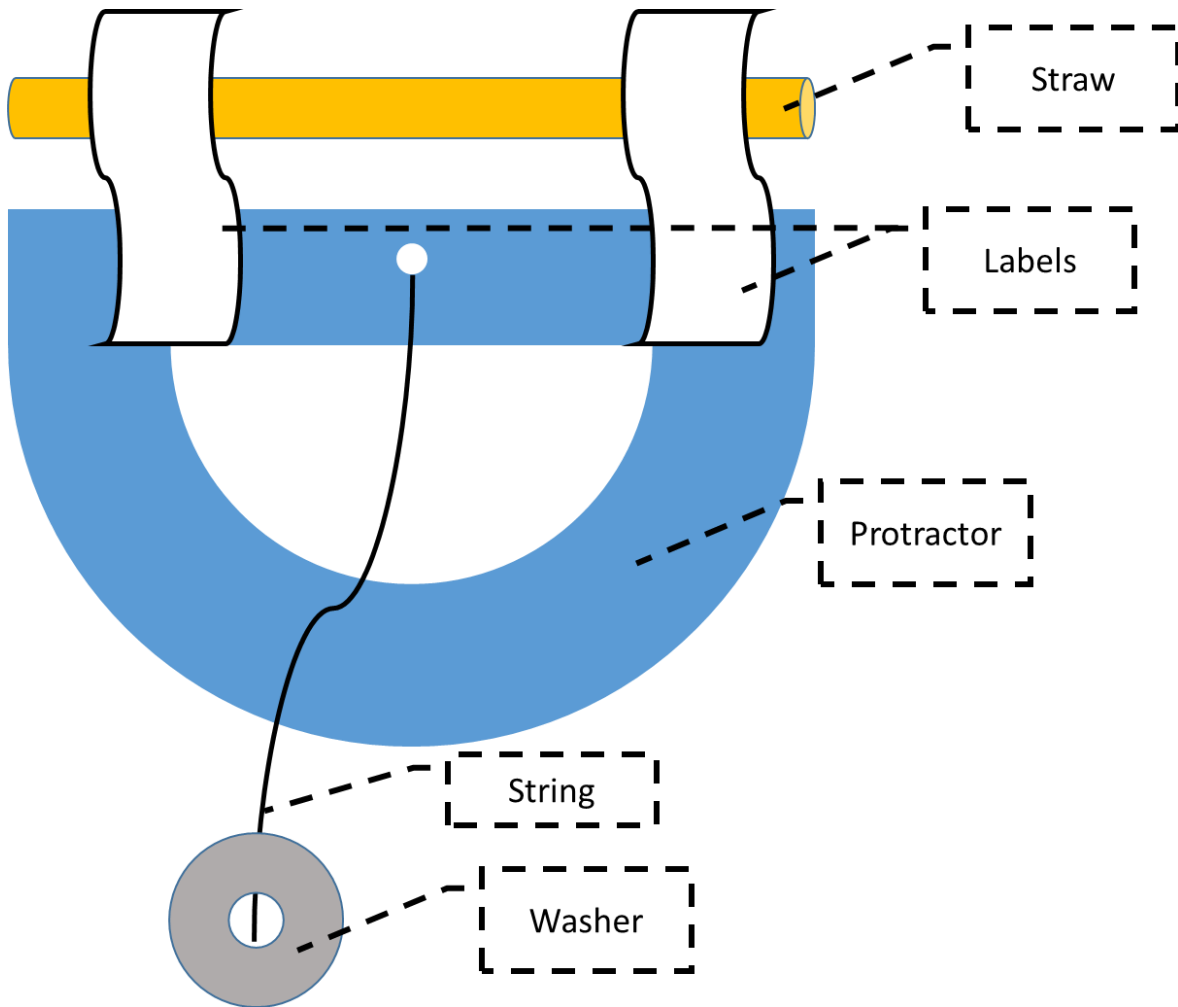


Simple Altitude Tracker

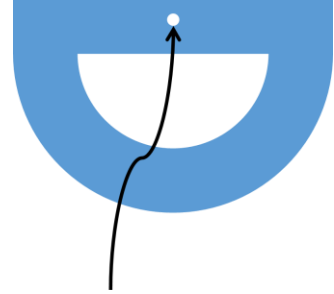
v1.0

January 9th, 2019

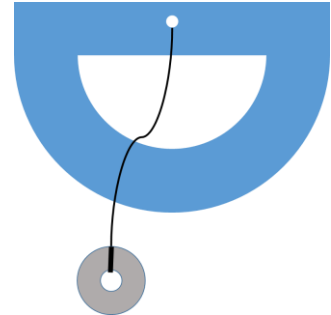
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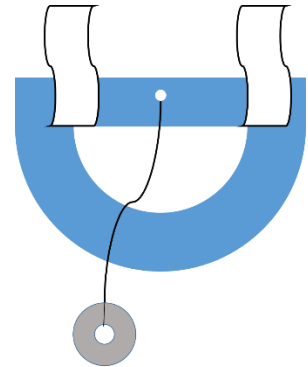
1. Pass one end of the string through the protractor and tie a knot in the string so it doesn't fall out.



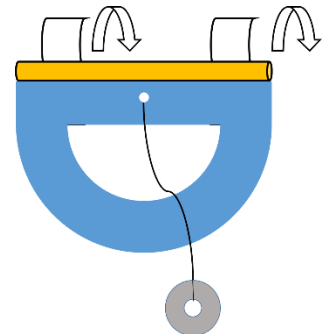
2. Slide the end of the string **without** the knot through the hole in the washer and tie the washer to the string so it doesn't fall off.



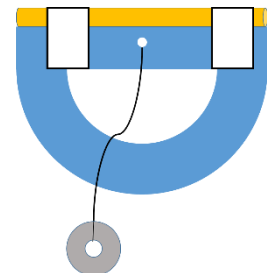
3. Place the labels (or tape) along the flat side of the protractor to create tabs as shown in the figure.



4. Place the straw on the sticky portion of the tabs along the flat part of the protractor. This will create the sight to sight the rocket.
5. Fold the tabs over the straw to the other side of the protractor.



6. This completes your altitude tracker



To use your altitude tracker to determine the height of a rocket (or other object):

1. Find a safe area to launch your rocket. (*Refer to the National Association of Rocketry Model Rocket Safety Code for details.*)
2. Setup your launch pad and prepare to launch.
3. From your launch pad measure ____ feet your launch pad and mark it. (*If you think your rocket will go 1000 feet you may want find a spot 400 feet away or further. The higher it goes the further back someone will need to be.*)
4. Designate someone to use your altitude tracker. They will be the tracker. They will stand at the mark you created in step 3.
5. The tracker will look through the straw at the rocket. With the string hanging down and able to move. When the rocket is sighted through the straw on the altitude tracker it should be over the 90 degree mark on the middle of the protractor.
6. Count down and launch your rocket.
7. The tracker will follow the rocket up into the air watching it through the straw.
8. When the rocket stops going up (this is called apogee) the tracker should mark where the string is on the protractor. The easiest thing to do is pinch the string against the protractor.
9. Retrieve your rocket
10. **SUBTRACT 90 degrees** from the angle measured by the tracker.
11. Use a calculator and the formula **$\tan(\text{angle}) \times \text{distance from rocket} = \text{height}$** to calculate the height of your rocket
12. You can also use the table on the next page to look up the altitude of your rocket

Example:

Sandy is launching her rocket. Her cousin, Tim, is standing **300 feet** away with an altitude tracker when Sandy launches her rocket. The tracker **angle** reads **127°** when the rocket reaches its highest point, known as apogee. Tim knows he needs to subtract 90° from the angle on the protractor to get the correct angle. How high did the rocket go?

$$\tan(127^\circ - 90^\circ) \times 300 \text{ feet} = \text{height}$$

Simplify

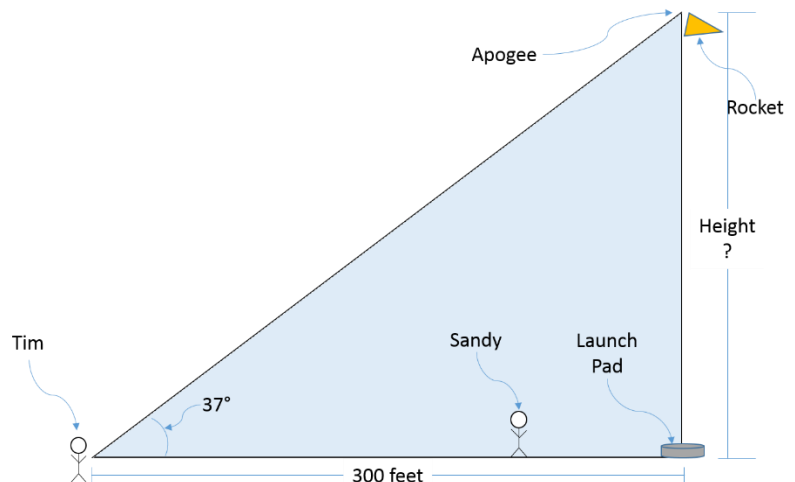
$$\tan(37^\circ) \times 300 \text{ feet} = \text{height}$$

Simplify

$$\sim 0.75355 \times 300 \text{ feet} = \text{height}$$

Simplify

$$\sim 226.07 \text{ feet} = \text{height}$$



Sandy's rocket flew about 226.07 feet in the air. (We round off the extra digits after .07)

Altitude table

Degrees Shown	Less 90°	Tangent	Distance Away							
			50	100	150	200	250	300	350	400
90.0	0.0	0.00000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
92.5	2.5	0.04366	2.18	4.37	6.55	8.73	10.92	13.10	15.28	17.46
95.0	5.0	0.08749	4.37	8.75	13.12	17.50	21.87	26.25	30.62	35.00
97.5	7.5	0.13165	6.58	13.17	19.75	26.33	32.91	39.50	46.08	52.66
100.0	10.0	0.17633	8.82	17.63	26.45	35.27	44.08	52.90	61.71	70.53
102.5	12.5	0.22169	11.08	22.17	33.25	44.34	55.42	66.51	77.59	88.68
105.0	15.0	0.26795	13.40	26.79	40.19	53.59	66.99	80.38	93.78	107.18
107.5	17.5	0.31530	15.76	31.53	47.29	63.06	78.82	94.59	110.35	126.12
110.0	20.0	0.36397	18.20	36.40	54.60	72.79	90.99	109.19	127.39	145.59
112.5	22.5	0.41421	20.71	41.42	62.13	82.84	103.55	124.26	144.97	165.69
115.0	25.0	0.46631	23.32	46.63	69.95	93.26	116.58	139.89	163.21	186.52
117.5	27.5	0.52057	26.03	52.06	78.09	104.11	130.14	156.17	182.20	208.23
120.0	30.0	0.57735	28.87	57.74	86.60	115.47	144.34	173.21	202.07	230.94
122.5	32.5	0.63707	31.85	63.71	95.56	127.41	159.27	191.12	222.97	254.83
125.0	35.0	0.70021	35.01	70.02	105.03	140.04	175.05	210.06	245.07	280.08
127.5	37.5	0.76733	38.37	76.73	115.10	153.47	191.83	230.20	268.56	306.93
130.0	40.0	0.83910	41.95	83.91	125.86	167.82	209.77	251.73	293.68	335.64
132.5	42.5	0.91633	45.82	91.63	137.45	183.27	229.08	274.90	320.72	366.53
135.0	45.0	1.00000	50	100	150	200	250	300	350	400
137.5	47.5	1.09131	54.57	109.13	163.70	218.26	272.83	327.39	381.96	436.52
140.0	50.0	1.19175	59.59	119.18	178.76	238.35	297.94	357.53	417.11	476.70
142.5	52.5	1.30323	65.16	130.32	195.48	260.65	325.81	390.97	456.13	521.29
145.0	55.0	1.42815	71.41	142.81	214.22	285.63	357.04	428.44	499.85	571.26
147.5	57.5	1.56969	78.48	156.97	235.45	313.94	392.42	470.91	549.39	627.87
150.0	60.0	1.73205	86.60	173.21	259.81	346.41	433.01	519.62	606.22	692.82
152.5	62.5	1.92098	96.05	192.10	288.15	384.20	480.25	576.29	672.34	768.39
155.0	65.0	2.14451	107.23	214.45	321.68	428.90	536.13	643.35	750.58	857.80
157.5	67.5	2.41421	120.71	241.42	362.13	482.84	603.55	724.26	844.97	965.69
160.0	70.0	2.74748	137.37	274.75	412.12	549.50	686.87	824.24	961.62	1098.99
162.5	72.5	3.17159	158.58	317.16	475.74	634.32	792.90	951.48	1110.06	1268.64
165.0	75.0	3.73205	186.60	373.21	559.81	746.41	933.01	1119.62	1306.22	1492.82
167.5	77.5	4.51071	225.54	451.07	676.61	902.14	1127.68	1353.21	1578.75	1804.28
170.0	80.0	5.67128	283.56	567.13	850.69	1134.26	1417.82	1701.38	1984.95	2268.51
172.5	82.5	7.59575	379.79	759.58	1139.36	1519.15	1898.94	2278.73	2658.51	3038.30
175.0	85.0	11.43005	571.50	1143.01	1714.51	2286.01	2857.51	3429.02	4000.52	4572.02
177.5	87.5	22.90377	1145.19	2290.38	3435.56	4580.75	5725.94	6871.13	8016.32	9161.51
180	90	Undefined	Out of bounds							
			▲ Altitude ▲							