Name: _____

Class: _____

Due Date: _____

Physics Topic 1F Math – Scalars and Vectors

Part 1: Define the following terms. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. Magnitude

2. Scalar

3. Vector (What is the symbol for a vector?)

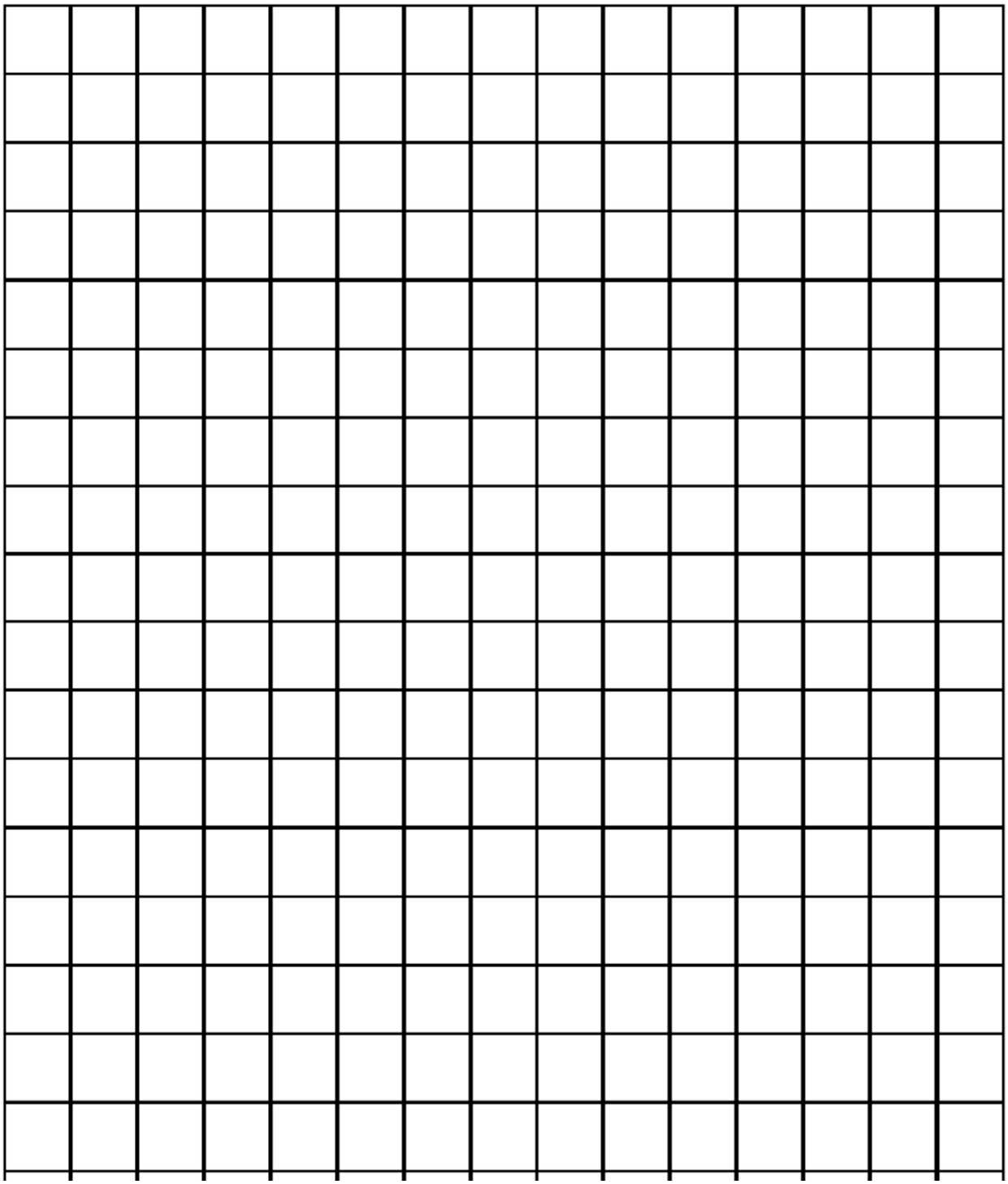
Part 2: Determine if the following quantities are *scalars* or *vectors*. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. Money	32. Specific heat capacity
2. Perimeter	33. Latent heat of fusion
3. Circumference	34. Luminosity
4. Area	35. Brightness
5. Volume	36. Emissivity
6. Angle	37. Albedo
7. Time	38. Pressure
8. Length	39. Moles
9. Distance	40. Entropy
10. Displacement	41. Charge
11. Speed	42. Current
12. Velocity	43. Voltage
13. Acceleration	44. Resistance
14. Force	45. Capacitance
15. Linear momentum	46. Electromotive force
16. Impulse	47. Wavelength
17. Work	48. Period
18. Calories	49. Frequency
19. Energy	50. Gravitational field strength
20. Kinetic energy	51. Gravitational potential
21. Potential energy	52. Electric field strength
22. Power	53. Electric Potential
23. Energy density	54. Magnetic field strength
24. Specific energy	55. Magnetic flux
25. Angular speed	56. Activity
26. Angular acceleration	57. Half-life
27. Moment of inertia	
28. Torque	
29. Angular momentum	
30. Density	
31. Temperature	

Part 3: Drawing vectors. Use a pencil and ruler! The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. Let the vectors $\vec{A} = (x_1, y_1) = (3, -2)$ and $\vec{B} = (x_2, y_2) = (-1,4)$

   a. Draw a horizontal and vertical axis on the graph below. Label the horizontal axis x and the vertical axis y.
   b. Draw $\vec{A}$ on the graph below.
   c. What is the magnitude of the horizontal component of $\vec{A}$?
   d. What is the magnitude of the vertical component of $\vec{A}$?
   e. What is the magnitude of $\vec{A}$?
   f. Draw $\vec{B}$ on the graph below.
   g. What is $\vec{A} + \vec{B}$? Draw it on the graph below.
   h. What is the magnitude of the horizontal component of $\vec{A} + \vec{B}$?
   i. What is the magnitude of the vertical component of $\vec{A} + \vec{B}$?
   j. What is the magnitude of $\vec{A} + \vec{B}$?
   k. What is $\vec{B} + \vec{A}$? Draw it on the graph below.
   l. What is $\vec{A} - \vec{B}$? Draw it on the graph below.
   m. What is $\vec{B} - \vec{A}$? Draw it on the graph below.
   n. What is $-\vec{A} - \vec{B}$? Draw it on the graph below.
   o. What is $-\vec{B} - \vec{A}$? Draw it on the graph below.



Part 4: Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

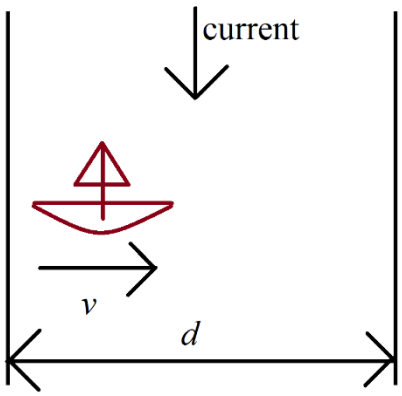
1. E: The classic "boat crossing a river" problem: Adam is on a boat. It is moving from south to north on a river at a speed of 9.00 m/s. The water in the river is moving from east to west with a speed of 4.00 m/s. The river is 81.0 m wide.

   a. Draw a figure.
   b. How long will it take for the boat to reach the other side?
   c. How many meters will the boat have traveled westward?
   d. What will be the total displacement of the boat?

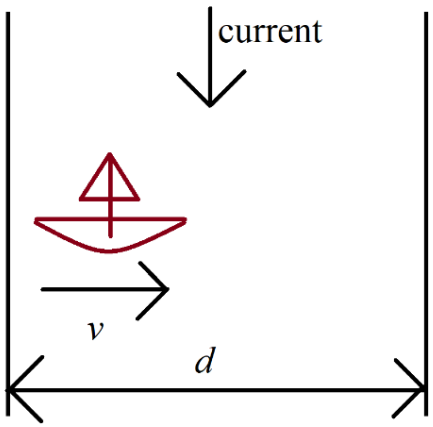
2. E: The classic “boat crossing a river” problem: Enoch is on a boat. It is moving from north to south on a river at a speed of 6.00 m/s. The water in the river is moving from west to east with a speed of 3.00 m/s. The river is 99.0 m wide.

    a. Draw a figure.
    b. How long will it take for the boat to reach the other side?
    c. How many meters will the boat have traveled eastward?
    d. What will be the total displacement of the boat?

3. E: A boat heads directly across a stream, which has a current of 4.00 m/s and which is 650 m wide. The boat has a speed of 9.00 m/s when it travels in still water. What will be the displacement (both direction and magnitude) of this boat when it reaches the opposite shore?



4. E: A boat, which has a speed of 9.00 m/s in still water, would like to reach a point on the shore directly across a river to the east. The river has a current of 3.50 m/s downstream and the river is 550. meters wide.



a. In which direction should the boat be aimed in order for the boat to head directly across the river?

b. How long will it take the boat to reach the opposite shore?

5. E: An airplane, which has an air speed of 235 mph, heads directly west. The wind, in turn, is blowing due south with a velocity of 45.0 mph. What will be the velocity of this airplane as measured by an observer on the ground?

6. E: An airplane, which has an air speed of 575 km/h, heads directly east. The wind is blowing with a velocity of 82.0 km/h on a heading of 35.0° west of south. What will be the resulting velocity of this airplane as measured from the ground?

7. E: In order for an airliner to arrive at its destination on time it must travel due west with a velocity of 475 mph. However, the wind is blowing due south with a velocity of 65.0 mph. What should the air speed and heading of this airplane be in order for this airplane to arrive at its destination on time?

8. E: In order for an airplane to arrive at its destination on time it must fly with a velocity of 985 km/h and a heading of 35.0° east of north. However, the wind is blowing with a velocity of 155 km/h on a heading of 12.0° south of east. With what velocity should the airplane fly in order to arrive at its destination on time?