

Name \_\_\_\_\_

Accelerated Pre-Calculus

Period TASK: Walking & Flying Around Hogsmeade

Name: \_\_\_\_\_

Period: \_\_\_\_\_

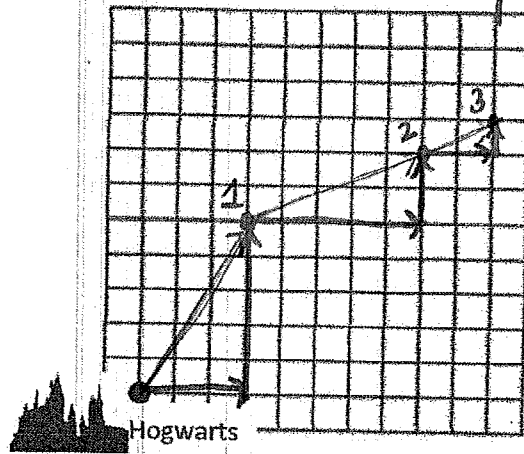


Harry Potter needs to make a few stops around Hogsmeade. Harry's broom is broken, so he must walk between the buildings. The town is laid out in square blocks, which makes it easy to give directions. Here are the directions Harry must follow Monday:

Monday - Start at Hogwarts		
	East/West	North/South
Stop 1 The 3 Broomsticks	3 blocks East	5 blocks North
Stop 2 Honeydukes	5 blocks East	2 blocks North
Stop 3 Gladrags	2 blocks East	1 block North

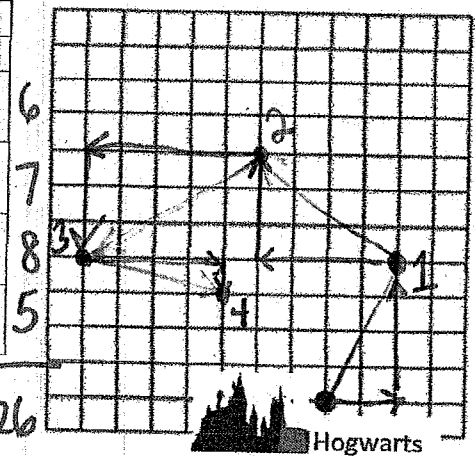
8  $\sqrt{34}$   
7  $\sqrt{29}$   
3  $\sqrt{5}$   
T 18 blocks

1. Draw the route of Harry's trip on the grid below.
2. Label each of Harry's stops.
3. Complete the chart above calculating Harry's total trek.
4. How would Harry's trip through Hogsmeade change if he was able to ride his broom to his three stops? If this would make a different route for Harry, draw this new route in a different color.



On Tuesday, Harry has more errands to run. When he is done, he will meet Ron at the Shrieking Shack, found 3 blocks West and 3 blocks North of Hogwarts. His directions for the first 3 stops are listed in the chart below. Draw the route of Harry's trip on the grid. Use the graph to determine his path to the Shrieking Shack. Calculate the totals for Harry's trip.

Tuesday - Start at Hogwarts		
	East/West	North/South
Stop 1 Zonko's Joke Shop	2 blocks East	4 blocks North
Stop 2 Scrivenshaft's	4 blocks West (or -4 blocks East)	3 blocks North
Stop 3 Dervish and Bangs	5 blocks West (or -5 blocks East)	3 blocks South (or -3 blocks North)
Stop 4 Shrieking Shack	<u>4</u> blocks <u>E</u>	<u>1</u> blocks <u>S</u>

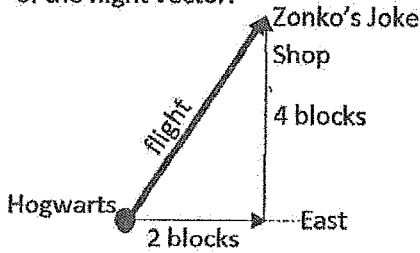


6  
7  
8  
5  
T 26 blocks  
2 $\sqrt{5}$   
5  
 $\sqrt{34}$   
 $\sqrt{17}$

Name \_\_\_\_\_

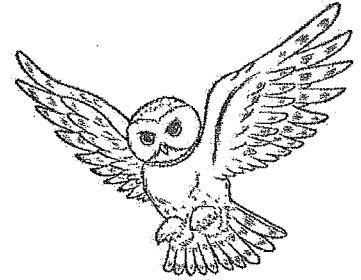
Harry's trusted owl, Hedwig, can fly over buildings, so she travels in a straight line from each stop to the next and waits for Harry to arrive. On Tuesday's graph, use a different color to draw arrows representing Hedwig's path.

How far did Hedwig fly to get to Stop 1 on Tuesday? This is known as the **magnitude** of the flight vector.



$$\sqrt{2^2 + 4^2}$$

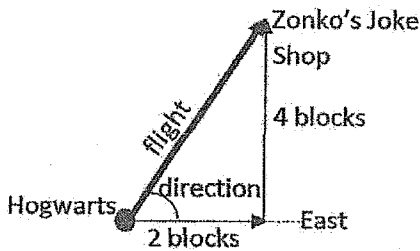
$$2\sqrt{5} \text{ blocks}$$



There are several ways to describe Hedwig's direction during this leg of the trip. We could simply say she traveled "north-east", but this would not be precisely accurate or an exact description. Why not?

NE is considered  $45^\circ$  or  $6/4 \ 0^\circ \frac{1}{2} \ 90^\circ$ ; either way it's not accurate or precise

For **vectors**, we include an angle, often measured in **standard position**, to indicate the **direction**. Use **inverse trigonometry** to find the direction of Hedwig's flight from Hogwarts to Tuesday's first stop.

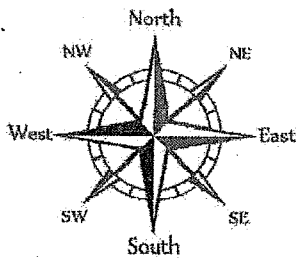


$$\theta = \tan^{-1}(2)$$

$$\theta = 63.4^\circ$$

Next stop: Scrivenshaft's. We might say that Hedwig flew north-west, but it would not be an exact description. What is the possible range of values for all angles measured in **standard position** that are generally pointing to the north-west? What is the value for an angle pointing precisely to north-west?

$$90^\circ < \theta < 180^\circ \quad \text{NW} = 135^\circ$$

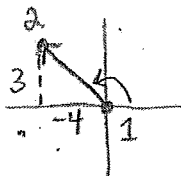


Find the **magnitude** (distance) and **direction** of Hedwig's path from Stop 1 to Stop 2 on Tuesday. Show work. CAUTION: The angle must be measured in **standard position**, meaning it opens counter-clockwise and is measured from the positive x-axis. The direction is NOT an acute angle measure!

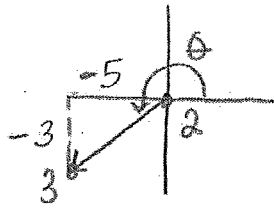
magnitude = 5

$$\theta = \tan^{-1}\left(\frac{3}{-4}\right) = -36.870 + 180^\circ$$

$$\approx 143.130^\circ$$



Find the **magnitude** (distance) and **direction** of Hedwig's path from Stop 2 to Stop 3 on Tuesday. Show work.

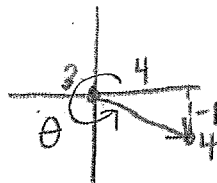


$$\text{magnitude} = \sqrt{5^2 + 3^2} = \sqrt{34} \text{ blocks}$$

$$\theta = \tan^{-1}\left(\frac{-3}{-5}\right) = 30.964 + 180$$

$$\approx 210.964^\circ$$

Find the **magnitude** (distance) and **direction** of Hedwig's path from Stop 3 to Stop 4 on Tuesday. Show work.



$$\text{magnitude} = \sqrt{4^2 + (-1)^2} = \sqrt{17} \text{ blocks}$$

$$\theta = \tan^{-1}\left(-\frac{1}{4}\right) = -14.036 + 360$$

$$= 345.964^\circ$$



Ron sets out from Hogwarts to the Shrieking Shack to meet Harry. What directions does he take for the shortest path that follows the town's square blocks?

3 West, 3 North

How does this route compare to the **overall displacement** of Harry during his errands on Tuesday?

They are the same.

The way we have expressed Harry's routes is known as **component form**, since it is made up of two parts, or components, that describe the changes in the horizontal direction and in the vertical direction. The way we have expressed Hedwig's path is known as **magnitude-direction form**, since it gives the distance directly to each stop and the angle measurement for the direction of the flight path.

It is important to be able to convert from one form to another. Practice this skill by filling in the table for Harry's route on Wednesday. Use the Pythagorean Theorem, trigonometry, and inverse trigonometry. Leaving the point (Hogwarts), draw Harry's path as horizontal and vertical components and Hedwig's path as a direct flight to the destination. Remember to include units.

Hint: create reference triangles! Remember, the angle for Hedwig's direction is measured in standard position.

Wednesday – Start at Hogwarts					
	Harry's description		Hedwig's description		
	Horizontal	Vertical	Magnitude	Direction	Drawing
a.	6 blocks East	3 blocks North	$\sqrt{6^2 + 3^2}$ 3√5 blocks	$\theta = \tan^{-1}(\frac{3}{6})$ $\theta = 26.565^\circ$	
b.	$\cos 113 = \frac{x}{16}$ 16 cos 113 6.252 blocks West	$\sin 113 = \frac{y}{16}$ 16 sin 113 14.728 blocks North	16 blocks	113°	
c.	2 blocks West	6 blocks South	$\sqrt{6^2 + 2^2}$ $= 2\sqrt{10}$ blocks	$\theta = \tan^{-1}(\frac{-6}{-2})$ $= 71.565$ $+180$ $= 251.565^\circ$	
d.	10 cos 315 $5\sqrt{2} \approx 7.071$ blocks East	10 sin 315 $-5\sqrt{2} = -7.071$ 7.071 blocks South	10 blocks	315°	

**Challenge:** Thursday, Harry followed these directions through town: 2 blocks East, 5 blocks South, 1 block East, 3 blocks North, 4 blocks West, 2 blocks North, 3 blocks East, 1 block North, 3 blocks West, and 5 blocks South. If Ron wants to walk to Harry's final destination, what route should he take for the shortest trip?

Horizontal =  $2 + 1 - 4 + 3 - 3 = -1$       one block West and 4 blocks South  
Vertical =  $-5 + 3 + 2 + 1 - 5 = -4$

Hedwig flies from Hogwarts directly to Harry's final destination. What is the **magnitude** of her flight? What **direction**, measured in **standard position**, does she fly?

mag =  $\sqrt{(-1)^2 + (-4)^2} = \sqrt{17}$  blocks  
 $\theta = \tan^{-1}(\frac{-4}{-1}) = 75.964 + 180$   
 $= 255.964^\circ$