



## Grade 7/8 Math Circles

March 27/28/29/30, 2023

### Vectors - Problem Set

1. Determine whether the following are scalar or vector quantities.

- a) A car travelling 100 km/h northeast
- b) A 5 kg weight
- c) A 1 km walk to the park
- d) The force of gravity pulling you in a downwards direction
- e) A car accelerating at a rate of  $2 \text{ m/s}^2$  south
- f) Finishing a sprint in 15 seconds

2. Draw the following vectors on the Cartesian plane.

a)  $\vec{v} = \begin{bmatrix} 2 \\ 8 \end{bmatrix}$

b)  $\vec{u} = \begin{bmatrix} 0 \\ -5 \end{bmatrix}$

c)  $\vec{s} = \begin{bmatrix} -4 \\ -1 \end{bmatrix}$

d)  $\vec{t} = \begin{bmatrix} 6 \\ 0 \end{bmatrix}$

e)  $\vec{p} = \begin{bmatrix} -5 \\ 10 \end{bmatrix}$

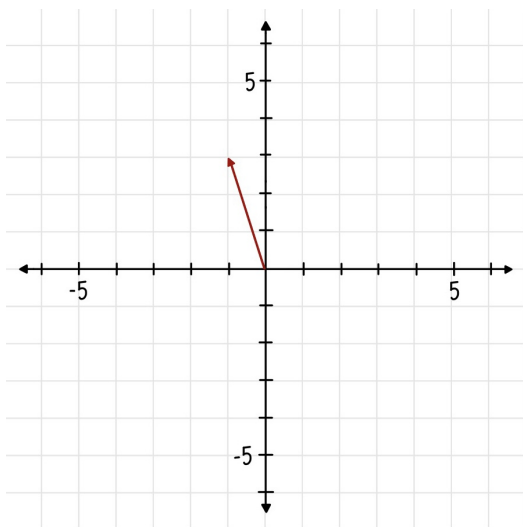
3. Find the magnitude of each vector. Approximate answers to 2 decimal places.

a)  $\begin{bmatrix} 1 \\ 7 \end{bmatrix}$

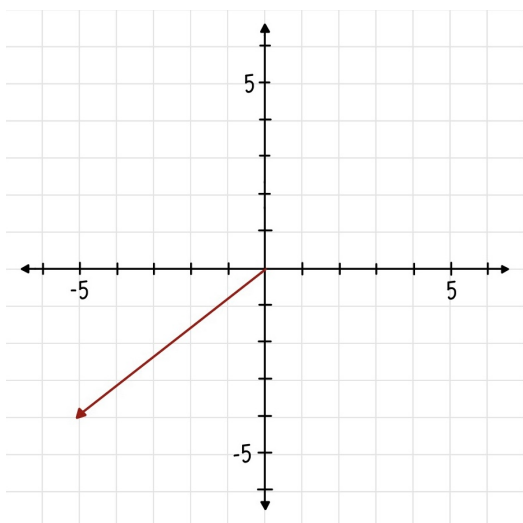
b)  $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$

c)  $\begin{bmatrix} 5 \\ -12 \end{bmatrix}$

d)



e)



4. Find  $x$  and  $y$  in the following vector equations.

a) 
$$\begin{bmatrix} x \\ y \end{bmatrix} = 12 \begin{bmatrix} 1 \\ 2 \end{bmatrix} + 3 \begin{bmatrix} -4 \\ 6 \end{bmatrix}$$

b) 
$$\begin{bmatrix} -8 \\ -12 \end{bmatrix} = -4 \begin{bmatrix} 3 \\ 6 \end{bmatrix} + 2 \begin{bmatrix} x \\ y \end{bmatrix}$$

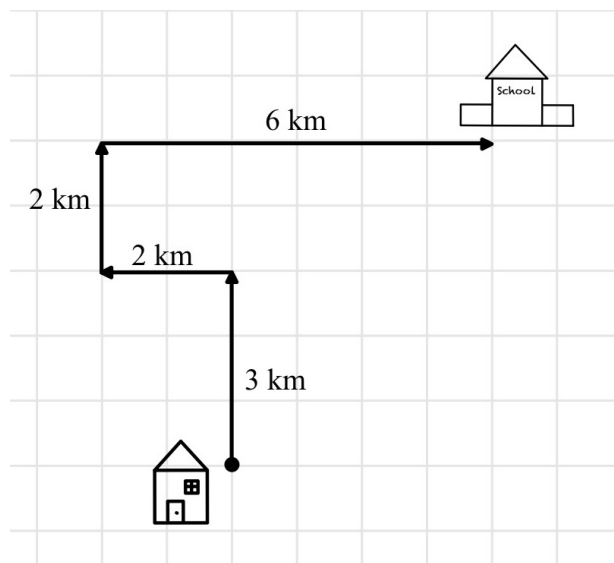
c) 
$$\begin{bmatrix} x \\ y \end{bmatrix} = -3 \begin{bmatrix} -8 \\ -7 \end{bmatrix} - 2 \begin{bmatrix} 11 \\ 3 \end{bmatrix}$$

d) 
$$\begin{bmatrix} 0 \\ 0 \end{bmatrix} = 2 \begin{bmatrix} x \\ y \end{bmatrix} - 4 \begin{bmatrix} -4 \\ 2 \end{bmatrix}$$



## Word Problems

5. Look at the following route that Fibonacci takes to get to school. How far is his house from his school? What direction is his school from his house?



6. A motorboat has a speed of 30 km/h in still water. When it moves in the opposite direction of the current, it has a speed of 26 km/h. What is the speed of the current?
7. Euclid takes the following path to get to his favourite restaurant.
- 5 km west
  - 4 km north
  - 9 km east
  - 3 km north
  - 2 km south

Find the distance from Euclid's starting point to the restaurant and state the general direction from Euclid's starting point to the restaurant.

**Optional Challenge:** Find the angle between the  $x$ -axis and the direct path from Euclid's starting point to the restaurant (hint: trigonometry will come in handy here).