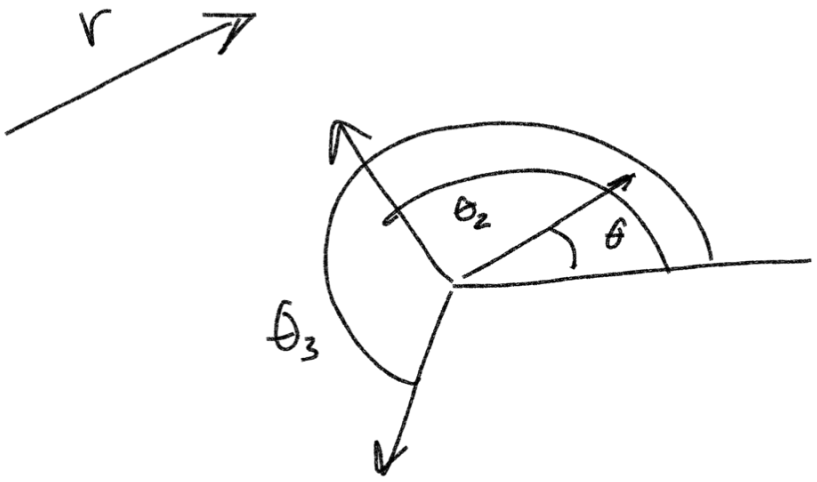
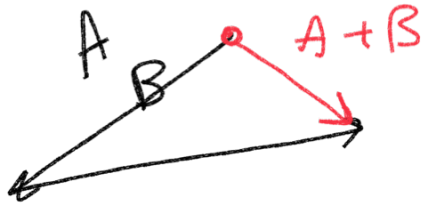
M-CT Calculus & Trigonometry

Vector → magnitude & direction

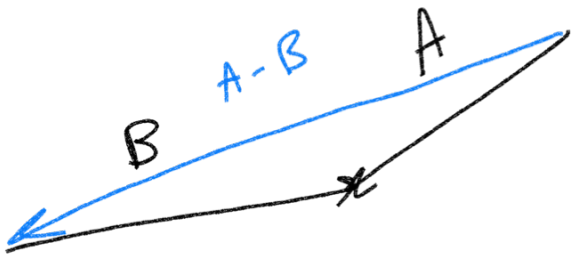
r, θ



A + B



A − B

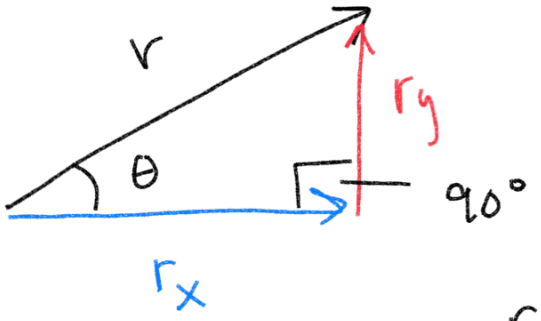


Vectors

X - component

y - component

$$r = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



$$\theta = \tan^{-1}\frac{y}{x}$$

$$r_x = r\cos\theta$$

$$r_y = r\sin\theta$$

$\vec{u} + \vec{v}$

$u: \langle 2, 6 \rangle$

$v: \langle 3, -8 \rangle$

x y

$r: \langle 2+3,\ 6+(-8) \rangle$

$\boxed{\langle 5, -2 \rangle}$

$-\vec{u} + \vec{v}$

$\langle 2, 6 \rangle \quad -u: \langle -2, -6 \rangle$

$\langle -2+3,\ -6+(-8) \rangle$

$\langle 1, -14 \rangle$

x y

$u: \langle 2, 6 \rangle$

$v: \langle 3, -8 \rangle$

$r: \langle 2+3, 6+(-8) \rangle$

$\boxed{\langle 5, -2 \rangle}$

$$r = \sqrt{5^2 + (-2)^2}$$

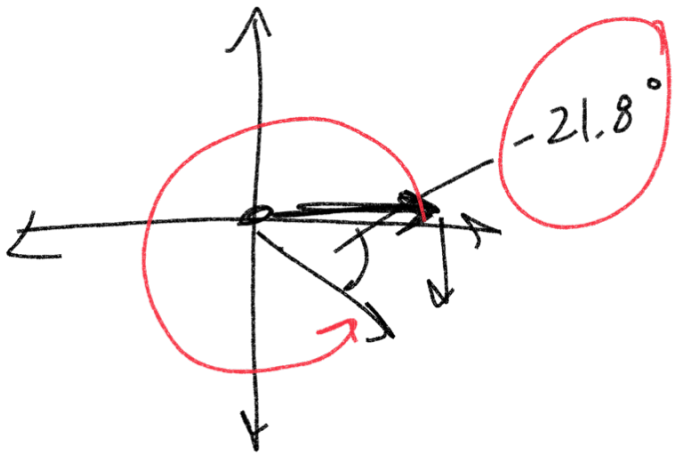
$$\sqrt{25+4} = \sqrt{29} = 5.38$$

$$\theta = \tan^{-1}\left(\frac{-2}{5}\right) = -21.8^\circ$$

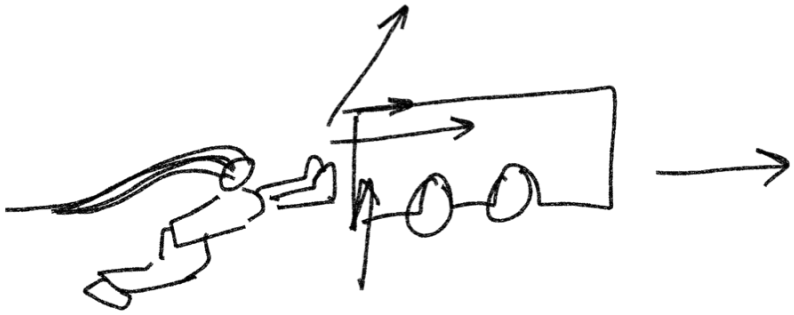
59
+ 360.0
− 21.8

$\boxed{338.2^\circ}$

$(5.38, 338.2^\circ)$
or
-21.8°



$\vec{u} \cdot \vec{v}$ Dot Product



$\vec{u}: \langle 2, 6 \rangle$ $\quad \vec{u} \cdot \vec{v}$

$\vec{v}: \langle 3, -8 \rangle$ $\quad (\vec{u}_x)(\vec{v}_x) + (\vec{v}_y)(\vec{u}_y)$

$(2)(3) + (6)(-8)$

$6 + (-48)$

$\boxed{= -42}$

Angle between two vectors

$$\cos\theta = \frac{u \cdot v}{|u| * |v|} \qquad 0^\circ \longrightarrow 180^\circ$$

$$\theta = \cos^{-1}\left(\frac{u \cdot v}{|u| * |v|}\right)$$

$\vec{u} \cdot \vec{v} = -42$ $\quad \vec{u}: (2, 6)$ $\quad \vec{v}: (3, -8)$

$|\vec{u}| = \sqrt{2^2 + 6^2}$

$\sqrt{4 + 36}$

$\sqrt{40} = 2\sqrt{10}$

$|\vec{v}| = \sqrt{3^2 + (-8)^2}$

$\sqrt{9 + 64}$

$\sqrt{73}$

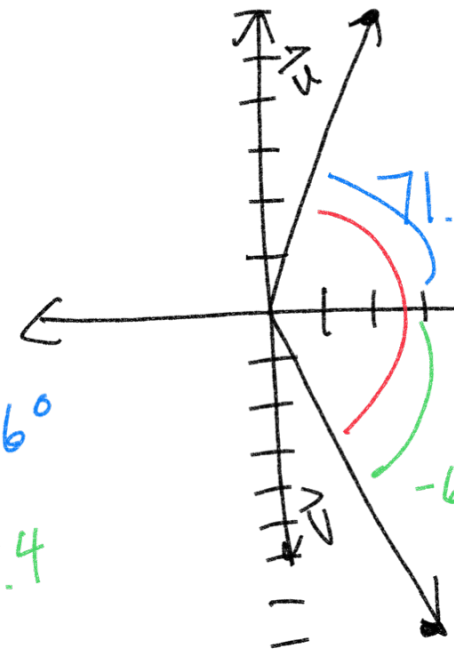
$\theta = \cos^{-1}\left(\frac{-42}{2\sqrt{10} * \sqrt{73}}\right)$,

142.5° ??

$u\ (2, 6)$

$v\ (3, -8)$

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



$\theta_u = \tan^{-1}\left(\frac{6}{2}\right) = 71.6°$

$\theta_v = \tan^{-1}\left(\frac{-8}{3}\right) - 69.4$

$\approx 142.5°$

-69.4

$\approx 71.6° + |-69.4|$

$\approx 141°$