1,

$$\left(\frac{1}{z+f} + \frac{1}{z+f}\right) = \frac{1}{f}$$

$\Downarrow$

idea taken from adding fractions formula

$$\left(\frac{a}{b} + \frac{c}{d}\right) = \left(\frac{ad + bc}{bd}\right)$$

$\Downarrow$

$$\frac{1}{z+f} + \frac{1}{z+f} = \frac{(1\cdot(z+f)) + (1\cdot(z+f))}{(z+f)\ (z+f)} = \frac{z+f + z+f}{(z+f)(z+f)}$$

$$\frac{z+z+2f}{(z+f)(z+f)} = \frac{1}{f} \quad \Big| \text{ cross multiply}$$

$$f(z+z+2f) = (z+f)(z+f) \quad \Big|$$

$\Downarrow$

$$fz + fz + 2f^2 = zz + fz + fz + f^2 \quad \Big| \text{ cancel out}$$

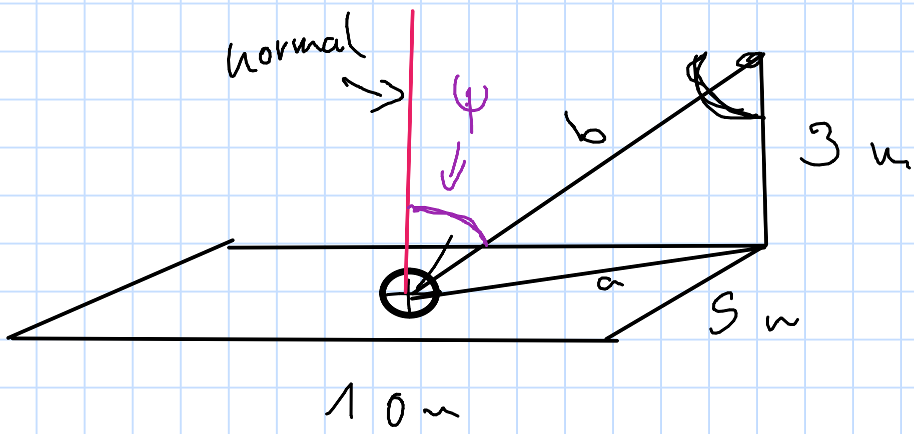
$\Downarrow$

$$2f^2 = zz + f^2 \quad \Big| -f^2$$

$\Downarrow$

$$\underline{\underline{f^2 = zz}}$$

3)



$$\text{solid angle} = \frac{\delta A \cos\psi}{r^2}$$

δA = area $= \pi \cdot (0{,}025)^2 \approx \underline{0{,}001963}\ m^2$

r = distance to origin center $= \underline{6{,}34\ m}$

ψ = angle between its normal and ray of origin

$$a = \sqrt{5^2 + 2{,}5^2} \approx 5{,}59\ m^2$$

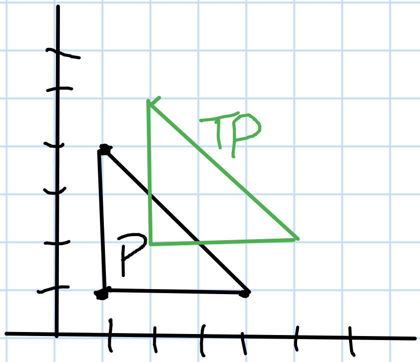
$$b = \sqrt{a^2 + 3^2} \approx 6{,}34\ m^2 = r$$

$$\psi = \cos\left(\sin^{-1}\left(\frac{a}{b}\right)\right) = \cos(61{,}78°) = 0{,}4728$$

so solid angle is $= \dfrac{0{,}001963 \cdot 0{,}4728}{6{,}34}$

$= \underline{0{,}000146389}$

5) from slides



$x' = Rx + t$

Point 1 $(1,1)$
$P_2 = (1,4)$
$P_3 = (4,1)$

$t = (1,1)$ also 1 nach rechts oben

$0°$

$$R = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$TP_1 = R \cdot P_1 + t = (2,2)$
$TP_2 = (2,5)$
$TP_3 = (5,2)$

distance between 2 points

$d(P_1, P_2) = \| P_2 - P_1 \|$

$d(TP_1, TP_2) = \| TP_2 - TP_1 \|$

to show

$\| P_2 - P_1 \| = \| TP_2 - TP_1 \|$

$$\|P_2 - P_1\| = \|RP_2 + \cancel{t} - RP_1 - \cancel{t}\|$$

$$\|P_2 - P_1\| = \|RP_2 - RP_1\|$$

$$\sim\|\sim \; = \|R(P_2 - P_1)\|$$

R is a rotation matrix and keeps the distance between the dots the same for sure

But tbh idont know how to show the angles

its kinda obvious tho that if i change the angle the same for all, they will keep the same angle

4)

$$I = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

from slides

$$[u]_\times = \begin{bmatrix} 0 & -w & v \\ w & 0 & -u \\ -v & u & 0 \end{bmatrix} \quad \sin\theta \cdot [u]_\times \rightarrow \begin{bmatrix} 0 & -w\sin(\theta) & v\sin(\theta) \\ w\sin(\theta) & 0 & -u\sin(\theta) \\ -v\sin(\theta) & u\sin(\theta) & 0 \end{bmatrix}$$

substi $\sin\theta \rightarrow s$

$$\begin{bmatrix} 0 & -ws & vs \\ ws & 0 & -us \\ -vs & us & 0 \end{bmatrix} + I = \begin{bmatrix} 1 & -ws & vs \\ ws & 1 & -us \\ -vs & us & 1 \end{bmatrix}$$

ok now idont get it anymore

cause fo $[u]_\times{}^{12}$ iget

$$\begin{matrix} v^2+w^2 & vv & uw \\ uv & -u^2-w^2 & vw \\ uw & vw & u^2+w^2 \end{matrix}$$

yeah ok idont get it sadly