Problem 11a-4 – Determine the moments at each support. Assume *A* is fixed. *EI* is constant.

12 k

4 k/ft

PINNED END

A B C D

|—20 ft—|—15 ft—|—8 ft—|—8 ft—|
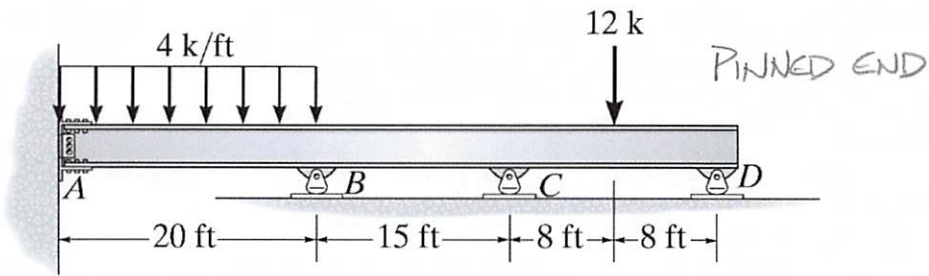
$$FEM_{AB} = \frac{WL^2}{12} = \frac{4k/ft\,(20\,ft)^2}{12} = \pm 135.33\,k\,ft$$

$$FEM_{CD} = \frac{3PL}{16} = \frac{3(12k)(16\,ft)}{16} = -36\,k\,ft$$

FIXED
$$DF_{AB} = 0$$

PINNED
$$DF_{DC} = 1$$

$$4EI$$

$$\downarrow$$

$$k = \frac{4EI}{L} \quad FIXED$$

$$k = \frac{3EI}{L} \quad PINNED$$

$$DF_{BA} = \frac{k_{BA}}{k_{BA} + k_{BC}} = \frac{1/20}{1/20 + 1/15} = 0.4286$$

$$DF_{BC} = 0.5714$$

$$DF_{CB} = \frac{k_{CB}}{k_{CB} + k_{CD}} = \frac{4/15}{4/15 + 3/16} = 0.5872$$

$$DF_{CD} = 0.4128$$

Example 11a-4

Determine the reactions at the supports. Assume A is fixed and B and C are rollers that can either push or pull on the beam. EI is constant.

Pinned end use 3EI/L

Joint	AB	B		C		D
Members	AB	BA	BC	CB	CD	DC
DF	0	0.429	0.571	0.587	0.413	1
FEM	-133.33	133.333			-36.000	
Dist.		-57.143	-76.190	21.138	14.862	
CO	-28.57		10.569	-38.095		
Dist.		-4.529	-6.039	22.368	15.727	
CO	-2.26		11.184	-3.020		
Dist.		-4.793	-6.391	1.773	1.247	
CO	-2.40		0.887	-3.195		
Dist.		-0.380	-0.507	1.876	1.319	
CO	-0.19		0.938	-0.253		
Dist.		-0.402	-0.536	0.149	0.105	
CO	-0.20		0.074	-0.268		
Dist.		-0.032	-0.042	0.157	0.111	
CO	-0.02		0.079	-0.021		
Dist.		-0.034	-0.045	0.012	0.009	
Sum	-166.97	66.02	-66.02	2.62	-2.62	0.00

4 k/ft   12 k

A   B   C   D

20 ft — 15 ft — 8 ft — 8 ft
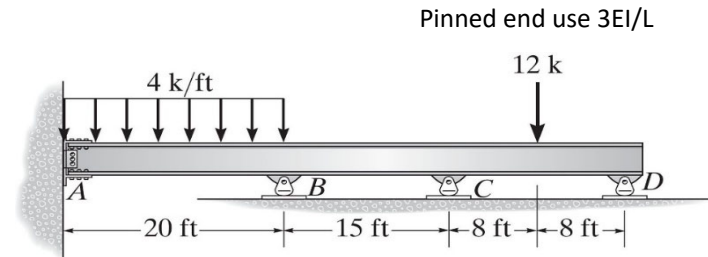
k_{BA} 4EI/L = 0.2000 k_{BC} 4EI/L = 0.2667
DF_{BA} 0.4286 DF_{BC} 0.5714

k_{CB} 4EI/L = 0.2667 k_{CD} 3EI/L = 0.1875
DF_{CB} 0.5872 DF_{BD} 0.4128

FEM_{AB} 133.33 kN m
FEM_{CD} 36.00 kN m