

Question 1.

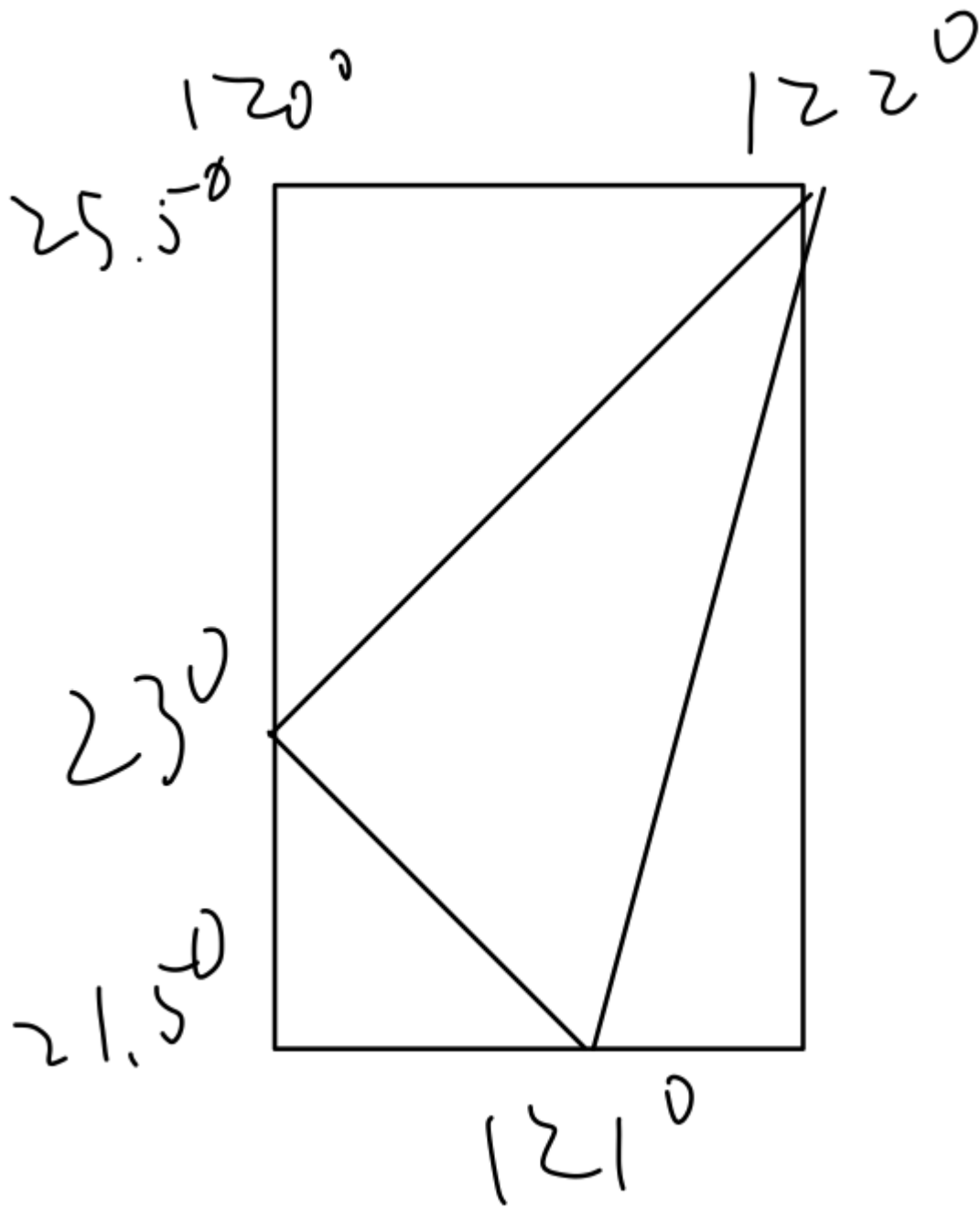
Q:By definition,list the right ascension and declination of the Sun when it is at the vernal equinox, the summer solstice, the autumnal equinox, and the winter solstice.

| time | right ascension | declination |
|------------------|-----------------|-----------------|
| vernal equinox | 0h | 0° |
| summer solstice | 6h | 23.5° |
| autumnal equinox | 12h | 0° |
| winter solstice | 18h | -23.5° |

Question 2.

(a)

Q:Please estimate the solid angle spanned by the main island of Taiwan by using it's range of the longitude and latitude.



$$\begin{aligned}
 \Omega_{Taiwan} &= (122^\circ - 120^\circ) \times (25.5^\circ - 21.5^\circ) - \frac{(122^\circ - 120^\circ) \times (25.5^\circ - 23^\circ)}{2} \\
 &\quad - \frac{(23^\circ - 21.5^\circ) \times (121^\circ - 120^\circ)}{2} - \frac{(122^\circ - 121^\circ) \times (23.5^\circ - 21.5^\circ)}{2} \\
 &= 3.75^\circ \approx 0.00114231532(\text{rad}^2)
 \end{aligned}$$

(b)

Q: Given that the radius of the earth is about 6400km, what is the approximated area of the main island of Taiwan?

$$A_{Tawian} = \Omega_{Taiwan} \times R^2 \approx 46789.24(km^2)$$

(c)

Q:Calculate the total surface area of the earth. What is the fraction of the area of Taiwan's main island with respect to the total surface of the earth?

$$\frac{A_{Taiwan}}{A_{Earth}} = \frac{\Omega_{Taiwan}}{\Omega_{Earth}} = \frac{0.00114231532}{4\pi} = 9.09 \times 10^{-5}$$

Question 3.

Q:Why do we always see the same side of the moon?(Why is the period of the moon's spin equal to that of it's orbiting aboutthe earth?) Please explain.

根據理論，潮汐力會將衛星的自轉動能轉換成公轉動能，也就是說自轉會越來越慢，公轉會越來越快，直到公轉和自轉兩個的角速度吻合，這時候行星就對衛星潮汐鎖定，衛星就只能以同一面面對行星了。