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## Angle Between Two Vectors

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- If  $\theta$  is between two non-zero vectors  $\vec{v}$  and  $\vec{w}$ , then

$$\cos\theta = \frac{\vec{v} \cdot \vec{w}}{\|\vec{v}\| \|\vec{w}\|}$$

← *dot product*

← *product of the magnitudes*

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Examples:

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- Find the angle between ...

$\langle 3, 5 \rangle$  and  $\langle 2, 6 \rangle$        $(6) + (30) = 36$

$\downarrow$                        $\downarrow$                        $\cos\theta = \frac{\vec{v} \cdot \vec{w}}{\|\vec{v}\| \|\vec{w}\|}$

$\sqrt{34}$                    $\sqrt{40}$

$\theta = \cos^{-1}\left(\frac{36}{\sqrt{34}\sqrt{40}}\right) = \cos^{-1}\left(\frac{36}{\sqrt{1360}}\right)$

$\theta = 12.53^\circ$

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Examples:

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- Find the angle between ...

$\langle -2, 4 \rangle$  and  $\langle -1, -3 \rangle$        $(2) + (-12) = -10$

$\downarrow$                        $\downarrow$                        $\cos\theta = \frac{\vec{v} \cdot \vec{w}}{\|\vec{v}\| \|\vec{w}\|}$

$\sqrt{20}$                    $\sqrt{10}$

$\theta = \cos^{-1}\left(\frac{-10}{\sqrt{20}\sqrt{10}}\right) = \cos^{-1}\left(\frac{-10}{\sqrt{200}}\right)$

$\theta = 135^\circ$

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