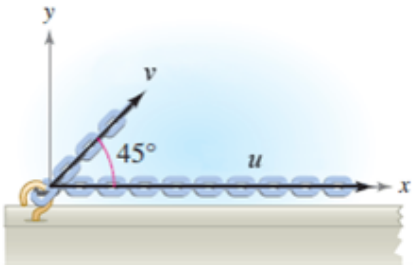
Writing Project #2?

4. Forces with magnitudes $\|\bar{u}\| = 90$ N and $\|\bar{v}\| = 25\sqrt{2}$ N are acting on a hook, as shown in the figure.
   a. (5 pts) Express $\bar{u}$ and $\bar{v}$ in component form.
   b. (5 pts) Express the resultant force in component form.
   c. (5 pts) Find the direction angle of the resultant force, in degrees, rounded to 4 decimal places.



(a) $\bar{u} = \|\bar{u}\| \langle \cos\theta, \sin\theta \rangle$

$= 90 \langle \cos(0°), \sin(0°) \rangle = 90 \langle 1, 0 \rangle = \boxed{\langle 90, 0 \rangle = \bar{u}}$

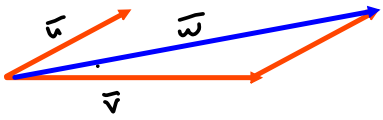
$\bar{v} = \|\bar{v}\| \langle \cos\phi, \sin\phi \rangle = 25\sqrt{2} \langle \cos(45°), \sin(45°) \rangle$

$= 25\sqrt{2} \left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle = \boxed{\langle 25, 25 \rangle = \bar{v}}$

45°, $\sqrt{2}$, 1, 1

(b) resultant $= \bar{u} + \bar{v} = \langle 90, 0 \rangle + \langle 25, 25 \rangle = \boxed{\langle 115, 25 \rangle = \bar{u} + \bar{v} = \bar{w}}$

(c) Direction angle $= \gamma$ = angle measured counter-clockwise from positive x-axis, measured in degrees



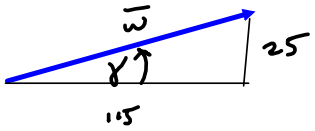
1st Quadrant

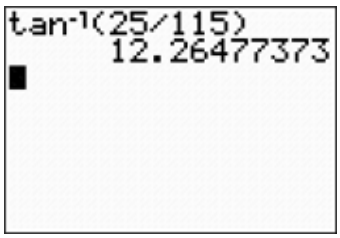
$\gamma = \arcsin\left(\frac{25}{\|\bar{w}\|}\right)$

$= \arccos\left(\frac{115}{\|\bar{w}\|}\right)$

$= \arctan\left(\frac{25}{115}\right)$

Only b/c we know $\gamma \in$ QI





In QI $\arcsin(\sin(\gamma)) = \gamma$

$\arccos(\cos(\gamma)) = \gamma$

$\arctan(\tan(\gamma)) = \gamma \approx 12.26477373°$

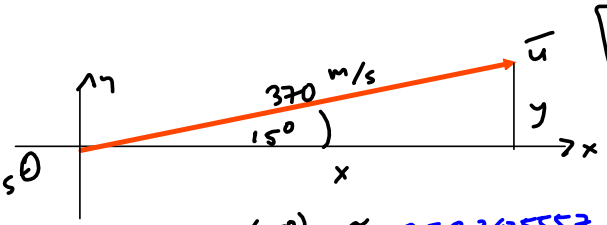
$\approx \boxed{12.2648° \approx \gamma}$

6. A gun with a muzzle velocity of 370 meters per second is fired, with an angle of 15^0 from the horizontal.
   a. (5 pts) Find the horizontal and vertical components of the bullet, as it leaves the muzzle, accurate to 4 decimal places.
   b. (5 pts) Use a half-angle formula to find the *exact* value for the answer to the previous.
   c. (5 pts) Using $-9.8\ \frac{m}{s^2}$ for the acceleration due to gravity, and neglecting air friction, predict where and when the bullet will hit the ground, in the gun question. Round your answer to 2 decimal place
   d. (5 pts) Find $\sin(2u), \cos(2u)$ and $\tan(2u)$, given that $\cos(u)=\frac{2}{5}$ and $\sin(u)<0$.

Are you smarter than the average bear?

Lexicon / Glossary
x = horizontal component in $\frac{m}{s}$
y = vertical " " "

(a)



$\frac{x}{370} = \cos\theta$

$x = 370\cos(15^\circ) \approx 357.3925557$

$\approx 357.3926\ m/s \approx x$

$\frac{y}{370} = \sin\theta$

$y = 370\sin(15^\circ) \approx 95.76304669$

$\approx 95.7630\ m/s \approx y$

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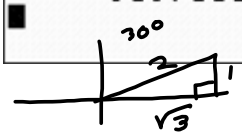
tan⁻¹(25/115)
      12.26477373
370cos(15)
      357.3925557
370sin(15)
      95.76304669
```



(b) $\sin\left(\frac{u}{2}\right) = \pm\sqrt{\frac{1-\cos(u)}{2}} = +\sqrt{\frac{1-\cos(30^\circ)}{2}}$

$\frac{u}{2}$ in QI

$= \sqrt{\frac{1-\frac{\sqrt{3}}{2}}{2}} = \sqrt{\frac{\frac{2-\sqrt{3}}{2}}{2}}$

$= \sqrt{\frac{2-\sqrt{3}}{2}\cdot\frac{1}{2}} = \sqrt{\frac{2-\sqrt{3}}{4}} = \frac{\sqrt{2-\sqrt{3}}}{\sqrt{4}} = \frac{\sqrt{2-\sqrt{3}}}{2} = x$

$\cos\left(\frac{u}{2}\right) = \pm\sqrt{\frac{1+\cos(u)}{2}} = +\sqrt{\frac{1+\cos(u)}{2}} = \text{etc.}$

QI

Recall falling Body

h = height in m

t = time in s

h_0 = initial height $\Rightarrow h = h(t) = \frac{1}{2}gt^2 + v_0 t + h_0$

v_0 = " velocity & we have $h_0 = 0$, $v_0 = y$

$a = g$ = acceleration

$v_0 = y$ from previous ≈ 95.76304669 m/s

$h(t) = \frac{1}{2}(-9.8)t^2 + 95\ldots t$ SET $= 0$

$= -4.9t^2 + 95\ldots t = 0$

$t(-4.9t + 95\ldots) = 0$

$\Rightarrow t = 0,$

Scratch:

$-4.9t + 95\ldots = 0$

$-4.9t = -95\ldots$

$t = \frac{-95\ldots}{-4.9} = \frac{95\ldots}{4.9} \approx 19.54347892$

$\approx$ 19.54s $\approx t$

```
     12.26477373
370cos(15)
     357.3925557
370sin(15)
     95.76304669
Ans/4.9
     19.54347892
```

Now. How far did it fly?

That's asking us about the horizontal distance

Recall

$357.3925557 \approx x$ = horizontal component of velocity.

It will fly at that speed until gravity brings it back.

$D = r \cdot t = (357.\ldots)(19.\ldots) \approx 6984.693878$ m

$\approx$ 6984.69 m is how far down-range it will fly.

```
     357.3925557
370sin(15)
     95.76304669
Ans/4.9
     19.54347892
Ans*370cos(15)
     6984.693878
```

970-290-0550

$\bar{u} = \langle 7, -8 \rangle = 7\langle 1,0 \rangle + -8\langle 0,1 \rangle$

$\bar{i} = \langle 1,0 \rangle \qquad = 7\bar{i} - 8\bar{j}$

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

MOAR Questions?