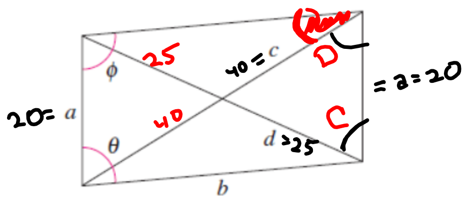
8. 0/3 points LarTrig10 3.2.029. [3882722]

Find the missing values by solving the parallelogram shown in the figure. (The lengths of the diagonals are given by c and d. Round your answers to two decimal places.)

READ!

a	b	c	d	θ	φ
20	✗ 26.69	40	25	✗ 62.83 °	✗ 117.17 °

2



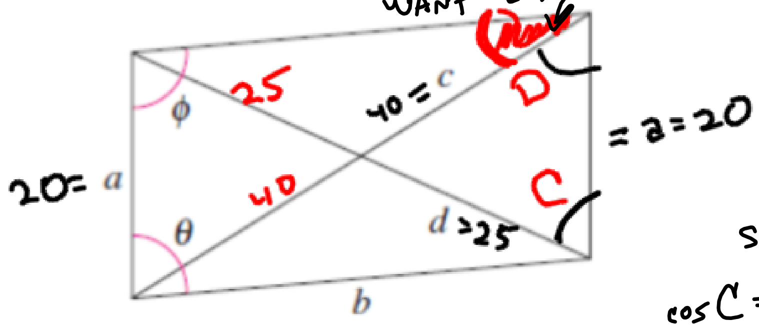
$\Rightarrow \cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

$\cos D = \dfrac{20^2 + 40^2 - 25^2}{2(20)(40)}$ by re-labeling

$\approx \dfrac{400 + 1600 - 625}{1600} = \dfrac{2000 - 625}{1600} = \dfrac{1375}{1600}$

$\Rightarrow D = \cos^{-1}\left(\dfrac{1375}{1600}\right) \approx \boxed{30.7535781° \approx D}$

WANT E:?

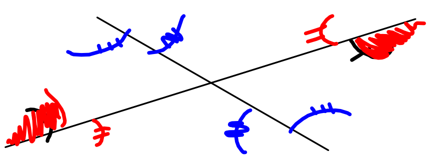


Solve for C:

$\cos C = \dfrac{a^2 + b^2 - c^2}{2ab} = \dfrac{25^2 + 20^2 - 40^2}{2(20)(25)}$

$= \dfrac{625 + 400 - 1600}{1000}$

$= \dfrac{1025 - 1600}{1000}$? NEGATIVE?



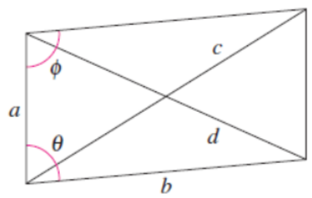
```
25²+20²-40²
                -575
Ans/1000
               -.575
cos⁻¹(Ans
         125.0996322
```

DOES NOT LOOK CORRECT

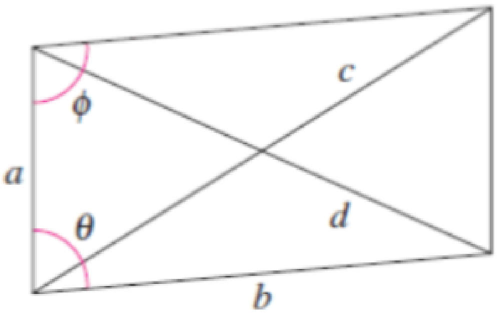
8. 0/3 points LarTrig10 3.2.029. [3882722]

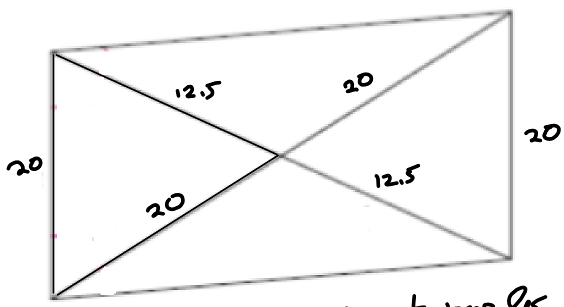
Find the missing values by solving the parallelogram shown in the figure. (The lengths of the diagonals are given by *c* and *d*. Round your answers to two decimal places.)

a	*b*	*c*	*d*	*θ*	*φ*
20	✗ 26.69	40	25	✗ 62.83 °	✗ 117.17 °

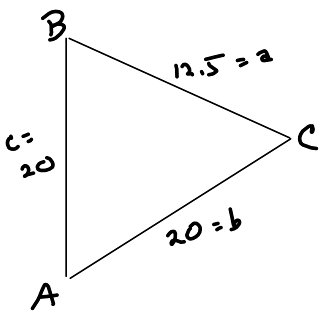


Josh Baud was helpful in class.





we have SSS for the triangles on right & left



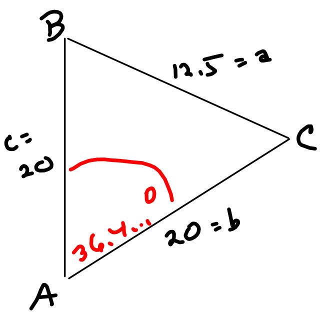
$a^2 = b^2 + c^2 - 2bc\cos A$

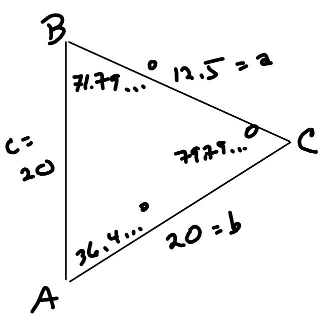
$$\cos A = \frac{b^2+c^2-a^2}{2bc} = \frac{20^2+20^2-(12.5)^2}{2(20)(20)} \approx 0.8046875000$$

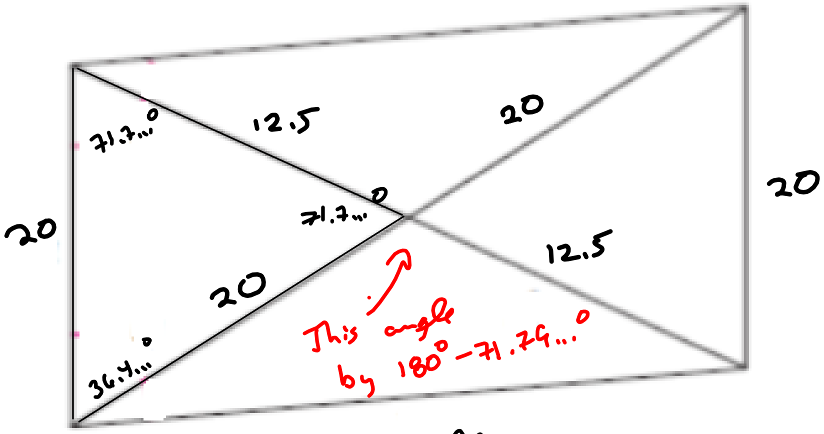
$$A \approx \arccos(0.8046875000) \approx \boxed{36.41991372^\circ \approx A}$$

$$\cos B = \frac{a^2+c^2-b^2}{2ac} = \frac{12.5^2+20^2-20^2}{2(12.5)(20)} \approx 0.3125000000$$

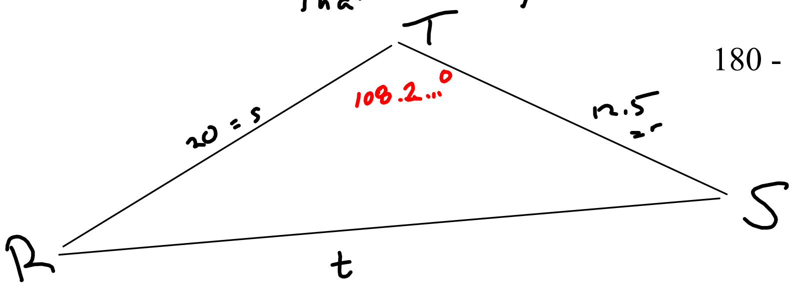
$$\arccos(0.3125000000) \approx \boxed{71.79004314^\circ \approx B = C}$$





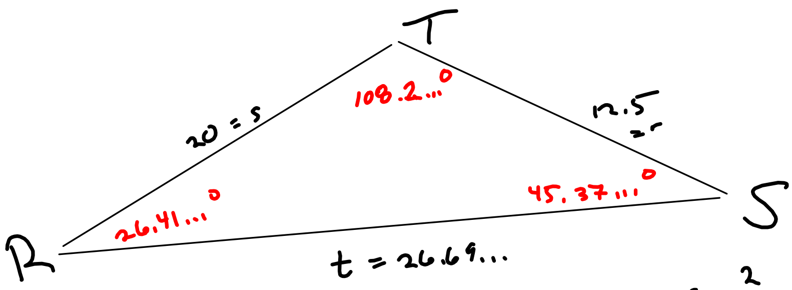


That will give us



180 - 71.79004314 = 108.2099569

$$t^2 = r^2 + s^2 - 2rs\cos T$$
$$= 12.5^2 + 20^2 - 2(12.5)(20)\cos(108.2\ldots^\circ) \approx 712.5000006$$
$$\Rightarrow t \approx (712.5\ldots)^{\frac{1}{2}} \approx \boxed{26.69269564 \approx t}$$

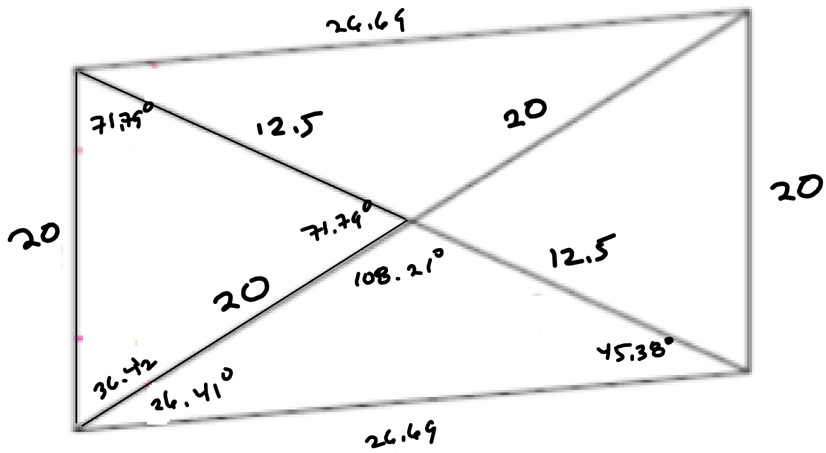


$$\cos R = \frac{s^2 + t^2 - r^2}{2st} = \frac{20^2 + 26.69...^2 - 12.5^2}{2(20)(26.69...)} \approx 0.8956101817$$

$$\Longrightarrow R \approx \arccos(0.8956101817) \approx \boxed{26.41308642^\circ \approx R}$$

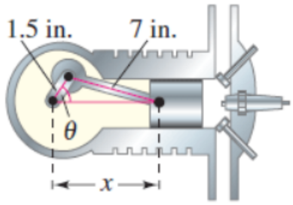
$$S = 180^\circ - R - T = 180^\circ - 26.4...^\circ - 108.2...^\circ$$

$$\approx 45.3769567^\circ$$



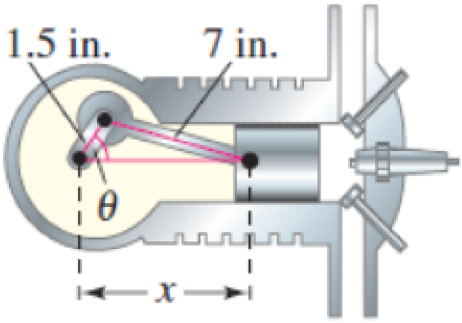
12. 0/4 points LarTrig10 3.2.056. [3882859]

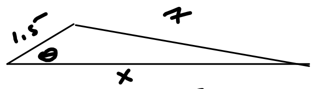
An engine has a seven-inch connecting rod fastened to a crank (see figure).



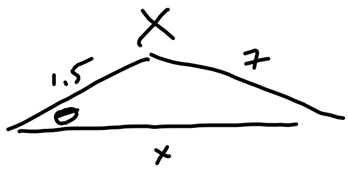
(a) Use the Law of Cosines to write an equation giving the relationship between x and θ.

$x^2 - 3x\cos(\theta) - 46.75 = 0$





$\theta = 0 \Rightarrow x = 8.5$



$$\cancel{x^2 = 1.5^2 + 7^2 - 2(1.5)(7)\cos\theta}$$
$$\cancel{x = 2.25 + 49 - 21\cos\theta}$$
$$\cancel{x = 51.25 - 21\cos\theta}$$
$$\cancel{x + 21\cos\theta = 51.25}$$

Nope!

$$7^2 = x^2 + 1.5^2 - (2x)(1.5)\cos\theta$$
$$x^2 + 2.25 - 49 - 3x\cos\theta = 0$$
$$x^2 - (3\cos\theta)x - 46.75 \overset{\text{SET}}{=} 0$$
$$x^2 + (3\cos\theta)x - 46.75 = 0$$
$$a = 1,\ b = 3\cos\theta,\ c = -46.75$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{iff} \quad ax^2 + bx + c = 0$$
$$x = \frac{-3\cos\theta \pm \sqrt{9\cos^2\theta + 4(46.75)}}{2}$$
$$x = \frac{-3\cos\theta + \sqrt{9\cos^2\theta + 4(46.75)}}{2}$$

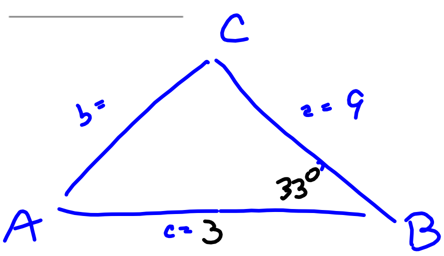
9. 0/4 points

Determine whether the Law of Sines or the Law of Cosines is needed to solve the triangle.

$a = 9$, $c = \cancel{X}$ 3 $B = \cancel{42}°$ 33°

Solve (if possible) the triangle. If two solutions exist, find both. Round your answers to two decima possible, enter IMPOSSIBLE in each corresponding answer blank.)

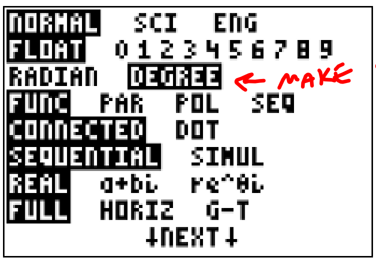
A = [ ] ✗ 114.06 ° 23.94 ° 6.59



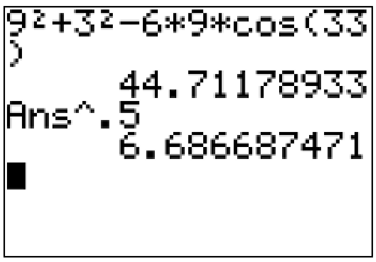
$b^2 = a^2 + c^2 - 2ac \cos\theta$

$= 9^2 + 3^2 - 2(3)(9)\cos(33°)$

$= 81 + 9 - 54 \cos 54°$

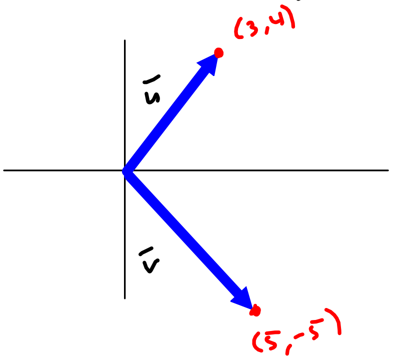


← MAKE SURE!



A vector is a directed line segment emanating from the origin.

We denote a vector by entering the coordinates of its endbpoints in angle brackets.



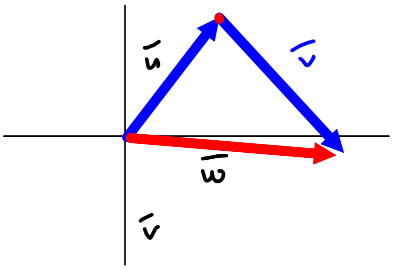
$\bar{u} = \langle 3,4 \rangle$

$\bar{v} = \langle 5,-5 \rangle$

Vector Sums:

$\bar{u} + \bar{v} = \langle 3+5, 4-5 \rangle = \langle 8,-1 \rangle$

NOSE TO TAIL.



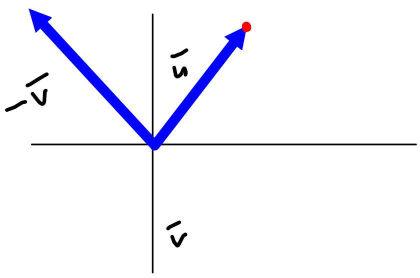
$\bar{w} = \langle 8,-1 \rangle$ is the "resultant"

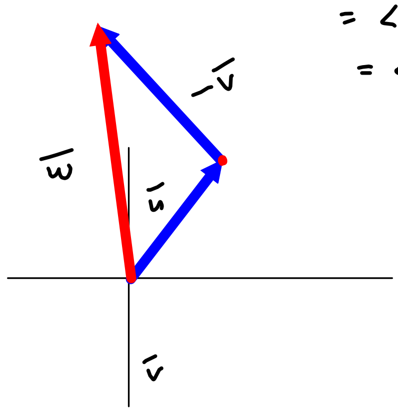
$\bar{u} - \bar{v} = \bar{u} + (-\bar{v}) = \bar{w} = \langle 3,4\rangle - \langle 5,-5\rangle$

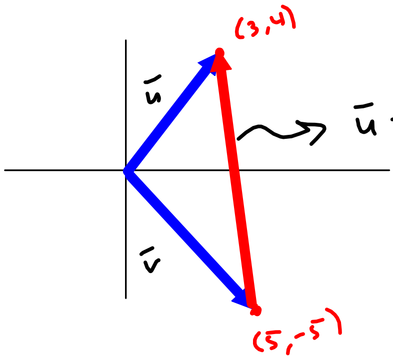
$= \langle 3,4\rangle + \langle -5,5\rangle$

$= \langle -2,9\rangle$

$= \langle -2,9\rangle$







$\bar{u} - \bar{v}$ can be viewed as the vector from the tip of $\bar{v}$ to the tip of $\bar{u}$.

Scalar multiples: $a=5$, $\bar{u} = \langle 7,-4\rangle$, then

$a\bar{u} = 5\langle 7,-4\rangle = \langle 5(7), 5(-4)\rangle$

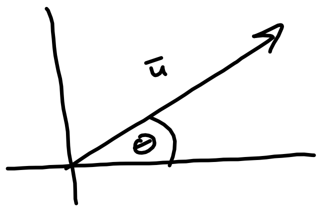
$= \langle 35, -20\rangle$

$\|\bar{u}\|$ is the length of $\bar{u} = \langle u_1, u_2\rangle$

$\|\bar{u}\| = \sqrt{u_1^2 + u_2^2}$

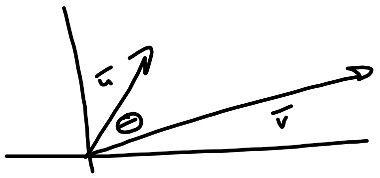
$\|\bar{u}\| \quad \|\langle 5,6\rangle\| = \sqrt{5^2+6^2} = \sqrt{25+36} = 61 = \|\bar{u}\|$

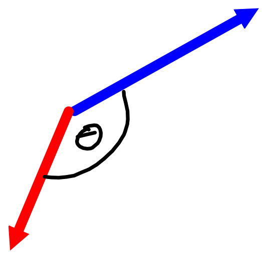
Direction angle θ is the angle a vector makes with the positive x-axis



I'm pretty sure $0^\circ \le \theta < 360^\circ$
$(0 \le \theta < 2\pi)$

If θ is Angle Between vectors: $0^\circ \leq \theta < 180^\circ$
$(0 \leq \theta < \pi)$





Fact: $0^\circ \leq \theta < 180^\circ \longrightarrow$
arccos(cos (θ)) will
always give θ. You don't
have to interpret the
calculator result.

32. 0/2 points Lar

Find the component form of **v** given its magnitude and the angle it makes with the positive *x*-axis.

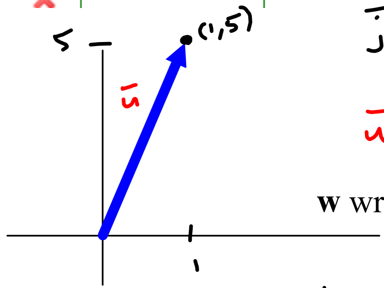
Magnitude	**Angle**
$\|\|\mathbf{v}\|\| = 3$	**v** in the direction **i** + 5**j**

$= \bar{i} + 5\bar{j}$

v = ✗ $\left\langle \frac{3}{\sqrt{26}}, \frac{15}{\sqrt{26}} \right\rangle$

$\bar{i} = \langle 1, 0 \rangle$ canonical Vectors for $\mathbb{R}^2$

$\bar{j} = \langle 0, 1 \rangle$



$\bar{w} = \langle 5, 6 \rangle = 5\langle 1,0 \rangle + 6\langle 0,1 \rangle$

$= 5\bar{i} + 6\bar{j}$

w written as a linear combination of **i** and **j**

Want a vector of length 3 that's parallel to $\langle 1,5 \rangle$

1st unit vector in direction of $\bar{v}$

2nd multiply that by 3!

$\bar{u} = \langle 1, 5 \rangle$

$\|\bar{u}\| = \sqrt{1^2 + 5^2} = \sqrt{26}$

Let $\bar{v} = 3\left(\underbrace{\frac{1}{\sqrt{26}}\langle 1, 5 \rangle}_{\text{unit vector in direction of } \langle 1,5 \rangle}\right)$

Dot Product: $\bar{u} = \langle u_1, u_2 \rangle$, $\bar{v} = \langle v_1, v_2 \rangle \Rightarrow$

$\bar{u} \cdot \bar{v} = u_1 v_1 + u_2 v_2$

$\bar{u} = \langle 3, 4 \rangle$, $\bar{v} = \langle -11, 7 \rangle$

$\Rightarrow \bar{u} \cdot \bar{v} = (3)(-11) + (4)(7) = -33 + 28 = \boxed{5 = \bar{u} \cdot \bar{v}}$

If $\bar{u}$ is perpendicular to $\bar{v}$, then $\bar{u} \cdot \bar{v} = 0$ & conversely. orthogonal

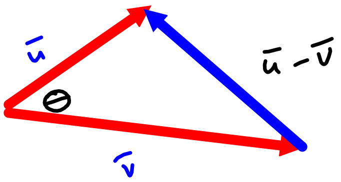
$\bar{u} \perp \bar{v}$ iff $\bar{u} \cdot \bar{v} = 0$

$\longleftrightarrow$

NOTE: $\bar{u} \cdot \bar{u} = u_1^2 + u_2^2$

$\Rightarrow \sqrt{\bar{u} \cdot \bar{u}} = \sqrt{u_1^2 + u_2^2} = \|\bar{u}\|^2$

FACT : $\cos\theta = \dfrac{\bar{u}\cdot\bar{v}}{\|\bar{u}\|\|\bar{v}\|}$



Recall Law of cosines

$$\cos\theta = \frac{\|\bar{u}\|^2 + \|\bar{v}\|^2 - \|\bar{u}-\bar{v}\|^2}{2\|\bar{u}\|\|\bar{v}\|}$$

W.T.S. $= \dfrac{\bar{u}\cdot\bar{v}}{\|\bar{u}\|\|\bar{v}\|}$

$$= \frac{\bar{u}\cdot\bar{u} + \bar{v}\cdot\bar{v} - (\bar{u}-\bar{v})\cdot(\bar{u}-\bar{v})}{2\|\bar{u}\|\|\bar{v}\|}$$

$$= \frac{\bar{u}\cdot\bar{u} + \bar{v}\cdot\bar{v} - (\bar{u}\cdot\bar{u} - 2\bar{u}\cdot\bar{v} + \bar{v}\cdot\bar{v})}{\text{same}}$$

$$= \frac{\bar{u}\cdot\bar{u} + \bar{v}\cdot\bar{v} - \bar{u}\cdot\bar{u} + 2\bar{u}\cdot\bar{v} - \bar{v}\cdot\bar{v}}{\text{same}} = \frac{2\bar{u}\cdot\bar{v}}{2\|\bar{u}\|\|\bar{v}\|} = \boxed{\frac{\bar{u}\cdot\bar{v}}{\|\bar{u}\|\|\bar{v}\|} = \cos\theta}$$

$(\bar{u}-\bar{v})\cdot(\bar{u}-\bar{v})$

Distributive Law!

$= \bar{u}\cdot\bar{u} - \bar{u}\cdot\bar{v} - \bar{v}\cdot\bar{u} + \bar{v}\cdot\bar{v}$

$= \bar{u}\cdot\bar{u} - 2\bar{u}\cdot\bar{v} + \bar{v}\cdot\bar{v}$

$\bar{u}\cdot\bar{v} = \bar{v}\cdot\bar{u}$