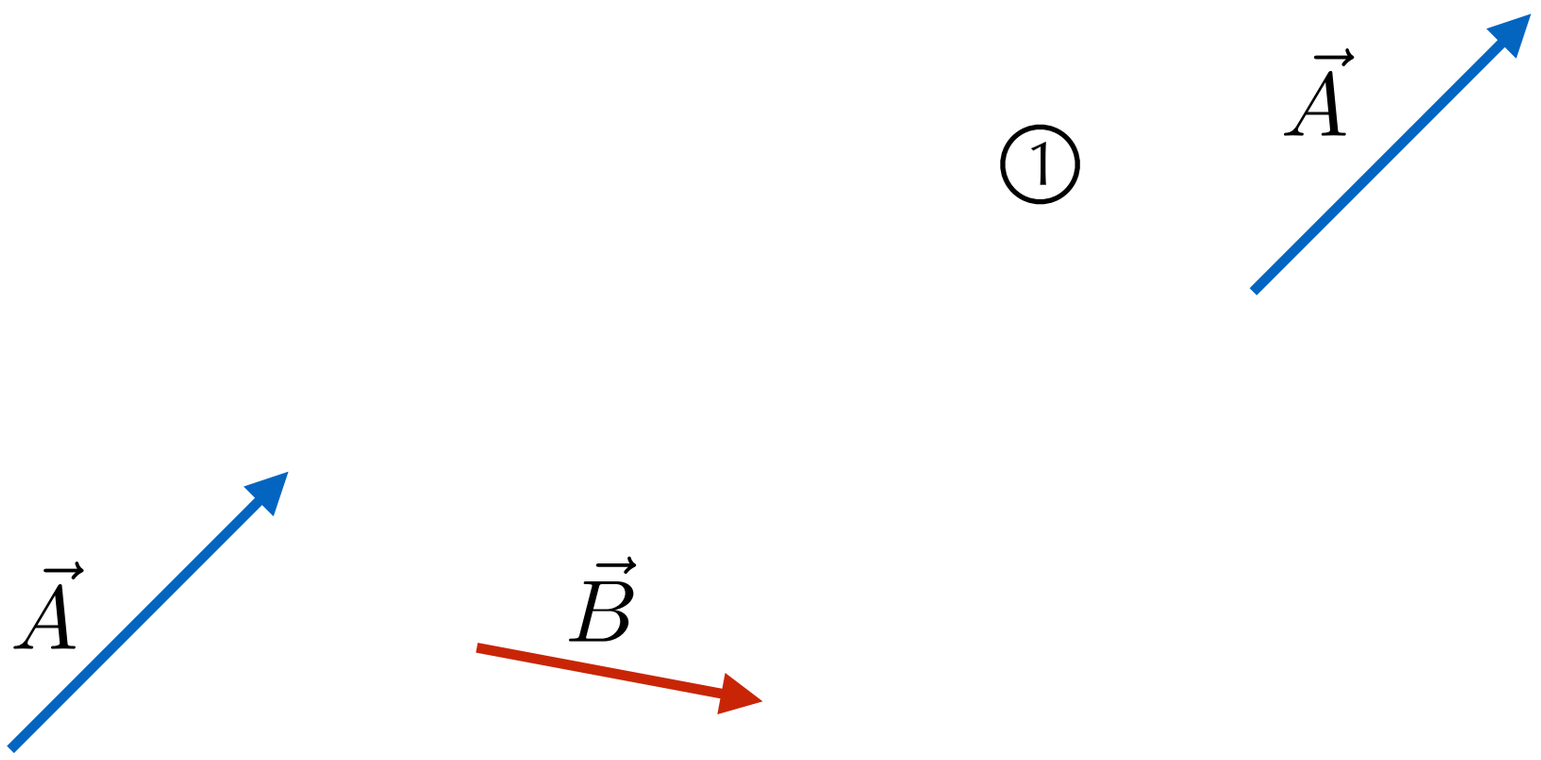

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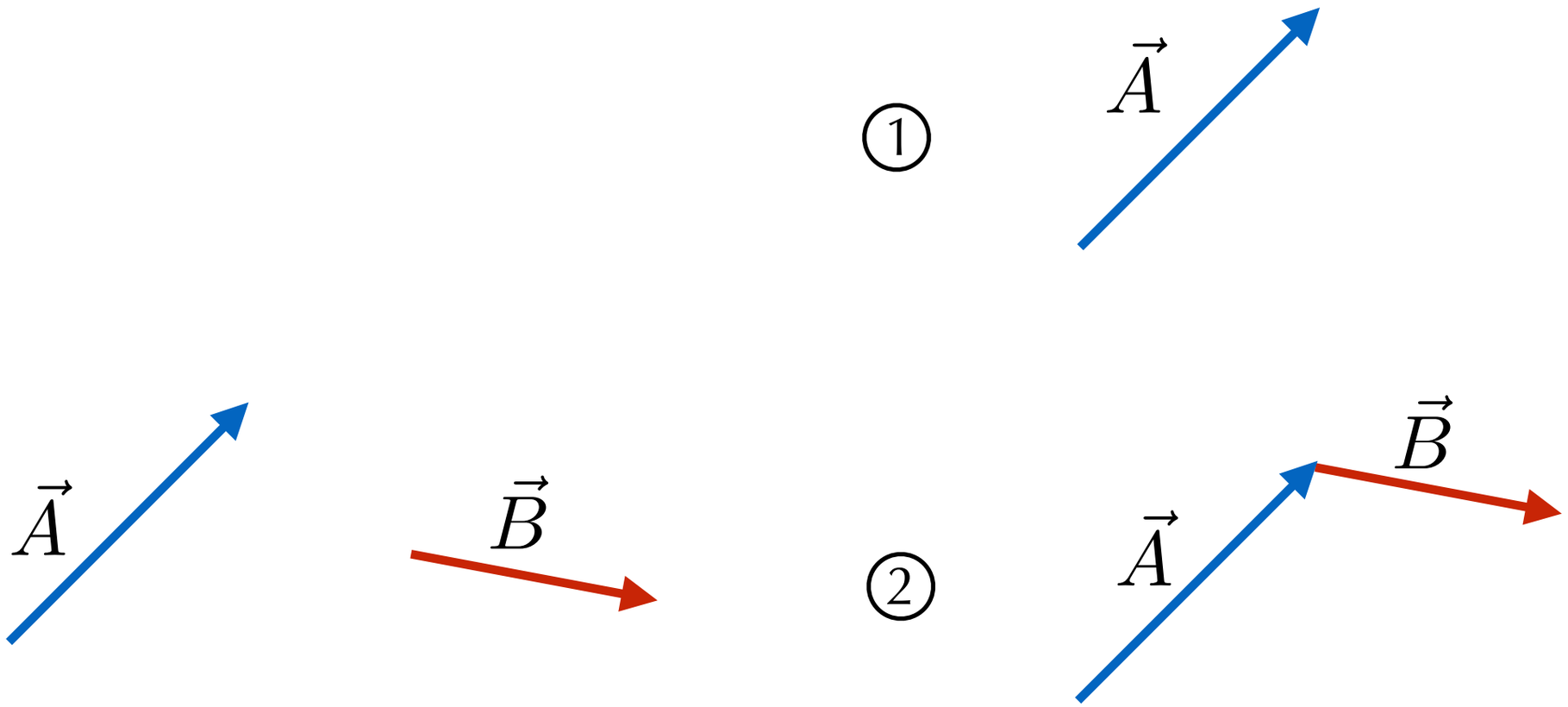

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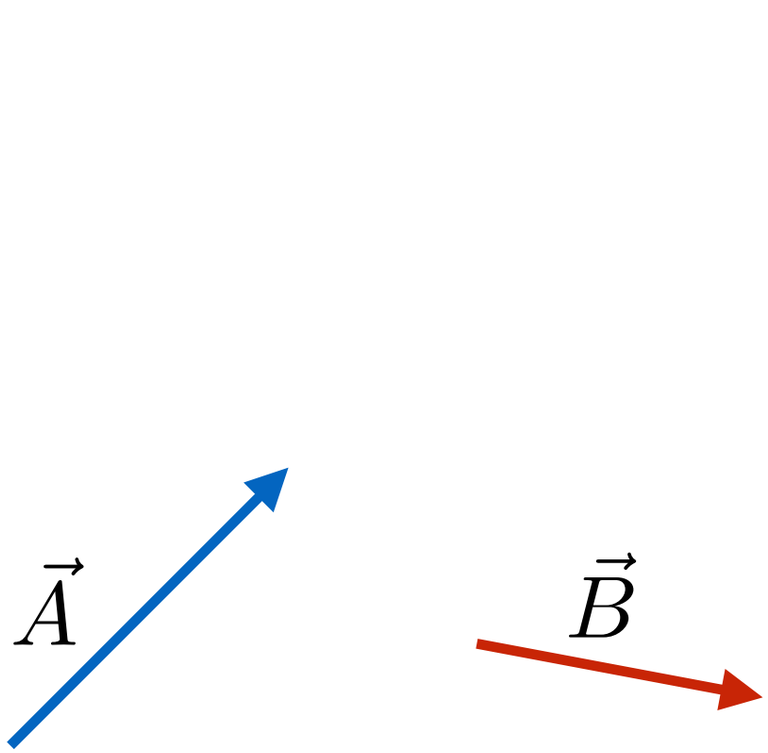
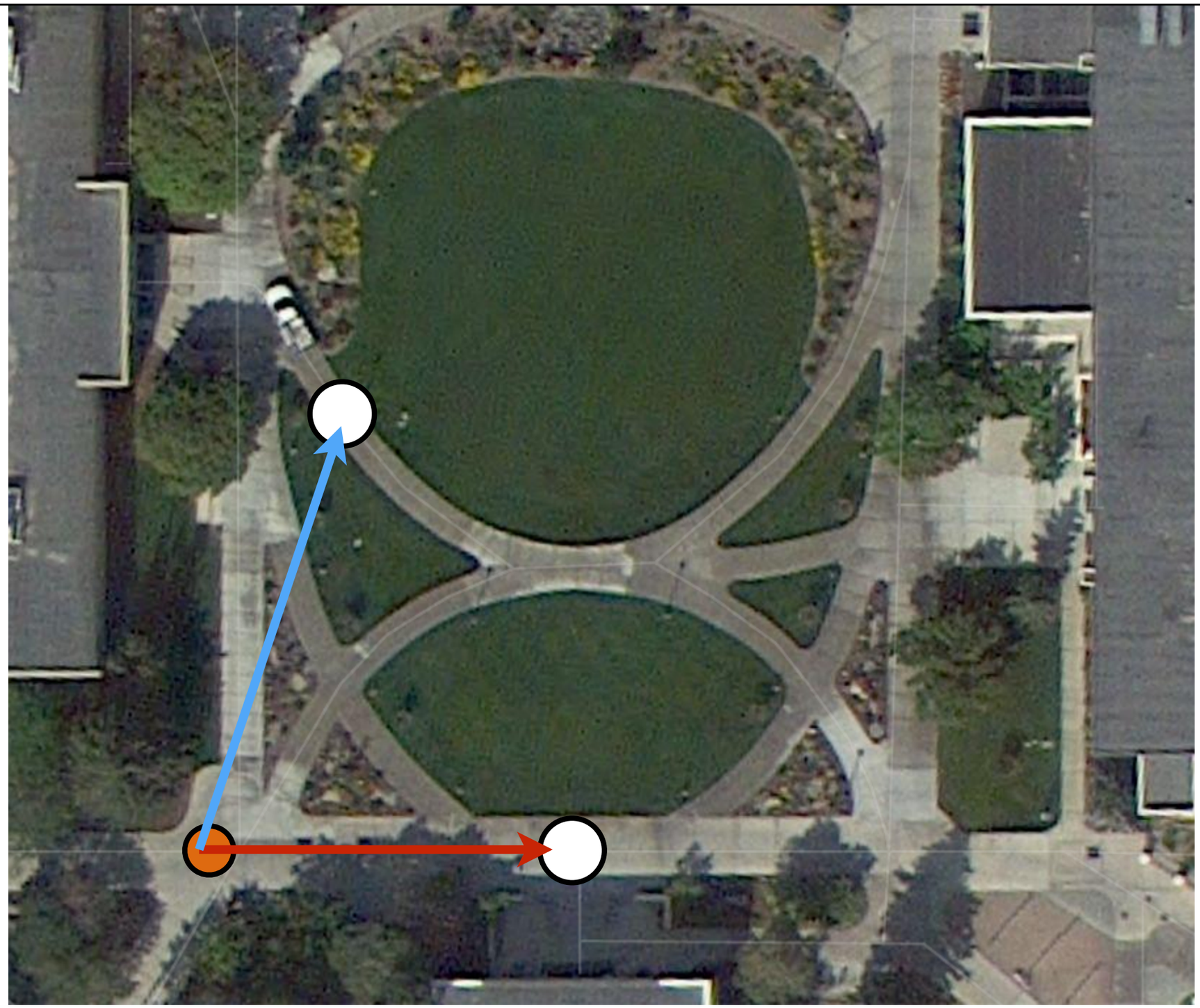



① $\vec{A}$

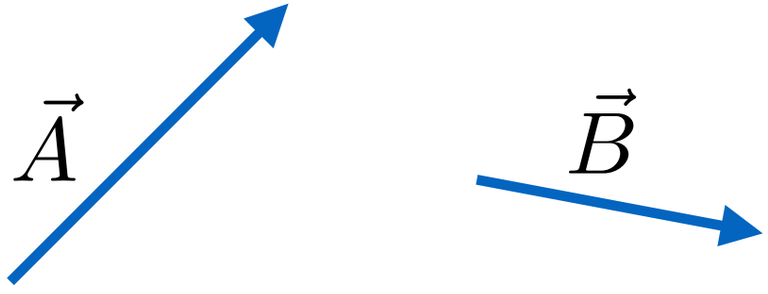
② $\vec{A}$ $\vec{B}$

③ $\vec{A}$ $\vec{B}$ $\vec{A}+\vec{B}$

You are standing in front of the library pondering a scripture you read this morning when you realize you are late for physics class. Just before you get to the Romney building you stop and ask yourself, "I wonder how my position vector has changed."



# Vector Subtraction



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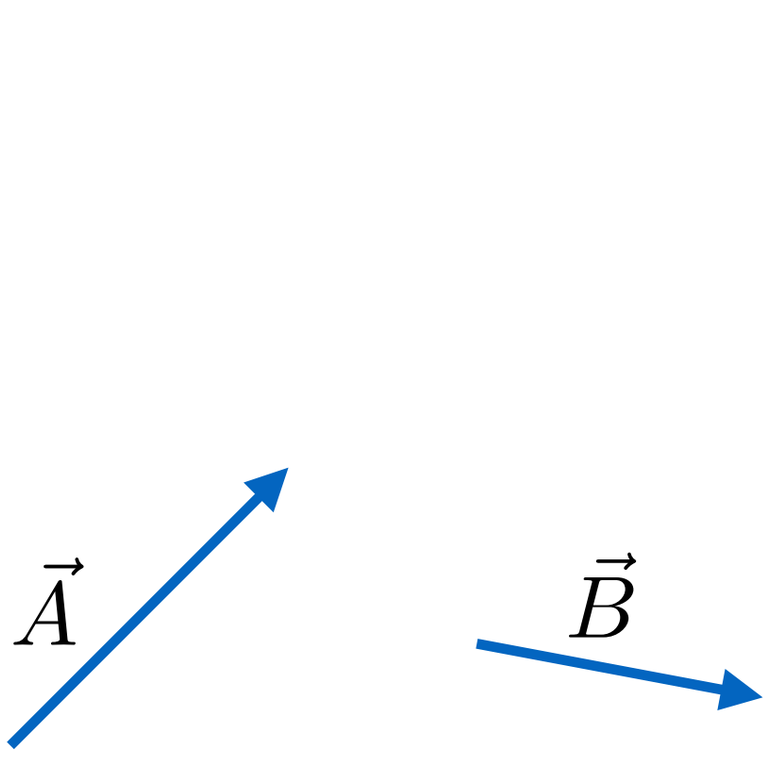

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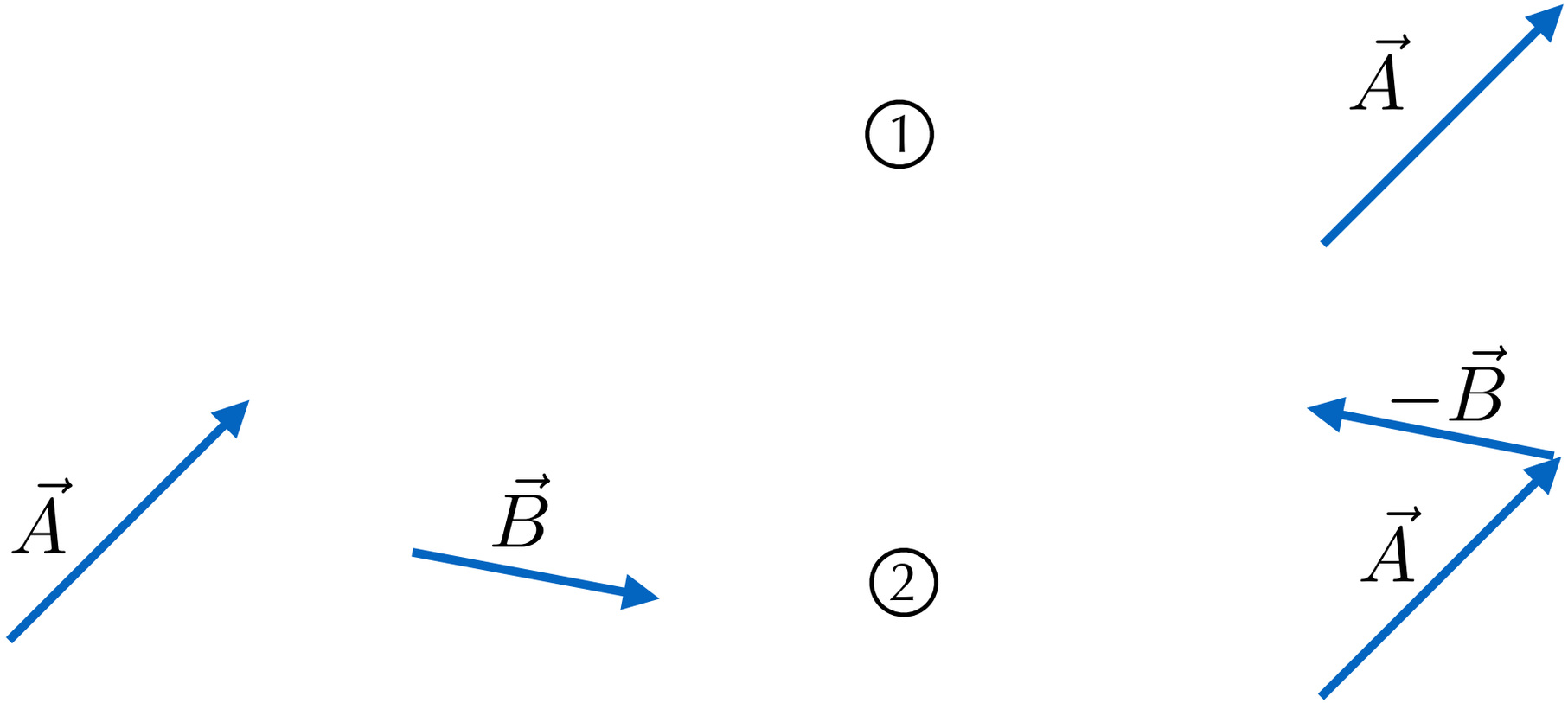

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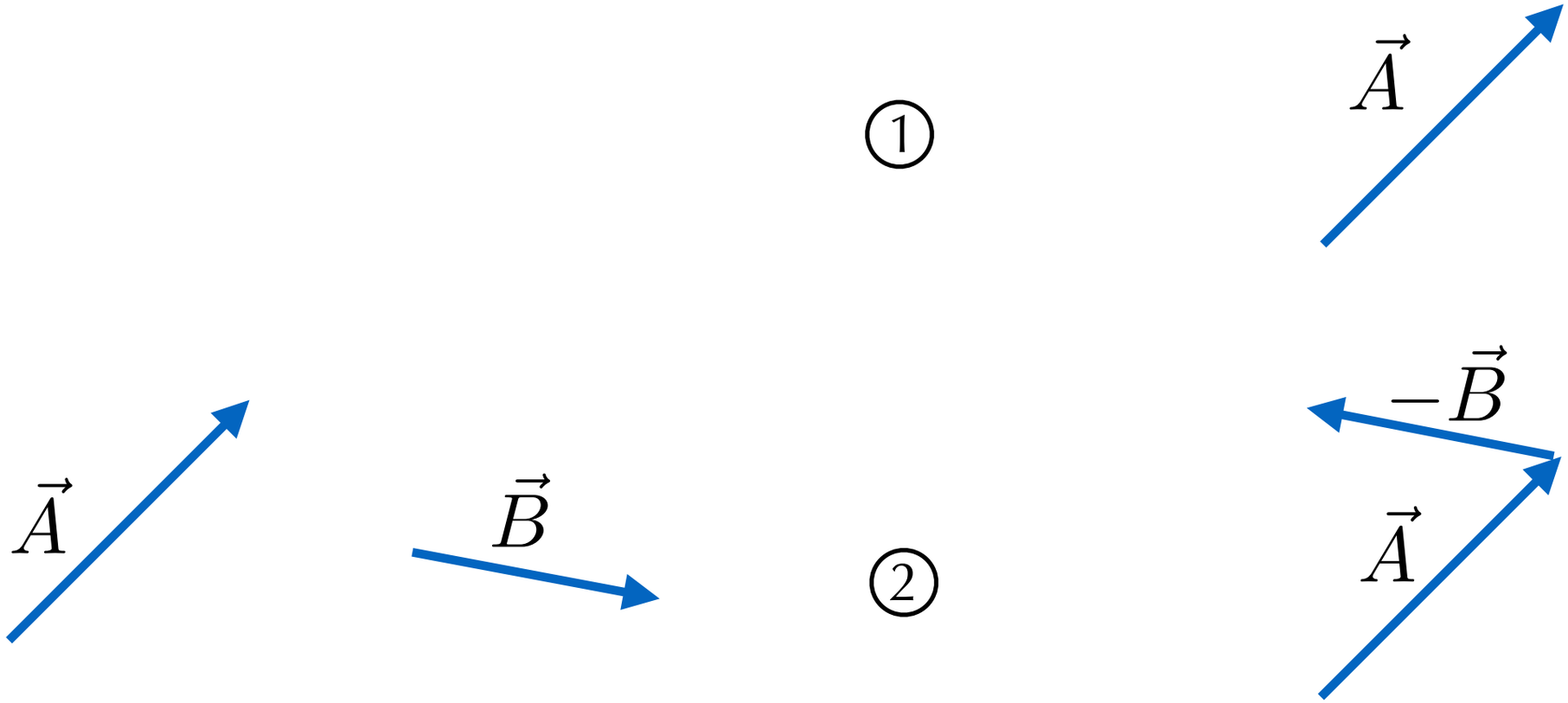
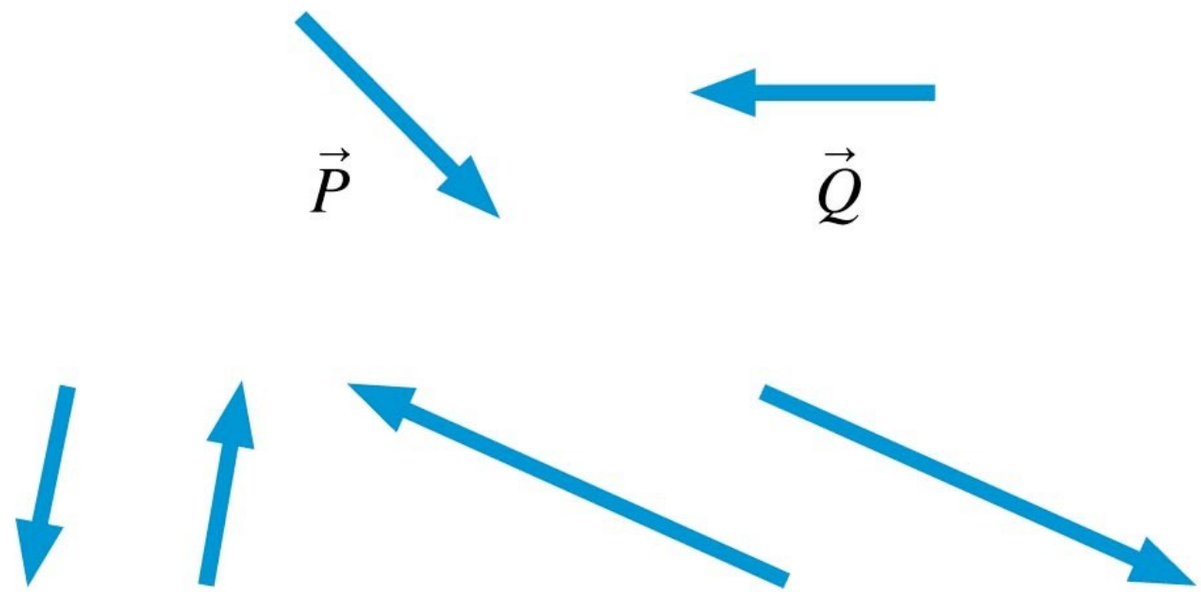


# Quiz

Given the vectors $\vec{P}$ and $\vec{Q}$ , what is $\vec{P} + \vec{Q}$



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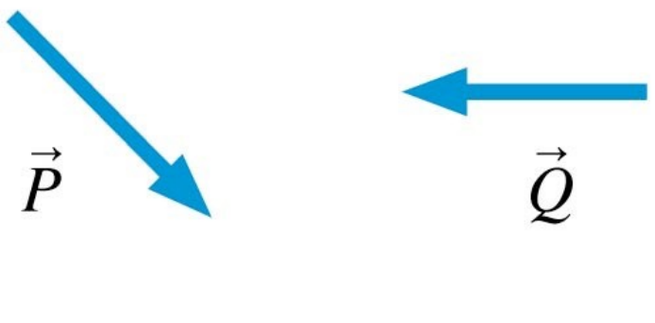
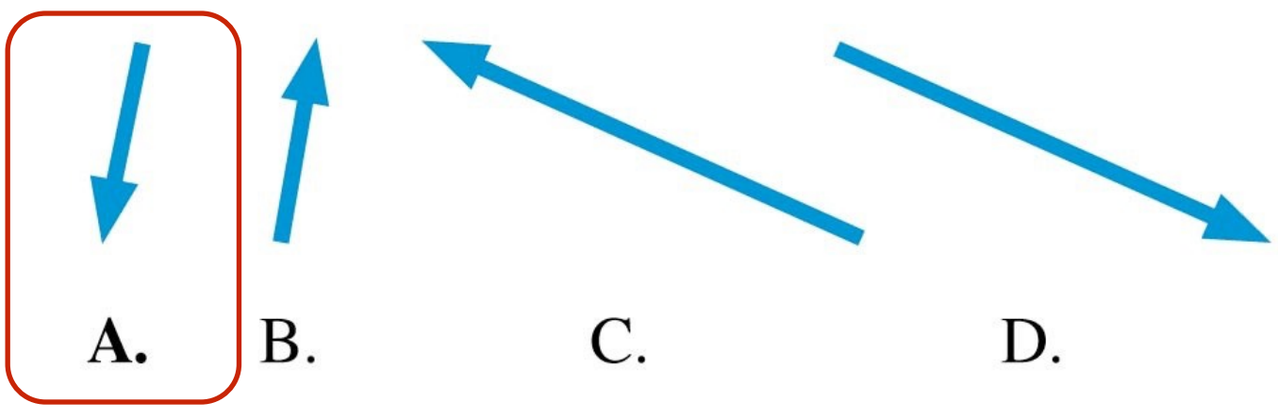
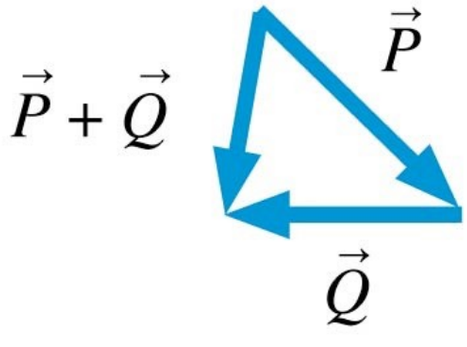
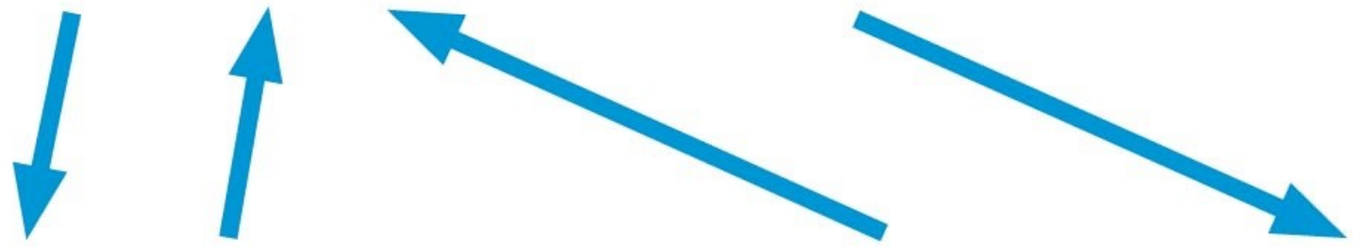


# Quiz

Given the vectors $\vec{P}$ and $\vec{Q}$ , what is $\vec{P} - \vec{Q}$

A. B. C. **D.**

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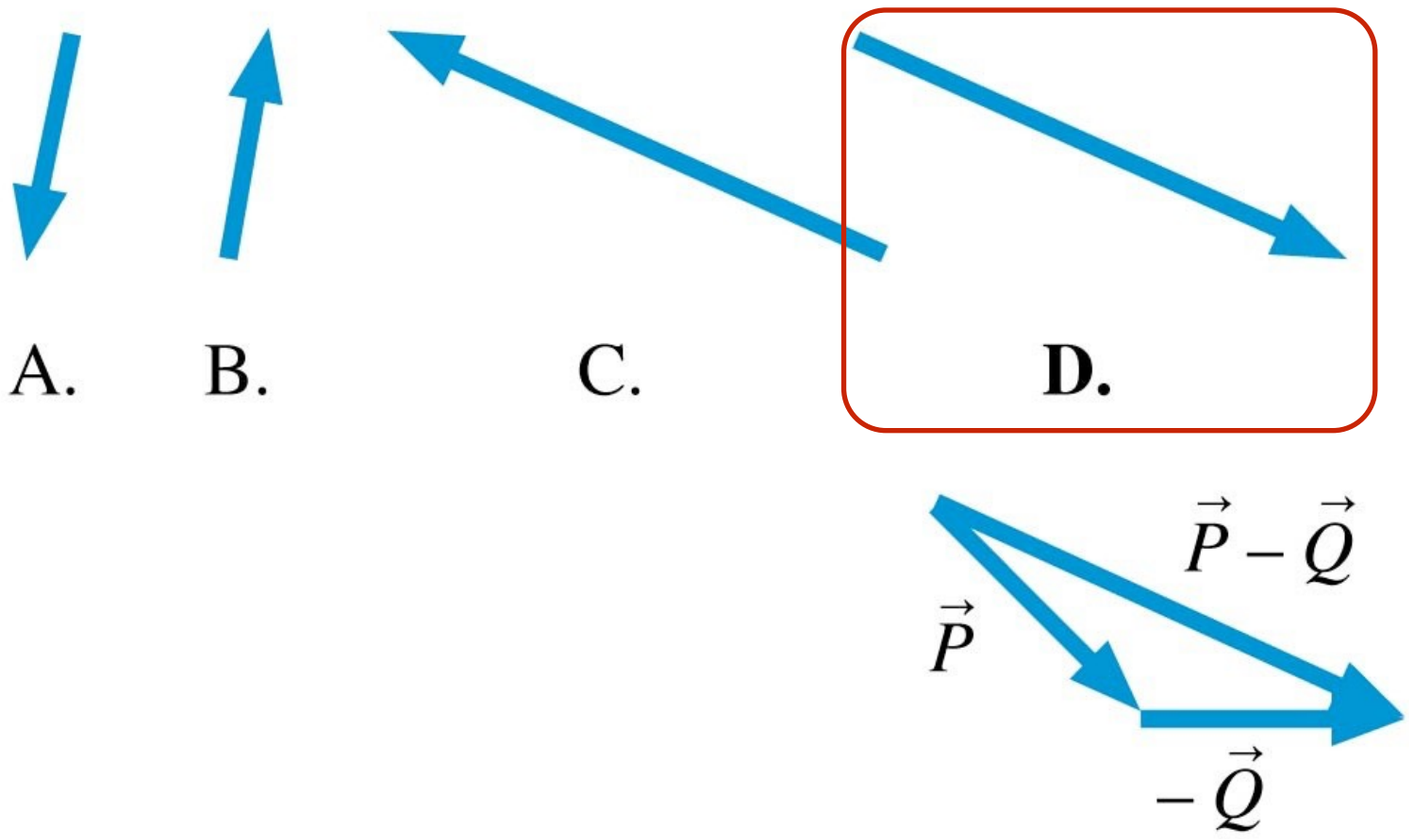
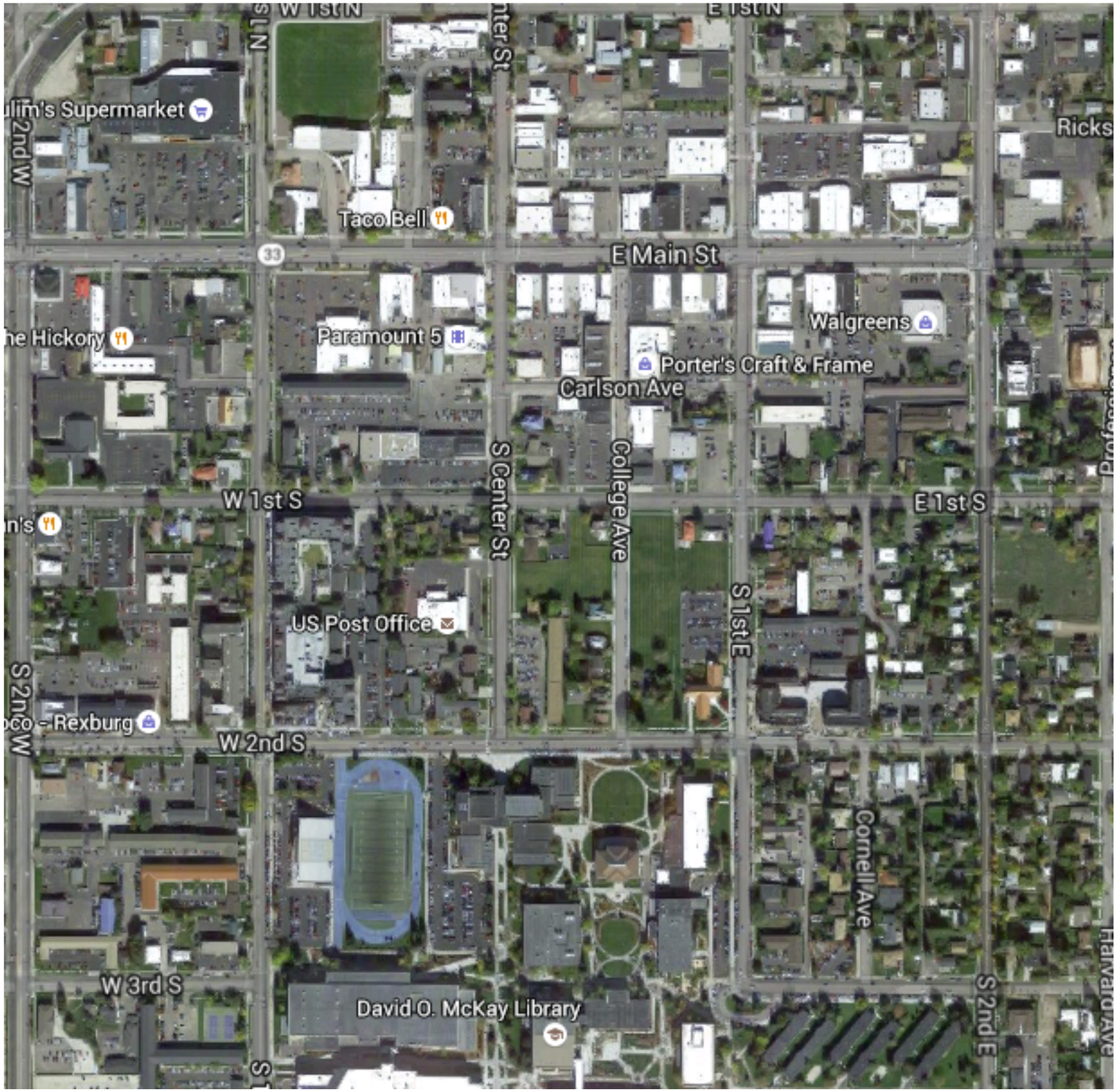
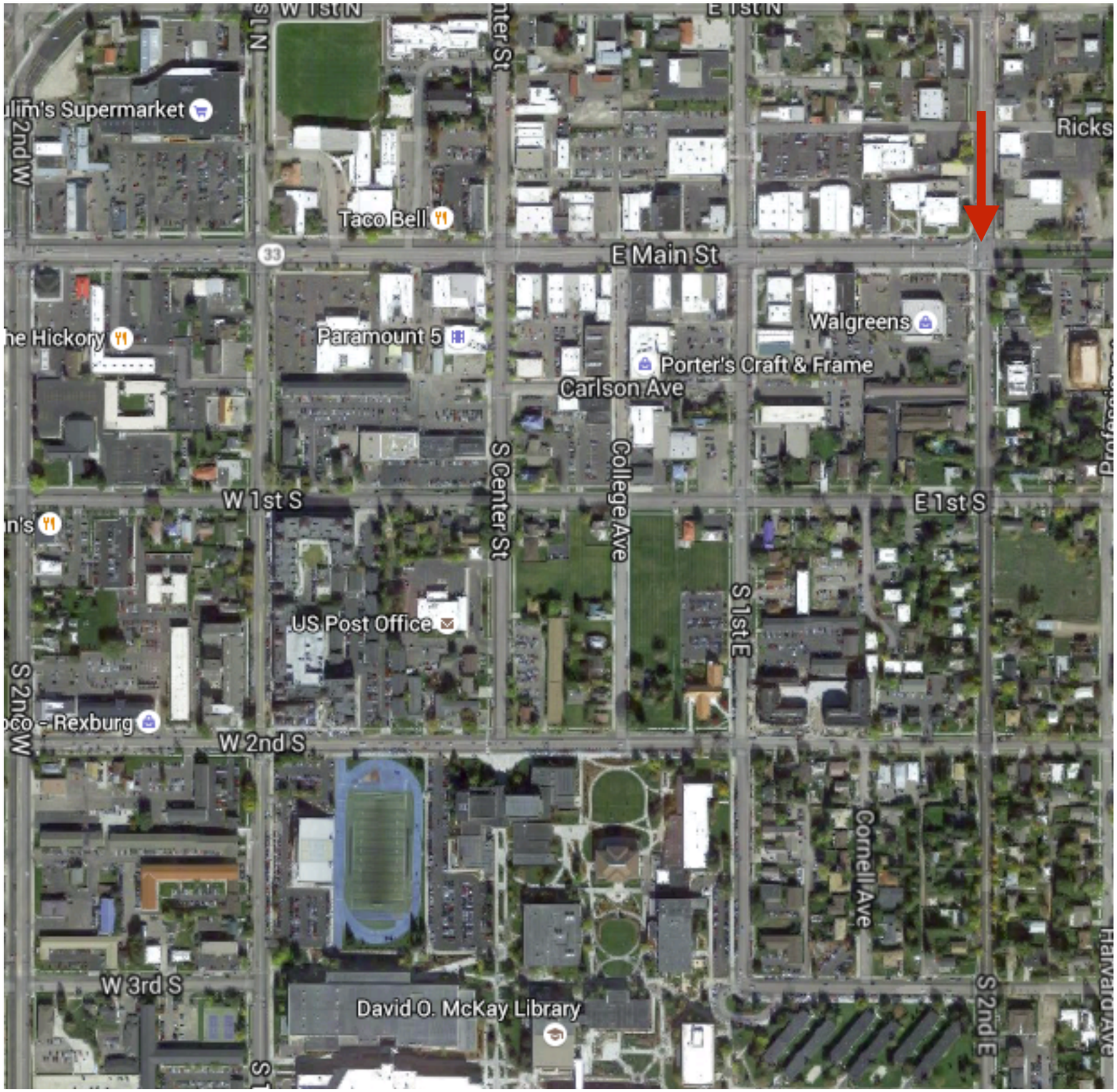



W 1st N
E 1st N
Taco Bell
E Main St
Walgreens
Paramount 5
Porter's Craft & Frame
Carlson Ave
W 1st S
E 1st S
S Center St
College Ave
S 1st E
US Post Office
W 2nd S
S 2nd W
S 2nd E
Cornell Ave
W 3rd S
David O. McKay Library


W 1st N
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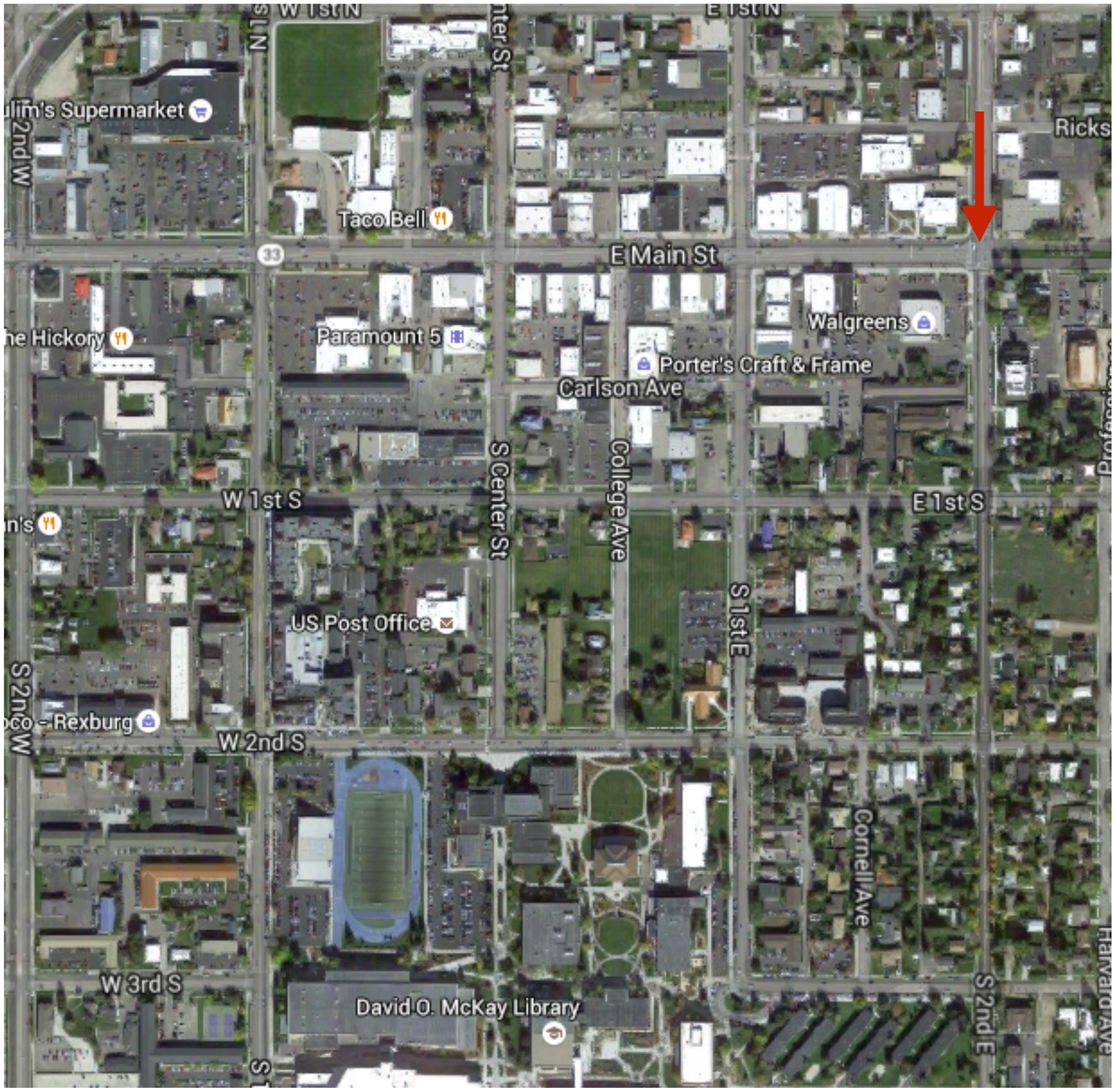
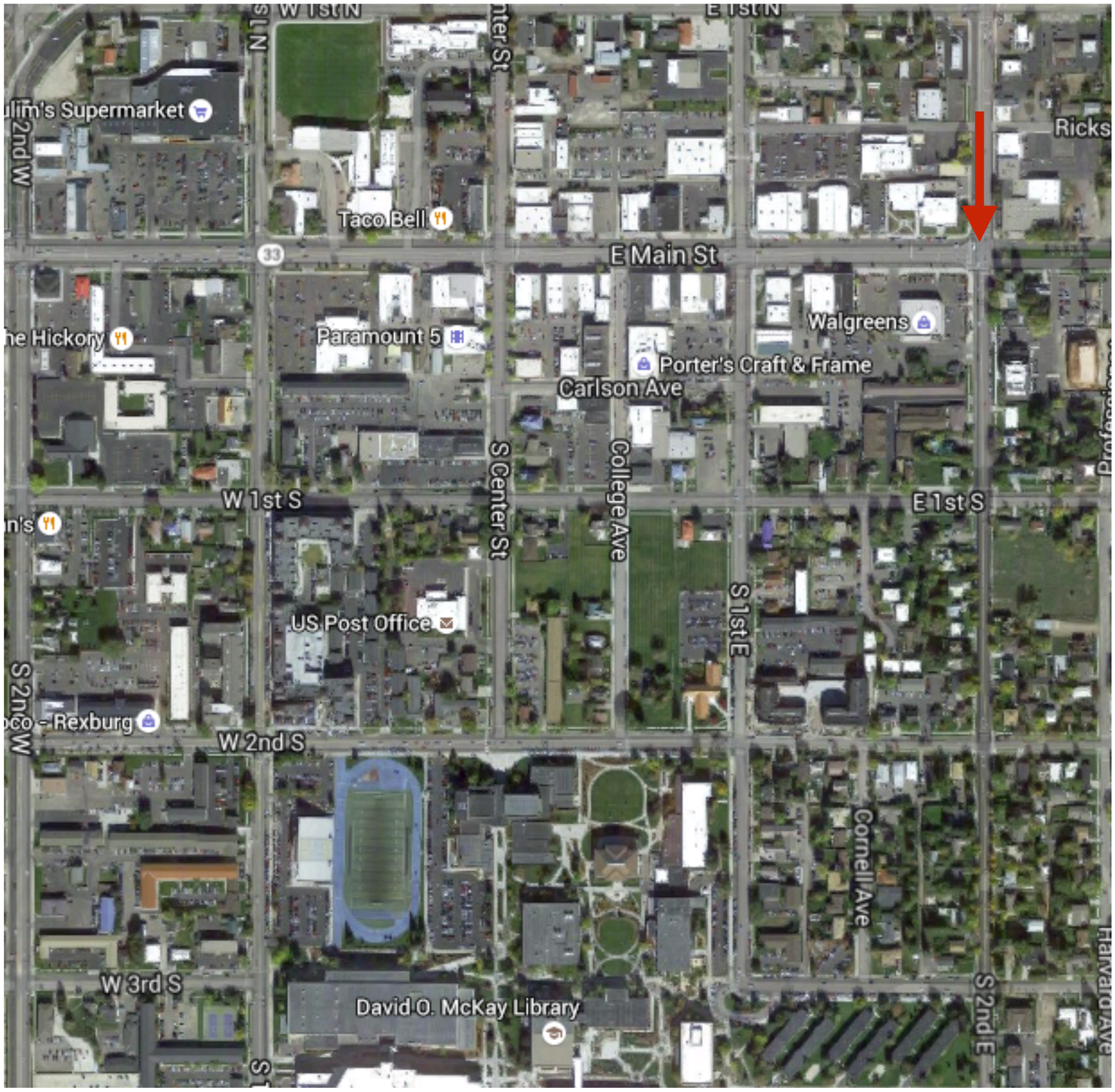



## Average speed

$$v_{\text{avg}} = \frac{\text{distance traveled}}{\text{time elapsed}}$$

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$$v_{\text{avg}} = \frac{\text{distance traveled}}{\text{time elapsed}}$$

## Average velocity

$$\vec{v}_{\text{avg}} = \frac{\Delta \vec{r}}{\Delta t}$$

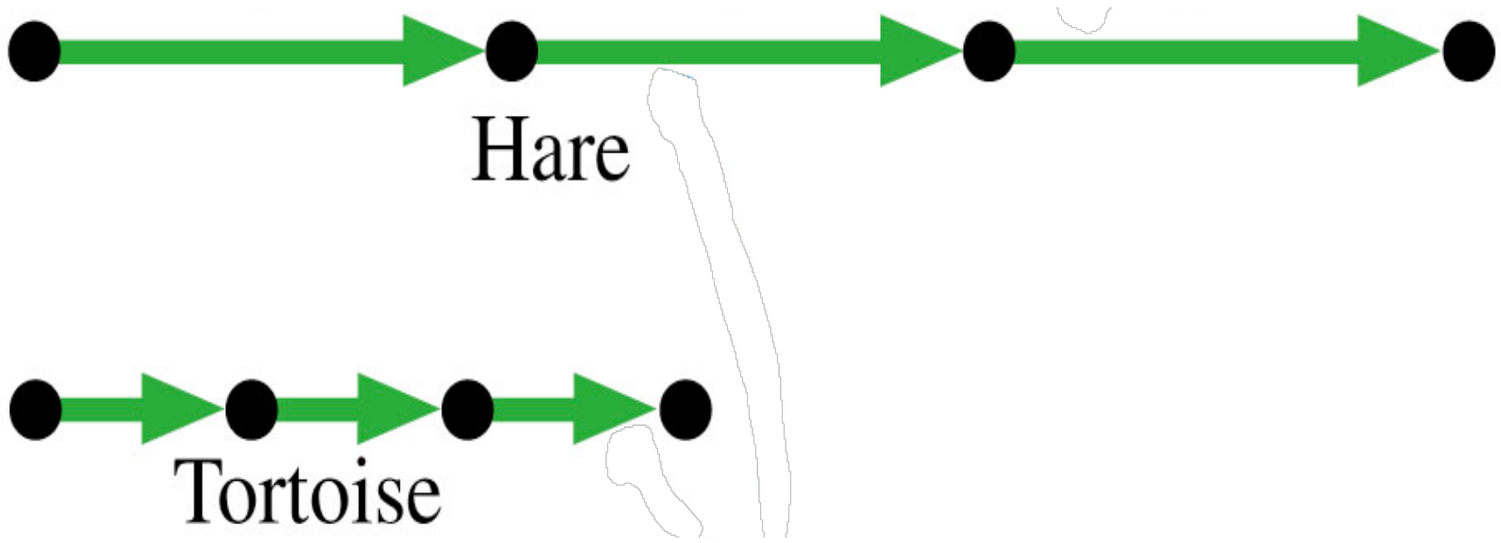

[Average speed]

$$v_{\text{avg}} = \frac{\text{distance traveled}}{\text{time elapsed}}$$

[Average velocity]

$$\vec{v}_{\text{avg}} = \frac{\Delta \vec{r}}{\Delta t}$$

# Motion Diagrams with Velocity Vectors



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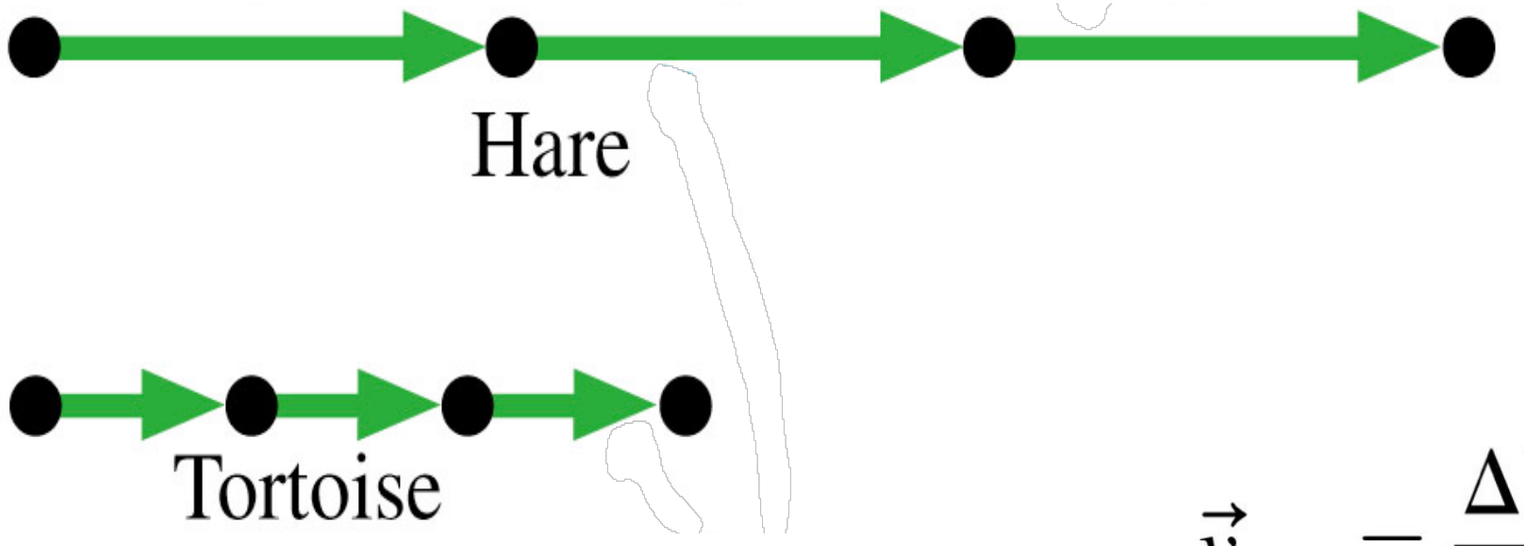


$$\vec{v}_{\text{avg}} = \frac{\Delta \vec{r}}{\Delta t}$$