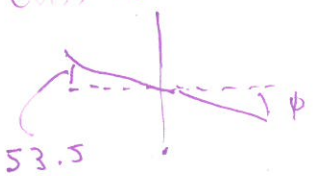
33: 22, 25, 34
class 13

22



$n \sin\phi = 1 \sin 53.5$

$2.46 \rightarrow \phi = 19.07$

$2.41 \qquad\quad 19.48$

$.412°$

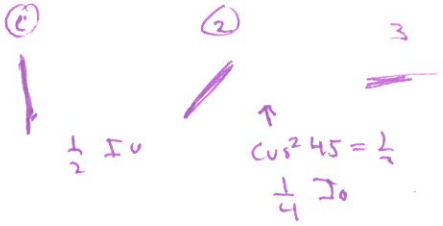
25

← this angle

Assum 50% thru first

$.5\, I_0 \cos^2 30° = .375\, I_0$

34



(b) zero

```
In[3]:= a=5

Out[3]= 5

In[4]:= b=ArcSin[(1.04/1.5) Sin[a Pi/180]]*180/Pi

Out[4]= 3.46438

In[5]:= c=10-b

Out[5]= 6.53562

In[6]:= d=ArcSin[(1.5/1.04) Sin[c Pi/180]]*180/Pi

Out[6]= 9.44872

In[7]:= e=d-5

Out[7]= 4.44872

In[8]:= 2/Tan[e Pi/180]

Out[8]= 25.7066
```

Consider the problem of designing a camera for a Venus rover: the Venusian atmosphere is about 100 times thicker than the Earth's atmosphere, so the index of refraction deviates noticeably from one: $n = 1.04$. The camera lens ($n = 1.5$) is supposed to take the parallel rays from a distant scene and focus them on the electronic film. In this problem you will ray-trace rays that hit near the circumference of the $R = 2$ cm lens. As diagrammed below, that portion of the lens can be considered a 10° prism. A bit of geometry shows the following relations among the angles: $a = 5°$ (because that side of the lens is angled 5° from vertical), $c = 10° - b$ (because a triangle says: $(90° - b) + (90° - c) + 10° = 180°$ — directly on this sheet draw/label where that triangle can be found), and $e = d - 5°$ (because that side of the lens is angled 5° from vertical). Tests in Earth's atmosphere find a focal length (where this edge ray hits the center line) of 22.71 cm; What do you calculate as the focal length in Venus's atmosphere? (Report your results for the angles a, b, c, d, e.)