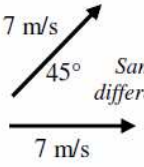
Name: _____

Period: _____

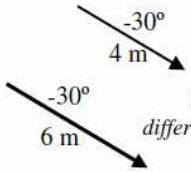
Vector Basics

2.2

We use arrows to represent vectors because vectors have both **magnitude (size)** and **direction (which way it points).**



Same magnitude; different directions.



Same direction; different magnitudes.

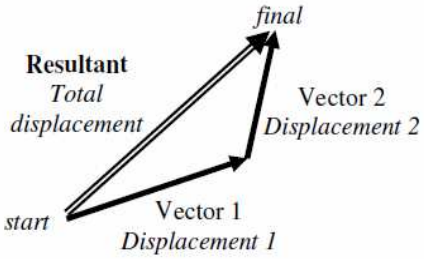
2 kg

*Mass is a **scalar**, which only requires magnitude. You don't need the direction of the mass.*

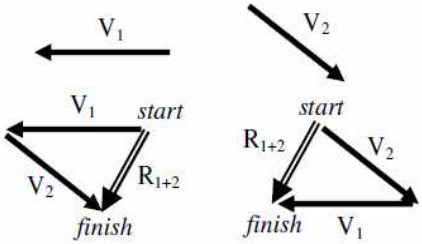
Adding Graphically

The *result* of adding together two or more vectors is called a ***resultant***.

When adding vectors graphically, put the arrows head to tail. The resultant points from start to finish. *In this example your total displacement is the straight line distance between your initial and final position NOT the distance you traveled.*



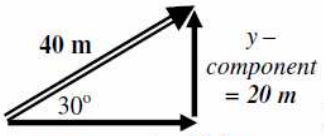
Order doesn't matter when adding vectors. The resultant will be the same.



Different order: same resultant.

Components

The components are the portions of the vector in the x or y direction, like coordinates on a graph.



*y – component = **20 m***

x – component = 34.6 m

$\sin 30° = \frac{y}{40\text{ m}}$

$y = (40\text{m})\sin 30°$

$y = (40\text{m})0.5 = \mathbf{20\text{ m}}$

$\cos 30° = \frac{x}{40\text{ m}}$

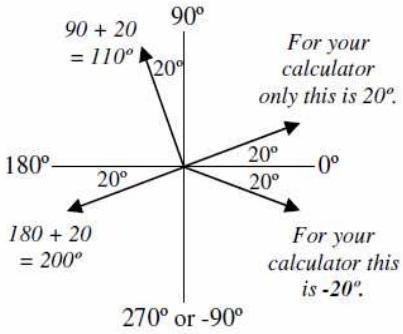
$x = (40\text{m})\cos 30°$

$x = (40\text{m})(.866) = \mathbf{34.6\text{ m}}$

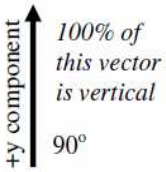
The components tell you that you would have to move 34.6 m in the x-direction and 20 m in the y-direction to move 40 m at 30°

Think directions NOT angles. Your calculator will give you positives and negatives automatically IF you give the calculator correct directions.

These angles are equal (20°), but point in different directions.



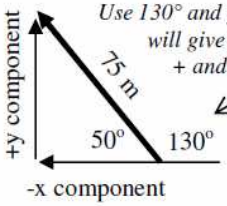
Components can be negative or zero.



100% of this vector is vertical

90°

No x comp.

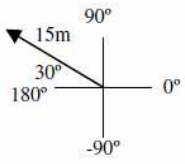


Use 130° and your calculator will give you the correct + and – components.

An example of no x-component: a cat climbs up a tree. The cat doesn't move horizontally, just vertically.

Setting up vectors.

Before you calculate components always find direction of θ, as shown above.



The angle is 30°, but the direction is 150° (180–30).

This vector is 15 m at 150°

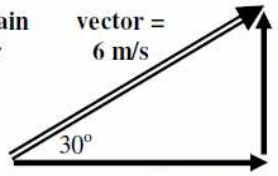
X and Y Components: *Direction of the vector*

X-comp = Hyp.(cosθ) **Y-comp = Hyp.(sinθ)**

Magnitude (length) of the vector

Units

Components retain the units of their vector (*and vice-versa*).



y – component
= 6m/s(sin 30°)
= 3 m/s

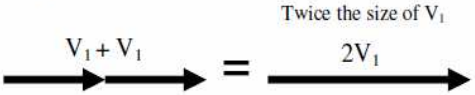
x – component
= 6m/s(cos 30°)
= 5.2 m/s

If the vector was a plane, think of the x-component as a race car trying to stay beneath the plane on the ground. The y-component could be how fast the plane gains altitude.

Math and Vectors

Subtracting vectors: add its opposite (the negative of the vector).

Multiplying vectors: multiply the size of the vector.



1. Resolve	A. The portion of the vector on the x or y axis.
2. Magnitude	B. To find the x– or y-component of a vector.
3. Resultant	C. The size of a vector ("35" of "35 m").
4. Component	D. Tells where a vector is pointing or the angle of the vector.
5. Direction	E. What you find by adding two vectors together.
6. Vector	F. Something that has magnitude and direction.

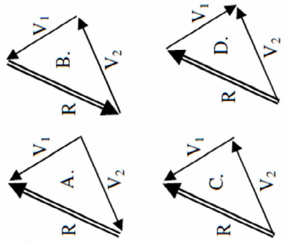
7. In figures A—D, which vectors are added correctly? If wrong, why?

A.

B.

C.

D.



Using the vectors at the right, draw the resultants for the following operations.

8. $V_2 - V_5 =$

9. $2V_2 + V_4 =$

10. $V_3 + 2V_4 - V_5 =$

11. $2V_1 - 2V_4 =$

12. Add $2V_1 + V_4$ mathematically.

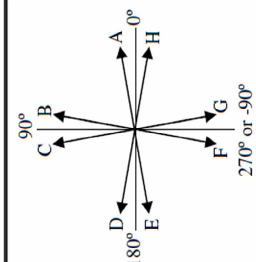
13. If each of the vectors is 10° from the closest axis, determine the directions of each of the vectors.

$\theta_A =$ $\theta_E =$

$\theta_B =$ $\theta_F =$

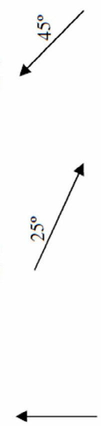
$\theta_C =$ $\theta_G =$

$\theta_D =$ $\theta_H =$



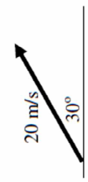
14. Find calculator directions for the following vectors.

A. θ = B. θ = C. θ =

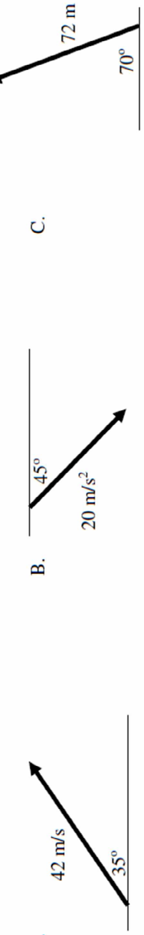


15. A person walks 12 m across a room.
A. What is their horizontal component?
B. What is their vertical component?

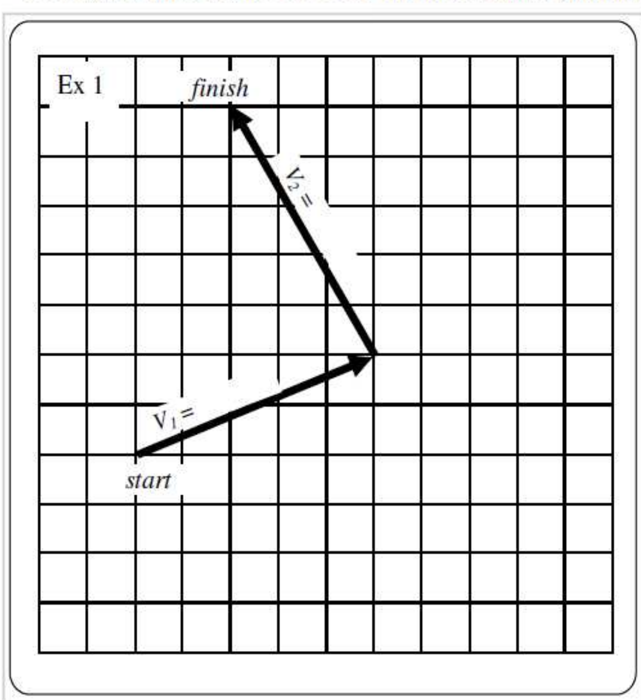
16. Resolve this vector into its components.



17. Resolve these vectors into their components.



Each grid square represents 1 m. In this example, you may count squares.



1. Find the following information for vector 1.
   A. How far does vector 1 move horizontally? (*This is the X-component.*) $X_1 =$
   B. What is the Y-component of vector 1? $Y_2 =$
   C. How long is vector 1? (*Find the magnitude of vector 1.*)

2. Resolve vector 2 into its x and y components. (*Do the same as in #1*)
   A. $X_2 =$
   B. $Y_2 =$
   C. Magnitude of vector 2 =

3. Draw the resultant from the start to the finish (Label it "R").
4. Add together X_1 and $X_2 =$ (this is X_{total})
5. $Y_{total} =$

6. Using X_{total} and Y_{total}, calculate the length of R (*with X_{total} and Y_{total} you have two sides of a right triangle*).