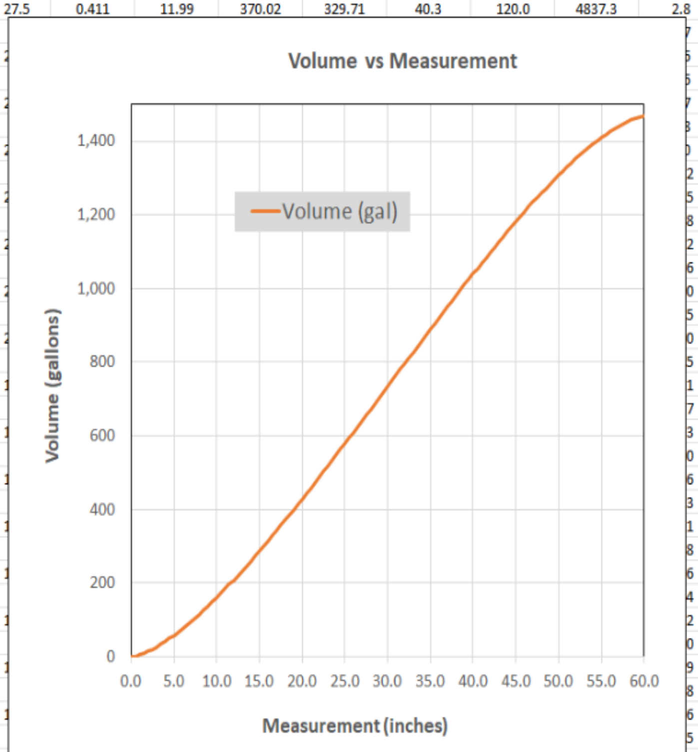
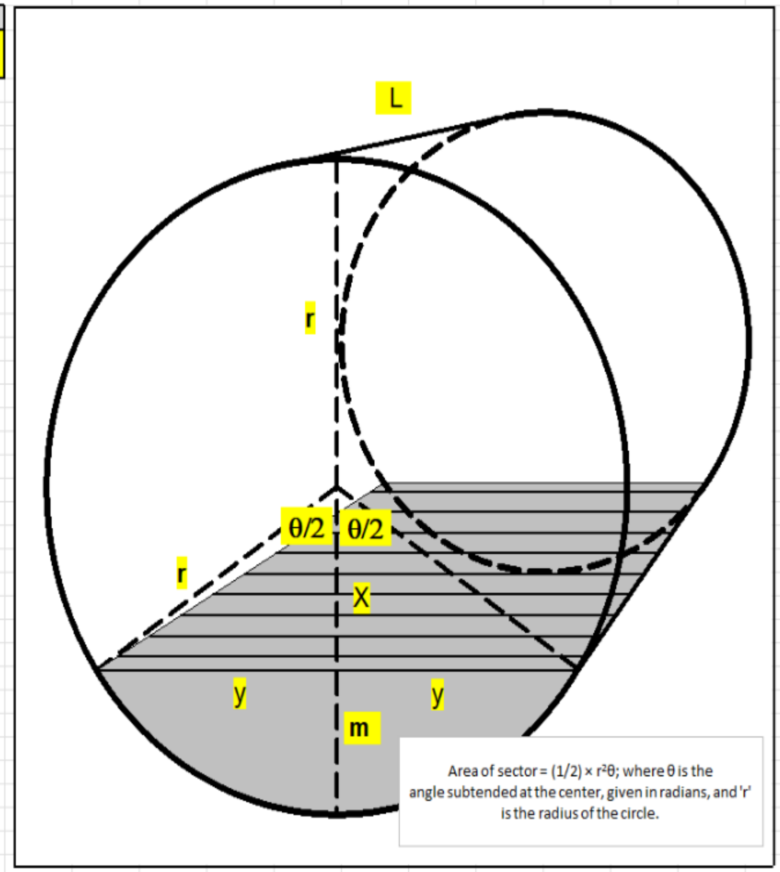
Given the cylindrical fuel tank shown in the drawing (radius = 30 inches, length = 120 inches), create a curve (graph) relating the depth of the fuel (as measured in inches from the tank bottom) to the volume of fuel within the tank.

Variable	Value	unit
δm =	0.5	inches
radius =	30.0	inches
Length =	120.0	inches

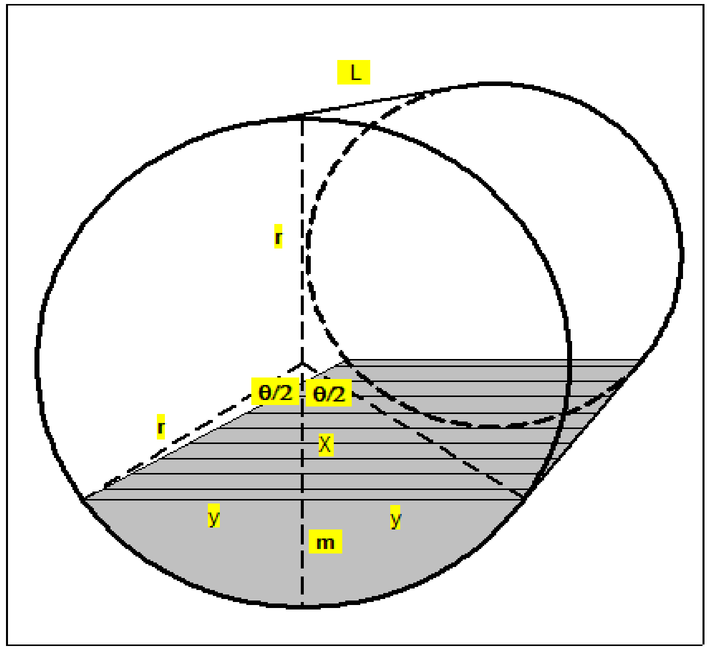
1 ft^3 =	7.48052	gallons

Increment #	measurement m (inches)	x = r-m (inches)	θ / 2 (radians)	y (inches)	$Area_{sector}$	$Area_{triangles}$	$Area_{fluid}$	Length	Volume (in^3)	Volume (ft^3)	Volume (gal)	Δ Volume
1	0.0	30	0.000	0.00	0.00	0.00	0.0	120.0	0.0	0.0	0.0	
2	0.5	29.5	0.183	5.45	164.55	160.90	3.6	120.0	437.1	0.3	1.9	1.9
3	1.0	29	0.259	7.68	233.03	222.75	10.3	120.0	1233.1	0.7	5.3	3.4
4	1.5	28.5	0.318	9.37	285.80	266.97	18.8	120.0	2259.7	1.3	9.8	4.4
5	2.0	28	0.367	10.77	330.49	301.57	28.9	120.0	3470.2	2.0	15.0	5.2
6	2.5	27.5	0.411	11.99	370.02	329.71	40.3	120.0	4837.3	2.8	20.9	5.9
7	3.0										27.5	6.5
8	3.5										34.5	7.1
9	4.0										42.1	7.5
10	4.5										50.0	8.0
11	5.0										58.5	8.4
12	5.5										67.3	8.8
13	6.0										76.4	9.2
14	6.5										86.0	9.5
15	7.0										95.8	9.8
16	7.5										106.0	10.2
17	8.0										116.4	10.5
18	8.5										127.2	10.7
19	9.0										138.2	11.0
20	9.5										149.4	11.3
21	10.0										160.9	11.5
22	10.5										172.6	11.7
23	11.0										184.6	12.0
24	11.5										196.8	12.2
25	12.0										209.1	12.4
26	12.5										221.7	12.6
27	13.0										234.4	12.8
28	13.5										247.4	12.9
29	14.0										260.5	13.1
30	14.5										273.7	13.3
31	15.0										287.2	13.4
32	15.5										300.7	13.6
33	16.0										314.4	13.7
34	16.5										328.3	13.9
35	17.0										342.3	14.0
36	17.5										356.4	14.1
37	18.0										370.6	14.2
38	18.5										384.9	14.3
39	19.0	11	1.195	27.91	1075.84	307.02	768.8	120.0	92258.3	53.4	399.4	14.4





$r := 30 \cdot in$ $L := 10 \cdot ft$ $\delta m := 1 \cdot in$ $m := 0 \cdot in, \delta m .. 2 \cdot r$ $V_{max} := \pi \cdot r^2 \cdot L = 1468.8\,gal$



x as a function of m $x(m) := r - m$

by observation $\cos\left(\frac{\theta}{2}\right) = \frac{x(m)}{r}$

(radians)

so... θ as a function of m $\theta(m) := 2 \cdot \operatorname{acos}\left(\frac{x(m)}{r}\right)$

by observation $\sin\left(\frac{\theta}{2}\right) = \frac{y(m)}{r}$

so... y as a function of m $y(m) := r \cdot \sin\left(\frac{\theta(m)}{2}\right)$

using the sector area formula $Area_{sector}(m) := \frac{r^2 \cdot \theta(m)}{2}$

the triangles area as a function of m $Area_{triangles}(m) := x(m) \cdot y(m)$

so... the fluid volume function (of m) is just: $Vol_{fluid}(m) := L \cdot \left(Area_{sector}(m) - Area_{triangles}(m)\right)$

checking a few obvious measurements: $Vol_{fluid}(0 \cdot in) = 0\,gal$ $Vol_{fluid}(30 \cdot in) = 734.4\,gal$ $Vol_{fluid}(60 \cdot in) = 1468.8\,gal$