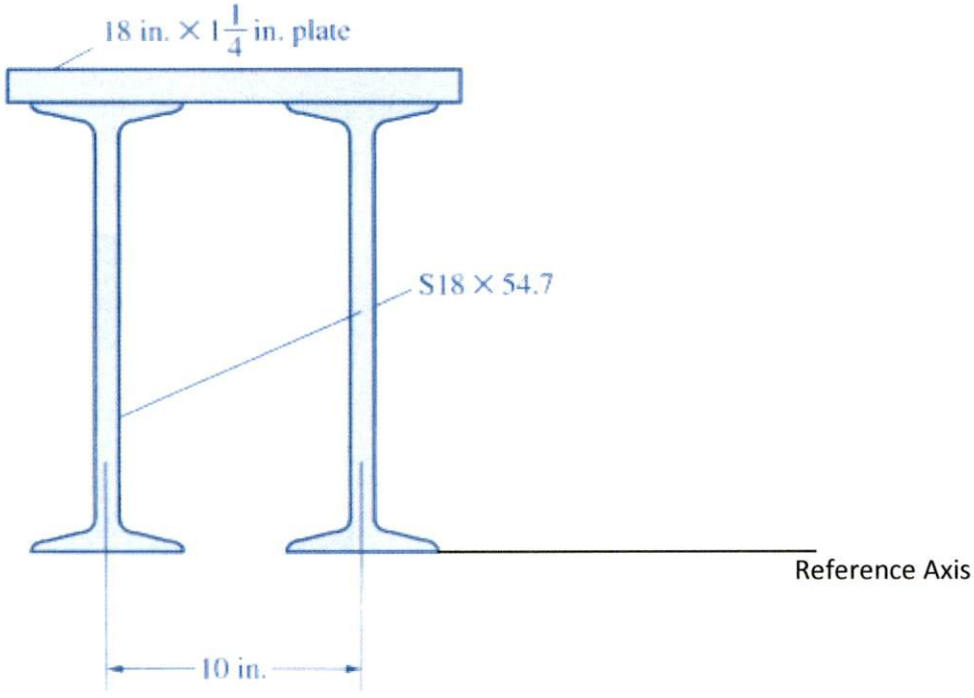
CMGT 340 - Quiz #12

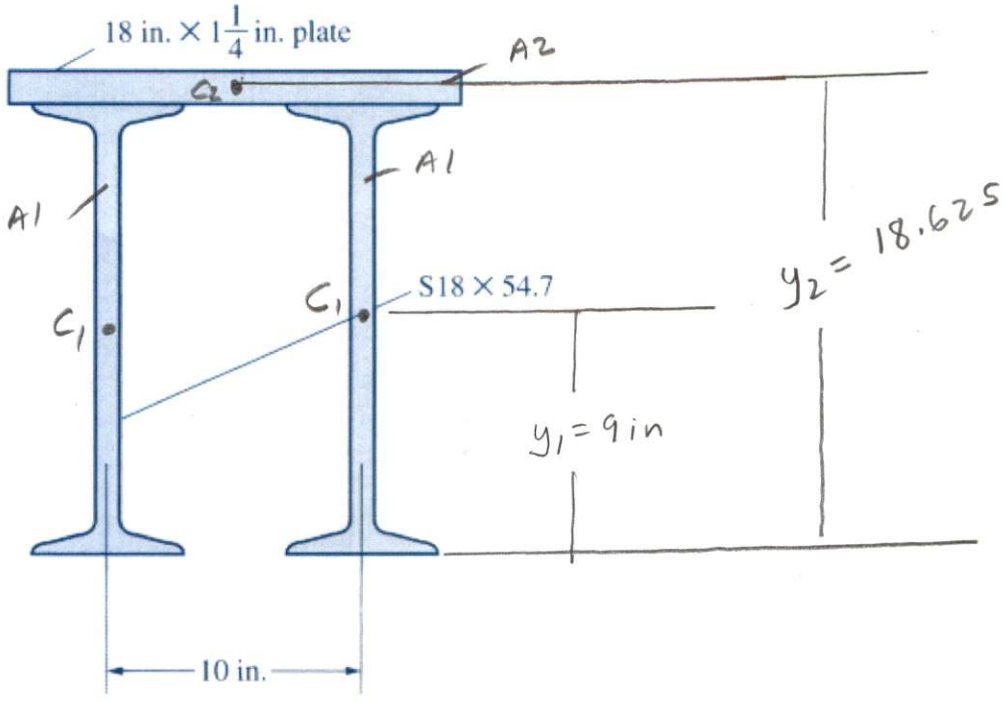
NAME: _____

1. Determine the Moment of Inertia and the radius of gyration of the section with respect to the horizontal centroidal axis. Use the Reference Axis shown.



(1)	(2)	(3)	(4)	(5)	(6)	(7)
Part	A (in^2)	y (in)	Ay (in^3)	$\bar{y}$-y (in)	A($\bar{y}$-y)^2 (in^4)	I (in^4)
Σ						

2. Determine the Moment of Inertia and the radius of gyration of the section with respect to the horizontal centroidal axis.



For S18×54.7

$A_1 = 16.1\ in^2$

$d = 18.00\ in$

$\bar{I}_{x_1} = 804\ in^4$

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Part	A (in^2)	y (in)	Ay (in^3)	$\bar{y}$-y (in)	$A(\bar{y}-y)^2$ (in^4)	I (in^4)
A1	16.1	9	144.9	3.96	252.47	804
A1	16.1	9	144.9	3.96	252.47	804
A2	18×1.25 = 22.5	18.625	419.0625	−5.665	722.075	$\frac{18(1.25)^3}{12} = 2.929$
Σ	54.7		708.8625		1227.015	1610.929

$$\bar{y} = \frac{\Sigma Ay}{\Sigma A} = \frac{708.8625}{54.7} = 12.96\ in$$

$$\bar{I}_x = I + A(\bar{y}-y)^2 = 1610.929 + 1227.015$$

$$= 2840\ in^4$$

$$r_x = \sqrt{\frac{\bar{I}_x}{A}} = \sqrt{\frac{2840\ in^4}{54.7\ in^2}} = 7.21\ in$$

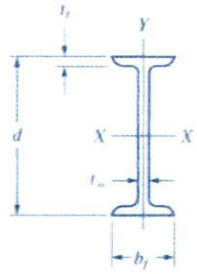


TABLE A–2(a) Properties of S Shapes (American Standard I-Beams): U.S. Customary Units

Designation	Area	Depth	Web Thickness	Flange Width	Flange Thickness	Elastic Properties						Plastic Modulus	
						Axis x–x			Axis y–y				
in. × lb/ft	A (in.^{2})	d (in.)	t_w (in.)	b_f (in.)	t_f (in.)	I (in.^{4})	S (in.^{3})	r (in.)	I (in.^{4})	S (in.^{3})	r (in.)	Z_x (in.^{3})	Z_y (in.^{3})
S24 × 121	35.6	24.50	0.800	8.050	1.090	3160	258	9.43	83.3	20.7	1.53	306	36.2
× 106	31.2	24.50	0.620	7.870	1.090	2940	240	9.71	77.1	19.6	1.57	279	33.2
S24 × 100	29.3	24.00	0.745	7.245	0.870	2390	199	9.02	47.7	13.2	1.27	240	23.9
× 90	26.5	24.00	0.625	7.125	0.870	2250	187	9.21	44.9	12.6	1.30	222	22.3
× 80	23.5	24.00	0.500	7.000	0.870	2100	175	9.47	42.2	12.1	1.34	204	20.7
S20 × 96	28.2	20.30	0.800	7.200	0.920	1670	165	7.71	50.2	13.9	1.33	196	24.9
× 86	25.3	20.30	0.660	7.060	0.920	1580	155	7.89	46.8	13.3	1.36	183	23.0
S20 × 75	22.0	20.00	0.635	6.385	0.795	1280	128	7.62	29.8	9.32	1.16	153	16.7
× 66	19.4	20.00	0.505	6.255	0.795	1190	119	7.83	27.7	8.85	1.19	140	15.3
S18 × 70	20.6	18.00	0.711	6.251	0.691	926	103	6.71	24.1	7.72	1.08	125	14.4
× 54.7	16.1	18.00	0.461	6.001	0.691	804	89.4	7.07	20.8	6.94	1.14	105	12.1
S15 × 50	14.7	15.00	0.550	5.640	0.622	486	64.8	5.75	15.7	5.57	1.03	77.1	9.97
× 42.9	12.6	15.00	0.411	5.501	0.622	447	59.6	5.95	14.4	5.23	1.07	69.3	9.02
S12 × 50	14.7	12.00	0.687	5.477	0.659	305	50.8	4.55	15.7	5.74	1.03	61.2	10.3
× 40.8	12.0	12.00	0.462	5.252	0.659	272	45.4	4.77	13.6	5.16	1.06	53.1	8.85
S12 × 35	10.3	12.00	0.428	5.078	0.544	229	38.2	4.72	9.87	3.89	0.980	44.8	6.79
× 31.8	9.35	12.00	0.350	5.000	0.544	218	36.4	4.83	9.36	3.74	1.00	42.0	6.40
S10 × 35	10.3	10.00	0.594	4.944	0.491	147	29.4	3.78	8.36	3.38	0.901	35.4	6.22
× 25.4	7.46	10.00	0.311	4.661	0.491	124	24.7	4.07	6.79	2.91	0.954	28.4	4.96
S 8 × 23	6.79	8.00	0.441	4.171	0.426	64.9	16.2	3.10	4.31	2.07	0.798	19.3	3.68
× 18.4	5.41	8.00	0.271	4.001	0.426	57.6	14.4	3.26	3.73	1.86	0.831	16.5	3.16
S 7 × 20	5.88	7.00	0.450	3.860	0.392	42.4	12.1	2.69	3.17	1.64	0.734	14.5	2.96
× 15.3	4.50	7.00	0.252	3.662	0.392	36.7	10.5	2.86	2.64	1.44	0.766	12.1	2.44
S 6 × 17.3	5.07	6.00	0.465	3.565	0.359	26.3	8.77	2.28	2.31	1.30	0.675	10.6	2.36
× 12.5	3.67	6.00	0.232	3.332	0.359	22.1	7.37	2.45	1.82	1.09	0.705	8.47	1.85
S 5 × 14.8	4.34	5.00	0.494	3.284	0.326	15.2	6.09	1.87	1.67	1.01	0.620	7.42	1.88
× 10	2.94	5.00	0.214	3.004	0.326	12.3	4.92	2.05	1.22	0.809	0.643	5.67	1.37
S 4 × 9.5	2.79	4.00	0.326	2.796	0.293	6.79	3.39	1.56	0.903	0.646	0.569	4.04	1.13
× 7.7	2.26	4.00	0.193	2.663	0.293	6.08	3.04	1.64	0.764	0.574	0.581	3.51	0.964
S 3 × 7.5	2.21	3.00	0.349	2.509	0.260	2.93	1.95	1.15	0.586	0.468	0.516	2.36	0.826
× 5.7	1.67	3.00	0.170	2.330	0.260	2.52	1.68	1.23	0.455	0.390	0.522	1.95	0.653