PHYS 111 W20 Class 1 GROUP WORKSHEET

TOPIC:

VECTORS

NAMES/IDs:

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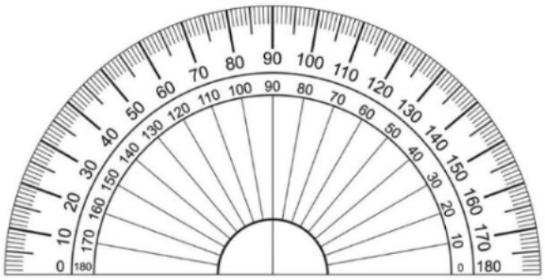
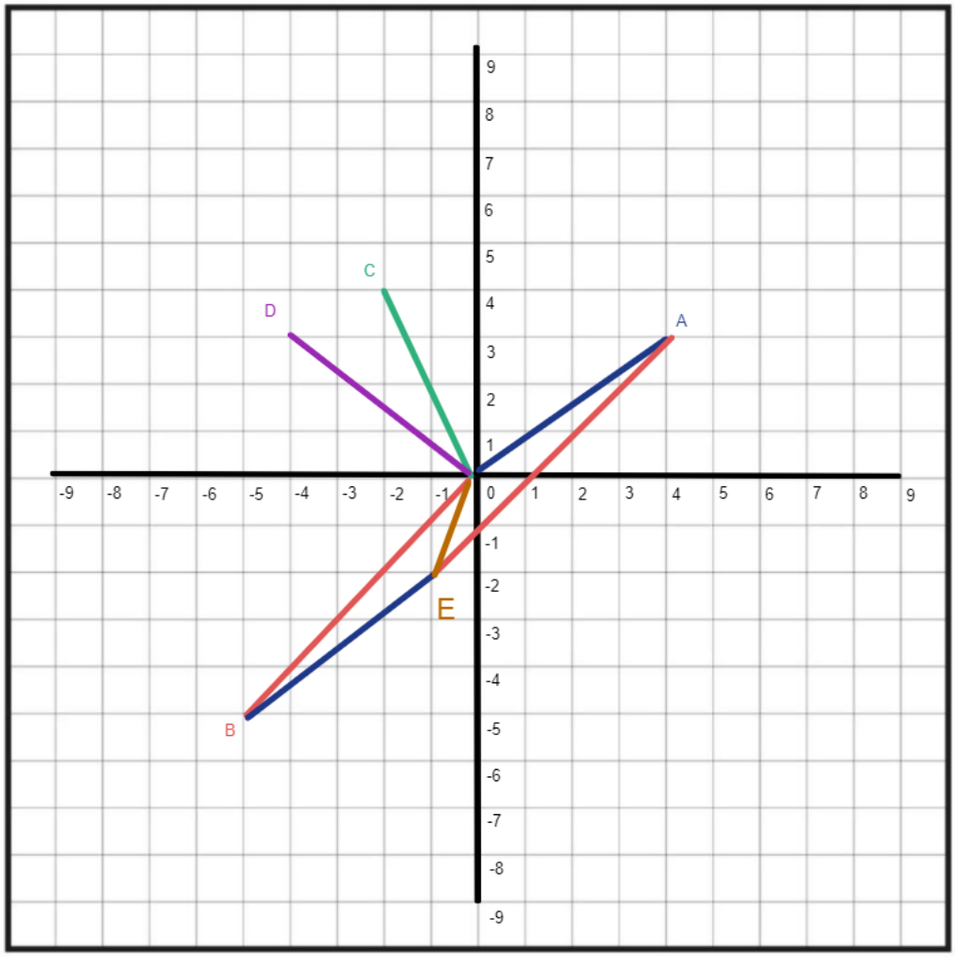
Remember to write your name/ID hand in your completed worksheet for marks!

OVERVIEW: Use the grid paper on the right to sketch out vectors **A**, **B**, **C**, **D**, and **E**. A protractor is provided to help with your sketches and angles. Remember to label your vectors!





Question 1: Use the grid paper to graphically depict the following vectors:

I. $\mathbf{A} = 4x + 3y$
II. $\mathbf{B}$, $|\mathbf{B}| = 7.07$, $\theta = 225°$
III. $\mathbf{C} = (-2,4)$
IV. $\mathbf{D} = -4\hat{\imath} + 3\hat{\jmath}$

Question 2: Find the magnitude and directions of vectors **A**, **C**, and **D**

$|\mathbf{A}| =$
√(4*4+3*3)
√(16+9)
√(25)
5

$\theta_A =$
tan^-1(3/4)
36.87

ANSWER: $|\mathbf{A}|$ 5 $\theta_A =$ 36.87

ANSWER: $|\mathbf{C}| =$ 4.47 $\theta_C =$ 116.57

ANSWER: $|\mathbf{D}| =$ 5 $\theta_D =$ 143.13

Question 3: Find the components of **B**

$B_x =$ -5

$B_y =$ -5

Question 4: Add **A** and **B** to make vector **E** using different methods:

I. Graphically, using tail to tip method
II. Graphically, using the parallelogram rule
III. Using component addition
IV. Calculate the magnitude and direction of **E**

Ex = -5 + 4
-1

Ey = -5 + 3
-2

|E| = √(1*1+2*2)
√(5)

Oe = tan(-2/-1)
=

ANSWER: $|\mathbf{E}| =$ 2.24 $\theta_E =$ 243.43

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PHYS 111 W20 Class 2
INDIVIDUAL WORKSHEET 1

TOPIC:

VELOCITIES

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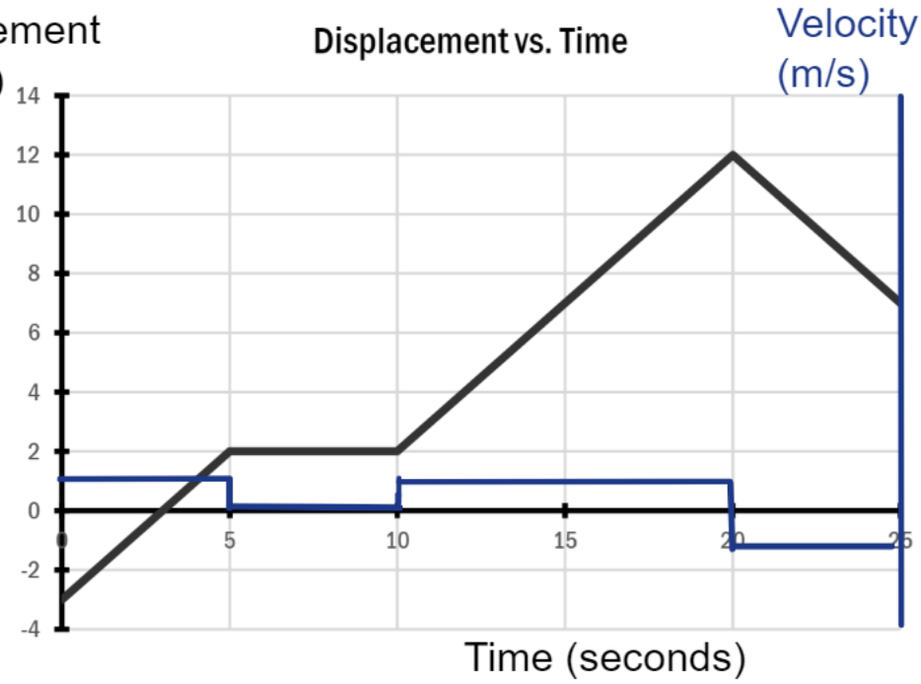
OVERVIEW: **Average Velocity** and **Instantaneous Velocity** are related to change in position (displacement x) and change in time.

In the following 1D examples, write down all of the relevant parameters (ex. x_i, x_f, t_i, t_f, Δt), state the appropriate equation using **symbols** at first. Include numbers only when the final equation has been derived!

Question 1: Label the axes



Question 2: Calculate the **average velocity between 5 and 10 seconds**

$x_i = 2 \quad x_f = 2 \quad \Delta t = 5$

$\bar{v} =$ (xf-xi)/t (no numbers)

$=$ (2-2)/5 (numbers)

$=$ 0 m/s (answer + units)

Question 3: Calculate the **instantaneous velocity at t = 15 s**

$v =$ Δx/Δt (no numbers)

$=$ 10/10 (numbers)

$=$ 1 m/s (answer + units)

Question 4: Calculate the **magnitude of the average velocity between 20 and 25 seconds**

$|\bar{v}| =$ 5/5 = 1 m/s

Question 5: How does the direction of this average velocity compare with that between 15 and 20 seconds?

ANSWER: Opposite

Question 6: What is the characteristic of the graph behaviour which determines the direction?

ANSWER: Negitive/Positive Slope

Question 7: Compare the instantaneous velocity at 15 s and the average velocity between 10 and 20 s.

ANSWER: Equal as slope is constant

Question 8: What can you say about the instantaneous velocity between 10 and 20 seconds?

ANSWER: All Equal

Question 9: Label the right hand axis of the graph as velocity, and decide on an appropriate scale. Show on the graph an instantaneous velocity vs. time (v vs. t) graph.

Question 10: What is the total path travelled between 0-25s, and how is this different than the displacement from 0-25s?

ANSWER: Path = 17, Displacement = 7

Question 11: Calculate the average speed ($\bar{s}$) between 0 and 25 s.

$|\bar{s}| =$ 17/25 = 0.68 m/s

Question 12: By inspection, what is the average velocity between 15 and 25 seconds?

$|\bar{v}| =$ 0 m/s

PHYS 111 W20 Class 2
INDIVIDUAL WORKSHEET 2

TOPIC:
1D KINEMATICS

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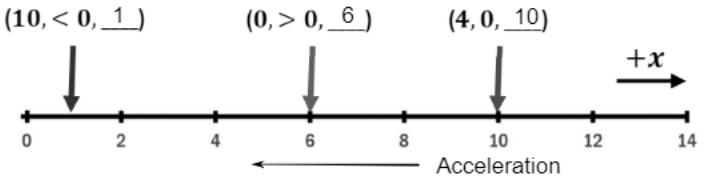
OVERVIEW: The main kinematic equations are as follows:

(1) $v = v_o + at$ (2) $\Delta x = v_0 t + \frac{1}{2}at^2$ (3) $v^2 = v_0^2 + 2a\Delta x$ (4) $\Delta x = \frac{v_0+v}{2}t$

The 3 arrows below indicate snapshots of an object's motion with constant acceleration. There are three coordinates (t, v, x) with time, velocity and position indicated. Not all information is available. Your goal is to work through the problems to solve unknowns.



Question 1: Add the x-coordinate to each bracket.

Question 2: At $t = 0$, what is the sign of v_0? **ANSWER**: +

Question 3: Is constant acceleration +ve or -ve? **ANSWER**: -ve

Question 4: Indicate the direction of acceleration on the diagram.

Question 5: What is the sign of Δx at t = 4s? **ANSWER**: +

Question 6: What is Δx at t = 0s, 4s and 10s?

ANSWER: $[t_0 =$ 0s $, \Delta x_0 =$ 0 $]$

$[t_4 =$ 4s $, \Delta x_4 =$ 4 $]$

$[t_{10} =$ 10s $, \Delta x_{10} =$ -5 $]$

Question 7: Write down a kinematic equation which can give v_0 from the information given.

ANSWER: Δx = (v0+v1)/2 * t

Question 8: Rearrange the equation to given an equation for the initial velocity (don't use any numbers!).

ANSWER: $v_0 =$ 2Δx/t - V1

Question 9: Choose one of the position-time coordinates and write down the properties and numerical values which can be used to solve the equation.

ANSWER: $t =$ 0s , 6m = 4s , 10m = N/A?

Question 10: Use it to determine the initial velocity. First put the numbers into the equation, then evaluate numerically with units.

ANSWER: $v_0 =$ 4*2/4 - 0, 2m/s

Question 11: Write down a kinematic equation which can be used to determine the acceleration of the object from information available.

ANSWER: v = v0 + at

Question 12: Rearrange the equation to make an equation which gives acceleration. Then determine magnitude and direction of acceleration.

ANSWER: $a =$ (v-v0)/t = -2/4 = -0.5m/s^2

Question 13: Write down a kinematics equation which can determine v from the information known

ANSWER: v = v0 + at

Question 14: Use this equation to calculate the velocity at t = 8s, 10s and 12s.

ANSWER: $v_{8s} =$ -2

$v_{10s} =$ -3

$v_{12s} =$ -4

Question 15: Determine the position at t = 8s using the same approach as above.

ANSWER: 2-2/2 *t = 0, so 6m

Question 16: Add the information to the diagram.

Question 17: Sketch a displacement vs. time graph below.

Displacement over time: