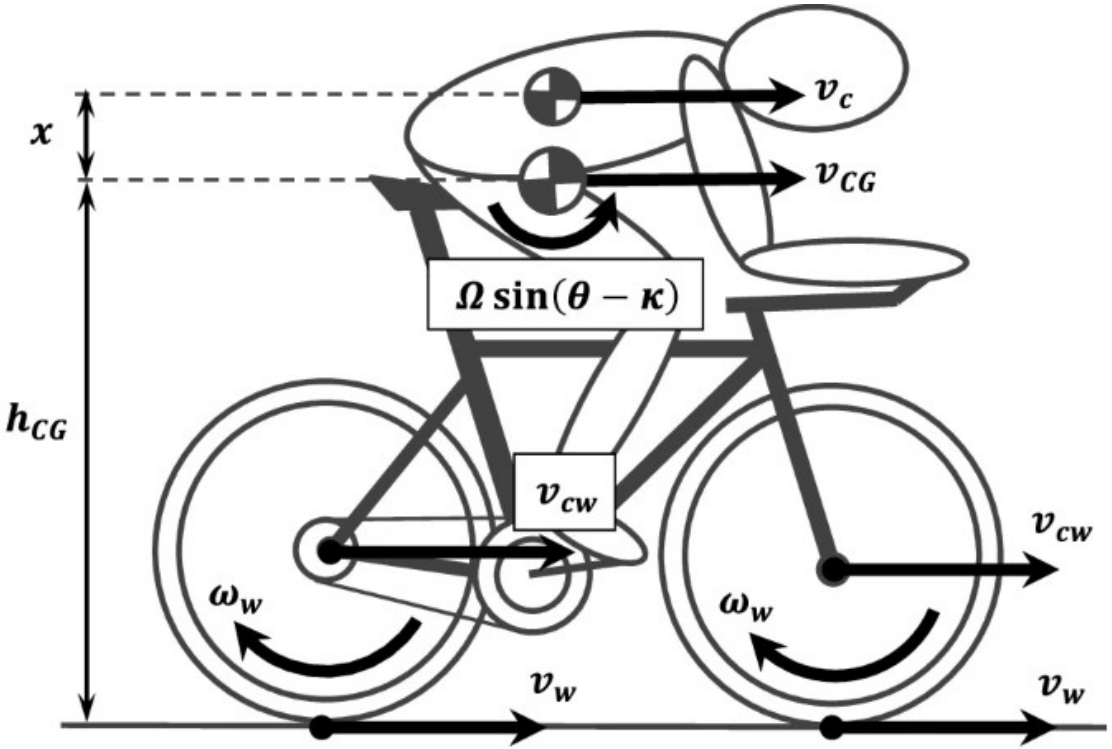
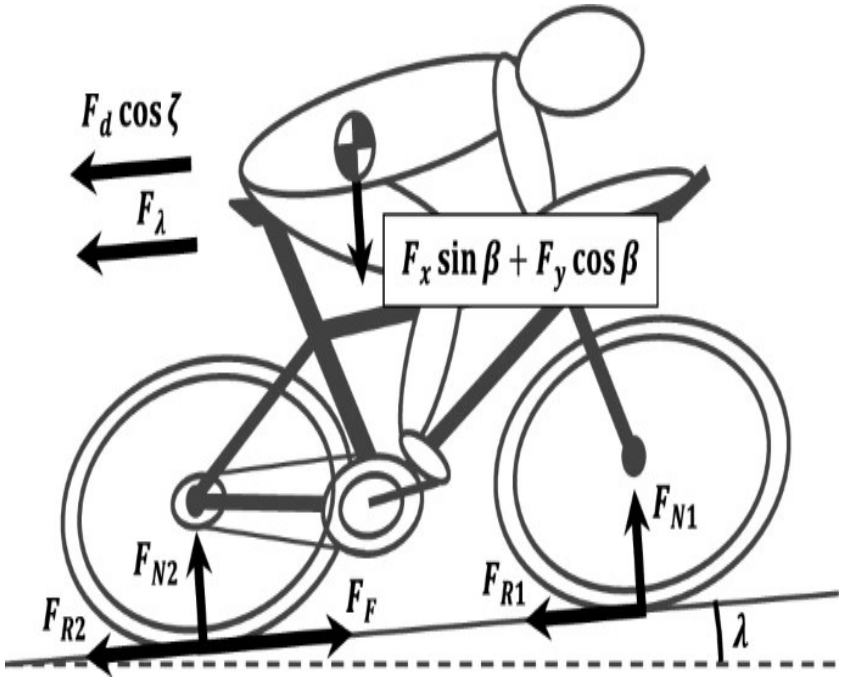

x
h_{CG}
v_c
v_{CG}
$\Omega \sin(\theta - \kappa)$
v_{cw}
v_{cw}
ω_w
ω_w
v_w
v_w

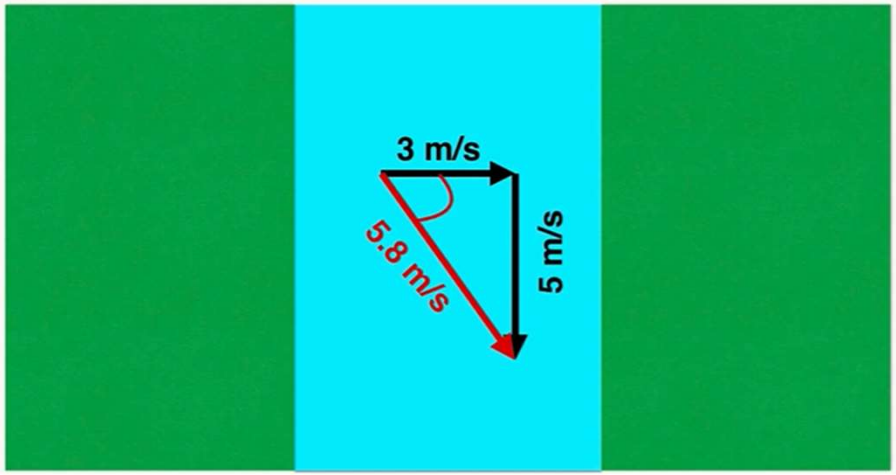

$F_d \cos\zeta$
F_λ
$F_x \sin\beta + F_y \cos\beta$
F_{N1}
F_{N2}
F_{R1}
F_{R2}
F_F
λ

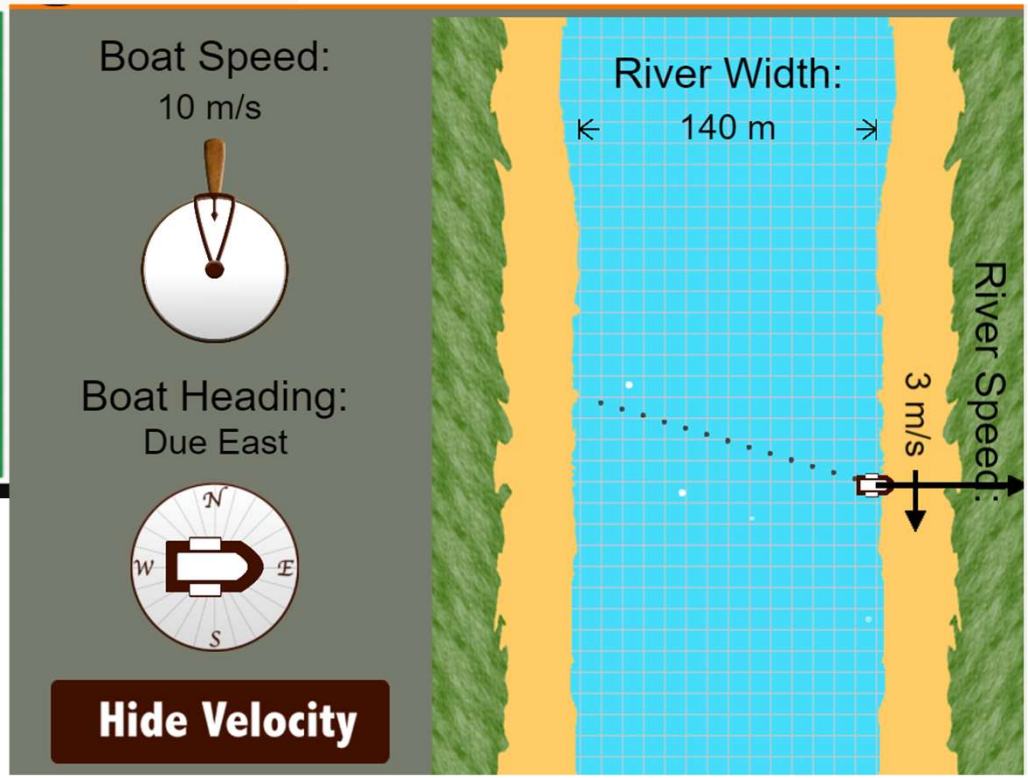
Vectors and scalars are both quantities (amounts of something)

Vectors	Scalars
Have magnitude (size) and direction	Have magnitude (size) and NO direction
Examples:	**Examples:**
(magnitude) (Direction) 5 meters east 	(magnitude) 5 meters 
· Displacement · Force · Velocity · Acceleration · Momentum	· Length · Area · Temperature · Mass · Energy

Finding the Angle of a Vector

Example: You start swimming straight across a river at 3 m/s but the river's current pulls you downstream at 5 m/s. What velocity do you have in total? What direction do you move in?





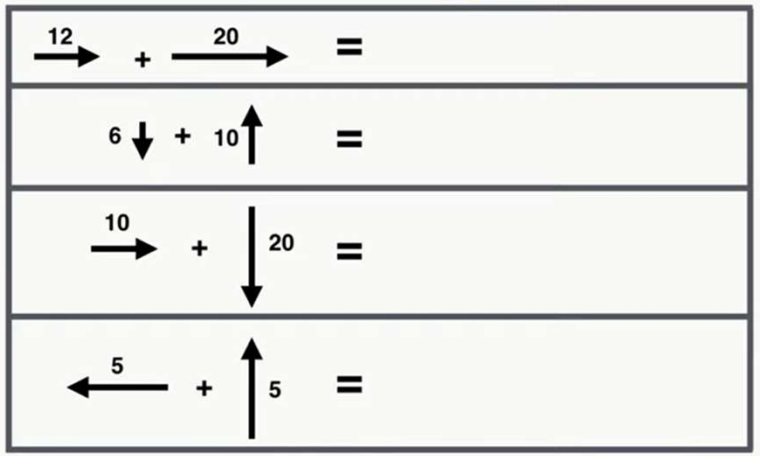
https://www.physicsclassroom.com/Physics-Interactives/Vectors-and-Projectiles/Riverboat-Simulator/Riverboat-Simulator-Interactive

https://www.physicsclassroom.com

Drawing a Vector

Vectors are quantities that have both magnitude (size) and direction. To show their magnitude and direction, we draw vectors as arrows.

Adding Vectors:



Check for understanding

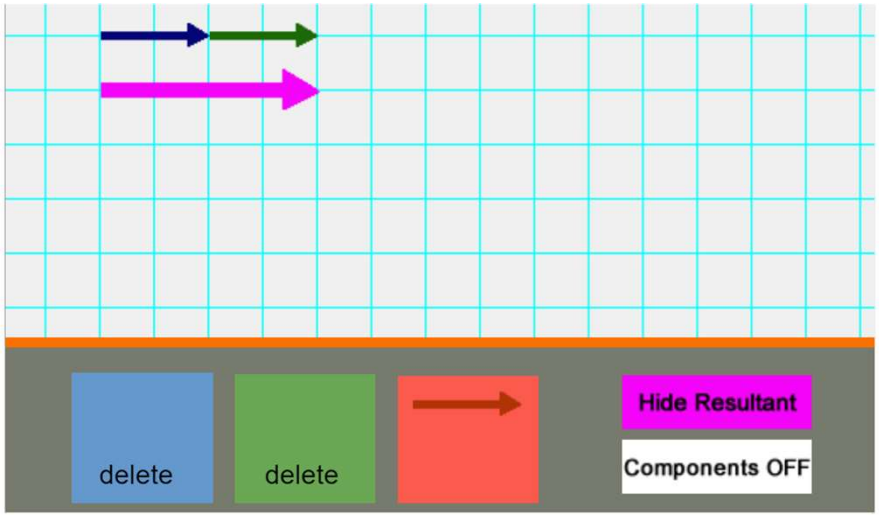
Labeling Vectors

The symbol we use for labeling vectors is a letter with an arrow above it.

$\vec{E}$ = 10 meters

The same letter without an arrow above it means the scalar magnitude of that vector

E = 10 meters

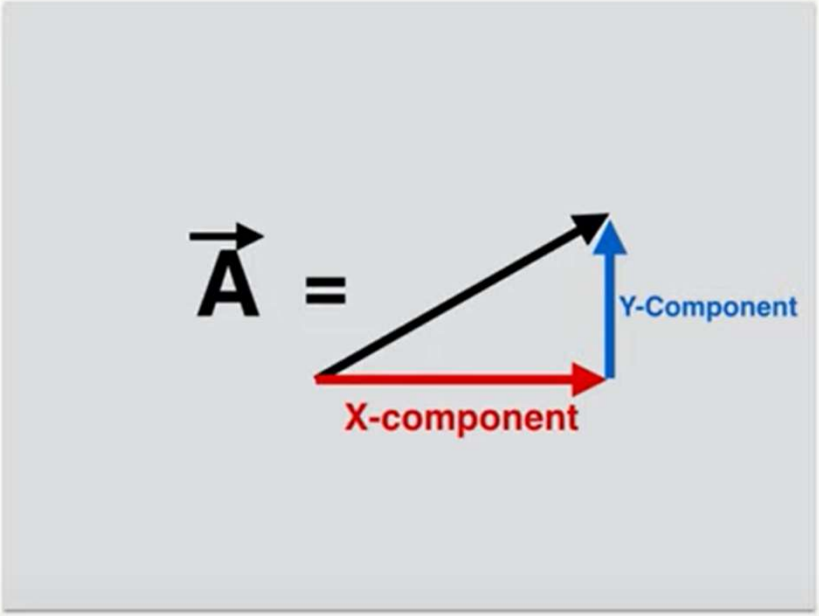


X and Y Components:

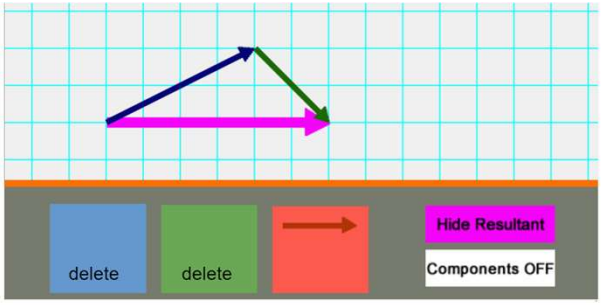
All vectors have an **x-component** and a **y-component**

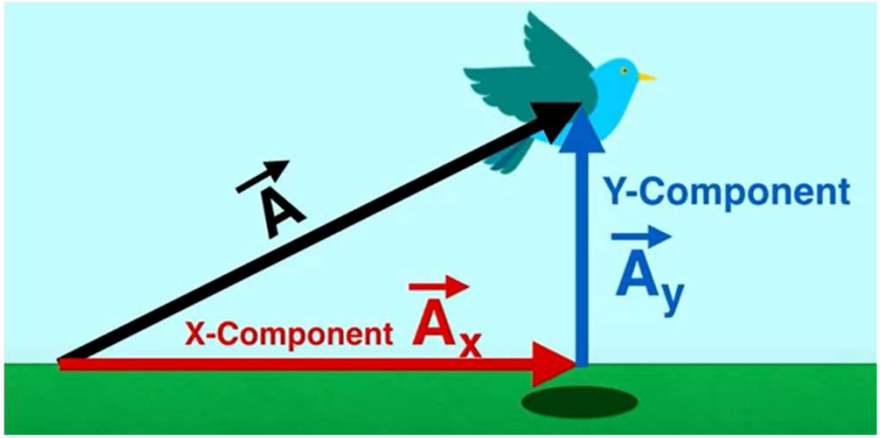
X-component: how far in the horizontal direction the vector travels

Y-Component: how far in the vertical direction the vector travels



https://www.physicsclassroom.com/Physics-Interactives/Vectors-and-Projectiles/Vector-Addition/Vector-Addition-Interactive

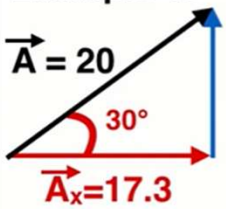




Finding X and Y Components Using Trig

All x and y components form right triangles with the vectors of which they are components, so we can find their values using trig.

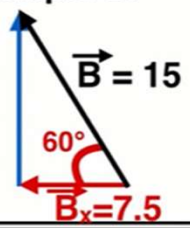
Example 1:



HCos(θ) = A
20Cos(30°) = A
17.3 = A

HSin(θ) = O

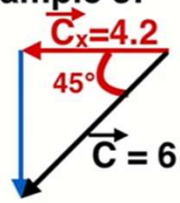
Example 2:



HCos(θ) = A
15Cos(60°) = A
7.5 = A

HSin(θ) = O

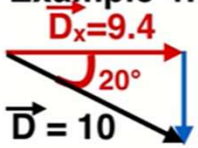
Example 3:



HCos(θ) = A
6Cos(45°) = A
4.2 = A

HSin(θ) = O

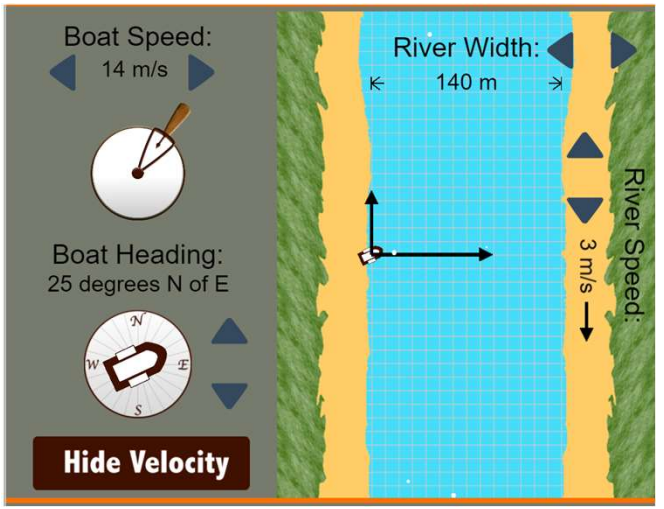
Example 4:



HCos(θ) = A
10Cos(20°) = A
9.4 = A

HSin(θ) = O

https://www.youtube.com/watch?v=GjgHAff_Oio&list=PLeveVE-rwOyLM5yS2-uMLPxKBIffiG8MS&index=6



https://www.physicsclassroom.com/Physics-Interactives/Vectors-and-Projectiles/Riverboat-Simulator/Riverboat-Simulator-Interactive

Finding the Angle of a Vector

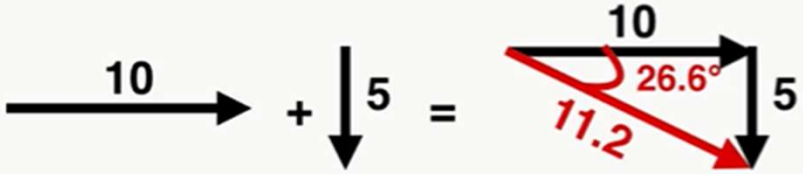
After adding two vectors that point up, down, left, or right together, you need to find the angle. Vectors communicate magnitude AND direction, so the direction of the sum of vectors matters a lot.

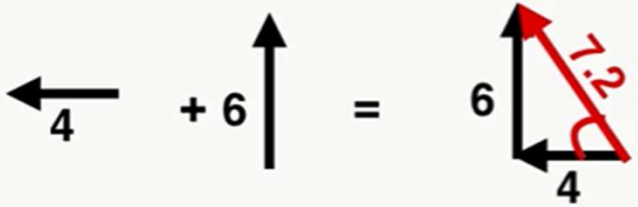
Because the simple vectors we're adding point up, down, left, and right, they form right triangles with their resultants, so we can use trig to find the angles of the vectors.

$$\text{Tan}^{-1}\left(\frac{\text{Opposite}}{\text{Adjacent}}\right) = \theta$$

$$\text{Tan}^{-1}\left(\frac{5}{10}\right) = \theta$$

$$26.6° = \theta$$



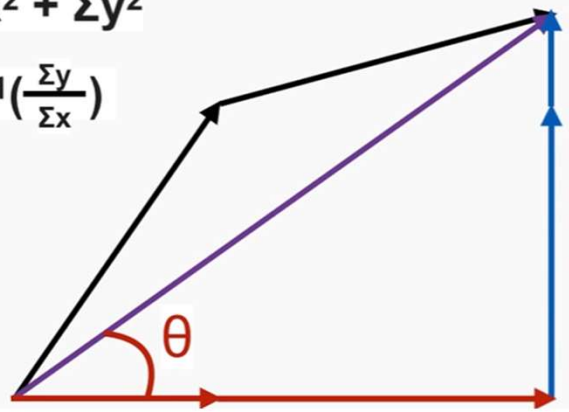


Adding Vectors Using X and Y Components:

$\Sigma x = R_x \quad \Sigma y = R_y$

$R = \sqrt{\Sigma x^2 + \Sigma y^2}$

$\theta = \text{Tan}^{-1}\left(\frac{\Sigma y}{\Sigma x}\right)$



Adding Vectors Using X and Y Components:

$\Sigma x = R_x \quad \Sigma y = R_y$

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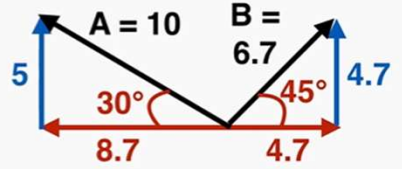


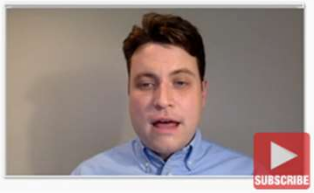
A_x___ A_y___

B_x___ B_y___

Σx___ Σy___

R___

θ___



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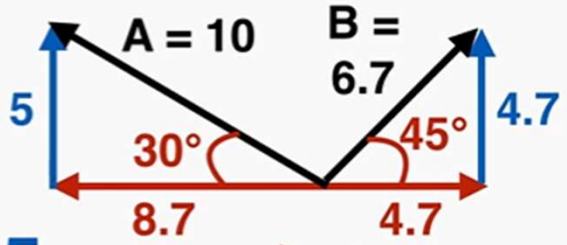
Adding Vectors Using X and Y Components:

$\Sigma x = R_x \quad \Sigma y = R_y$

$R = \sqrt{\Sigma x^2 + \Sigma y^2}$

$\theta = \text{Tan}^{-1}\left(\frac{\Sigma y}{\Sigma x}\right)$



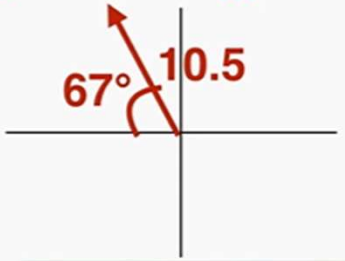
A_x -8.7 A_y 5

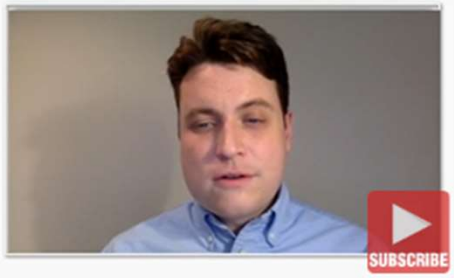
B_x 4.7 B_y 4.7

Σx -4 Σy 9.7

R 10.5

θ 67°





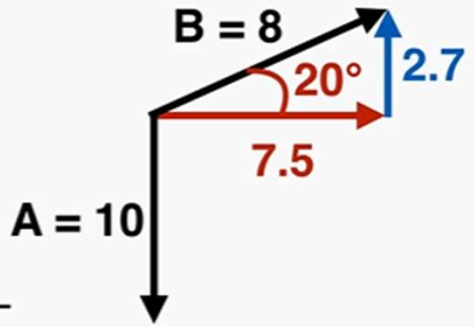
https://www.youtube.com/watch?v=2jv4REHqKI0&list=PLeveVE-rwOyLM5yS2-uMLPxKBIffiG8MS&index=7

Adding Vectors Using X and Y Components:

$\Sigma x = R_x \quad \Sigma y = R_y$

$R = \sqrt{\Sigma x^2 + \Sigma y^2}$

$\theta = \text{Tan}^{-1}\left(\frac{\Sigma y}{\Sigma x}\right)$



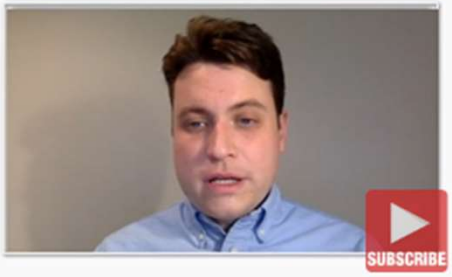
A_x___ A_y___

B_x___ B_y___

Σx___ Σy___

R___

θ___

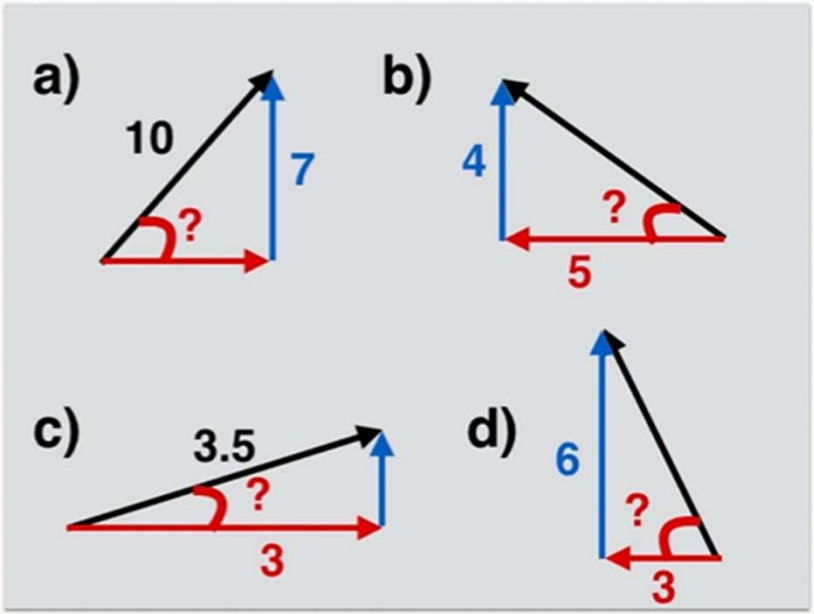


Finding the Angle of a Vector

$$\text{Sin}^{-1}\left(\frac{\text{Length of opposite side}}{\text{Length of hypotenuse}}\right) = \theta$$

$$\text{Cos}^{-1}\left(\frac{\text{Length of adjacent side}}{\text{Length of hypotenuse}}\right) = \theta$$

$$\text{Tan}^{-1}\left(\frac{\text{Length of opposite side}}{\text{Length of adjacent side}}\right) = \theta$$



https://www.youtube.com/watch?v=D_4WG6WO_NE&list=PLeveVE-rwOyLM5yS2-uMLPxKBIffiG8MS&index=4

Fonction trigonométrique	สูตร Excel	Fonction Excel
Sin(x)		=SIN(radians)
Cos(x)		=COS(radians)
Tan(x)		=TAN(radians)
ArcSin(x)		=ASIN(valeur)
arcCos(x)		=ACOS(valeur)
arcTan(x)		=ATAN(valeur)

	A	B	C	D	E	F
48	**Angle(rd.)**	**0**	**π/6**	**π/4**	**π/3**	**π/2**
49	Radians	-	0,5236	0,7854	1,0472	1,5708
50	Degrés	-	30,00	45,00	60,00	90,00
51	Sinus	-	0,5000	0,7071	0,8660	1,0000
52		0	1/2	√2/2	√3/2	1
53	Cosinus	1,0000	0,8660	0,7071	0,5000	0,0000
54		1	√3/2	√2/2	1/2	0
55	Tangente	-	0,5774	1,0000	1,7321	1,63E+16
56		0	√3/3	1	√3	∞

= ROUND(1.10789 ,2) = 1.11

= PI() = 3.14159 >> 180 องศา

= RADIANS(30) = PI()/6

= DEGREES(3.14159) = 180 >>

= SIN(RADIANS(30)) >> SIN (30)

=FORMULATEXT(F7) >> แสดงสูตร

	A	B	C	D	E	F
48	**Angle(rd.)**	**0**	**π/6**	**π/4**	**π/3**	**π/2**
49	Radians	0	=PI()/6	=PI()/4	=PI()/3	=PI()/2
50	Degrés	=DEGRES(B49)	=DEGRES(C49)	=DEGRES(D49)	=DEGRES(E49)	=DEGRES(F49)
51	Sinus	=SIN(B49)	=SIN(C49)	=SIN(D49)	=SIN(E49)	=SIN(F49)
52		0	1/2	√2/2	√3/2	1
53	Cosinus	=COS(B49)	=COS(C49)	=COS(D49)	=COS(E49)	=COS(F49)
54		1	√3/2	√2/2	1/2	0
55	Tangente	=TAN(B49)	=TAN(C49)	=TAN(D49)	=TAN(E49)	=TAN(F49)
56		0	√3/3	1	√3	∞