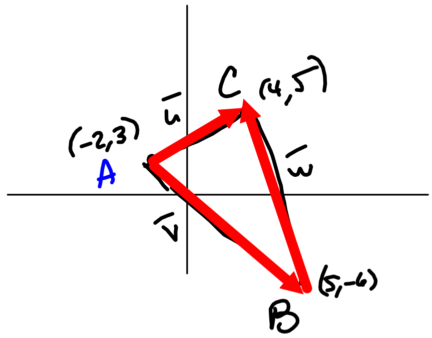
1. **Use vectors to find the interior angles of the triangle with the given vertices.** (to 4 places)

(-2,3), (5, - 6), and (10, 13) = A, B, & C, respectively

$\vec{AC} = \langle 4-(-2), 5-3\rangle = \langle 6,2\rangle = \vec{u}$

$\vec{AB} = \langle 5-(-2), -6-3\rangle = \langle 7,-9\rangle = \vec{v}$

$\vec{BC} = \langle 4-5, -6-5\rangle = \langle -1,-11\rangle = \vec{w}$

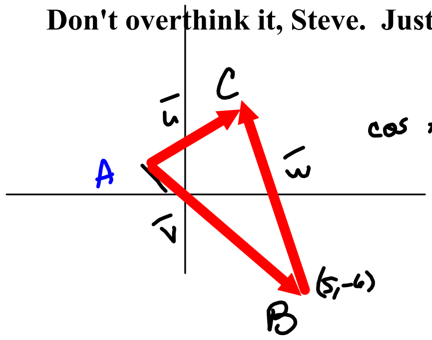


$\|\vec{u}\| = \sqrt{6^2+2^2} = \sqrt{40} = 2\sqrt{10}$

$\|\vec{v}\| = \sqrt{7^2+9^2} = \sqrt{49+81} = \sqrt{130}$

$\|\vec{w}\| = \sqrt{1^2+11^2} = \sqrt{122}$

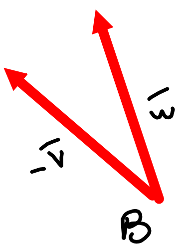
Don't overthink it, Steve. Just put the vectors butt-to-butt to find the angle.



$\cos A = \dfrac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\|\vec{v}\|} = \dfrac{42-18}{\sqrt{40}\sqrt{130}} = \dfrac{24}{\sqrt{40\cdot 130}}$

$\rightarrow A = \arccos\left(\dfrac{24}{\sqrt{5200}}\right) \approx 70.55996515 \approx {}^\circ$

$\boxed{A \approx 7.5600^\circ}$



$\cos B = \dfrac{-\vec{v}\cdot\vec{w}}{\|\vec{v}\|\|\vec{w}\|} = \dfrac{-\langle 7,-9\rangle\cdot\langle -1,11\rangle}{\sqrt{130}\sqrt{122}} = \dfrac{-(-7-99)}{\sqrt{130\cdot 122}} = \dfrac{106}{\sqrt{130\cdot 122}} \approx 32.68055471^\circ$

$\boxed{B \approx 32.6806^\circ}$

$C = 180^\circ - A - B \approx 70.55996515^\circ - 32.68055471^\circ \approx 76.75948009^\circ$

$\rightarrow \boxed{C \approx 76.7595^\circ}$

$\vec{u} = \langle 6,2\rangle$ $\quad 2\sqrt{10} = \|\vec{u}\|$

$\vec{v} = \langle 7,-9\rangle$ $\quad \sqrt{130} = \|\vec{v}\|$

$\vec{w} = \langle -1, 11\rangle$ $\quad \sqrt{122} = \|\vec{w}\|$

$\vec{u} = \langle 2, 8 \rangle$

$\bar{v} = \langle 7, -1 \rangle$

write $\bar{u}$ as the sum of 2 orthogonal vectors $\bar{w}_1$ & $\bar{w}_2$ such that $\bar{w}_1 \parallel \bar{v}$ & $\bar{w}_2 \perp \bar{v}$.

$$\bar{w}_1 = \text{proj}_{\bar{v}} \bar{u} = \frac{\bar{u} \cdot \bar{v}}{\|\bar{v}\|^2} \bar{v} = \frac{14-8}{7^2+1^2} \bar{v} = \frac{6}{50} = \frac{3}{25} \langle 7, -1 \rangle$$

$$= \boxed{\left\langle \frac{21}{25}, \frac{-3}{25} \right\rangle = \bar{w}_1}$$

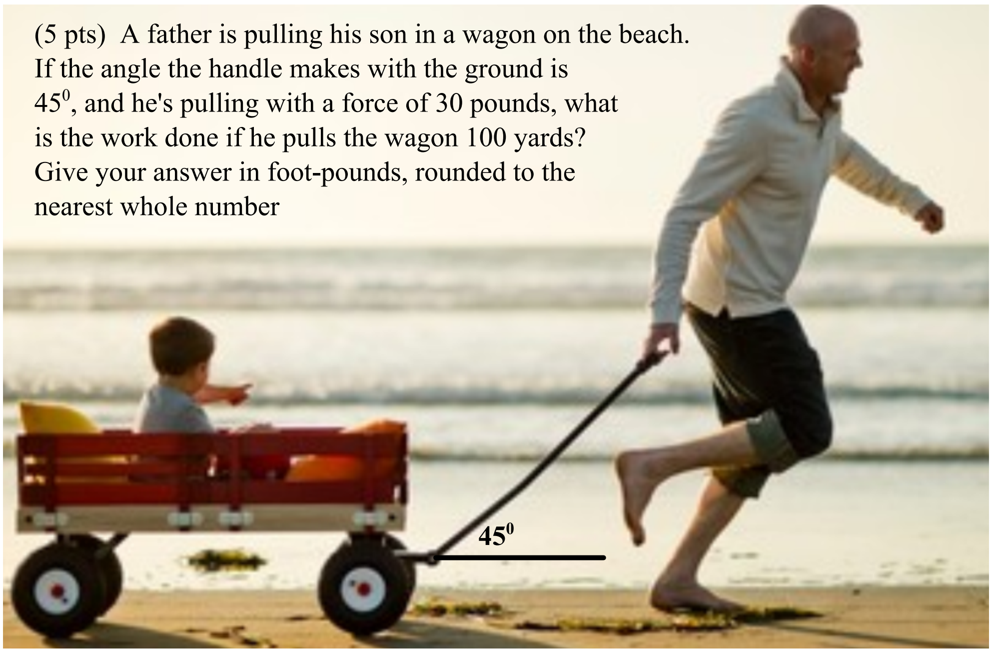
$$\bar{w}_2 = \bar{u} - \bar{w}_1 = \langle 2, 8 \rangle - \left\langle \frac{21}{25}, \frac{-3}{25} \right\rangle = \left\langle \frac{50-21}{25}, \frac{200+3}{25} \right\rangle$$

$$\boxed{= \left\langle \frac{29}{25}, \frac{203}{25} \right\rangle = \bar{w}_2}$$

3

10pts

(5 pts) A father is pulling his son in a wagon on the beach. If the angle the handle makes with the ground is 45^0, and he's pulling with a force of 30 pounds, what is the work done if he pulls the wagon 100 yards? Give your answer in foot-pounds, rounded to the nearest whole number



$\bar{F} = \|\bar{F}\| < \cos 45^0, \sin 45^0 >$

$= 30 < \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} >$

$\bar{v} = < 100, 0 >$

Work $= \bar{F} \cdot \bar{v} = < \frac{30}{\sqrt{2}}, \frac{30}{\sqrt{2}} > \cdot < 100, 0 >$

$= \frac{3000}{\sqrt{2}} = \frac{3000\sqrt{2}}{2} = 1500\sqrt{2} \approx 2121.320343$

$\approx$ $\boxed{2121 \text{ ft-lbs}}$ $\approx$ WORK