Table of Contents

Shear Force & Bending Moment Examples

```
%     This program calculates the shear force and bending moment
 profiles, draw
%     the free body, shear force and bending moment diagrams of the
 problem.
%
%     Under the free body diagram, the equations of each section is
 clearly
%     written with Latex
%
```

How to call the function

```
To use this program, you call the function placing the arguments in cel
with keywords at the beginning of each cell except for the first 2 argu
```

First Argument

```
The first argument is the name of the problem as a string e.g.: 'PROB 1
```

Second Argument

```
-Simply supported beam
The second argument is a row vector containing length of the beam and
location of the supports, for example, if the length of the beam is 20m
has 2 supports, one at 3m and the other at 17m, the second argument wil
```

thus be: [20, 3, 17]

-Cantilever

If the problem is a cantilever problem, then you have only one clamped support, at the beginning or end of the beam. In such a case, the numbe second argument contains 2 elements instead of three. For instance, fir cantilever of length 20m, supported at the beginning, the second argume would be [20,0], and if supported at the end, we have [20,20].

-Beam on the floor

Its possible to have a problem in which the body is lying on the floor without any point support. In such scenario, the second argument will j be the length of the beam

Third argument and on

From the third argument and onward, we use cells. The first element of cell contains a keyword describing what type of load is inside the argu The second element is the magnitude of the load while, the third elemen a cell argument is its location.

```
Keywords: Point Load       = 'CF'
          Moment           = 'M'
          Distributed Load = 'DF'
```

To add a downward point load of magnitude 5N at location 4m, the argume would be {'CF',-5,4}. Note the negative sign. If the force is acting up the argument would be {'CF',5,4};

Examples

Moment(Torque)

To add a clockwise moment of magnitude 10N-m at location 14m, the argum would be {'M',-10,14}. Note the negative sign. If the moment is anticlo the argument would be {'M',10,14};

Concentrated Load(Torque)

To add a downward force of magnitude 10N at location 14m, the argument would be {'CF',-10,14}. Note the negative sign. If the moment is upward the argument would be {'CF',10,14};

Distributed Force

To add distributed load we need to describe all of them with the minimu

number of point required to describe the profile with the highest complexity. For example, {'DF',[5,5],[2,10]}, or {'DF',[1,4,5],[2,8,10 There is no limit to the number degree of polynomial that can be used.

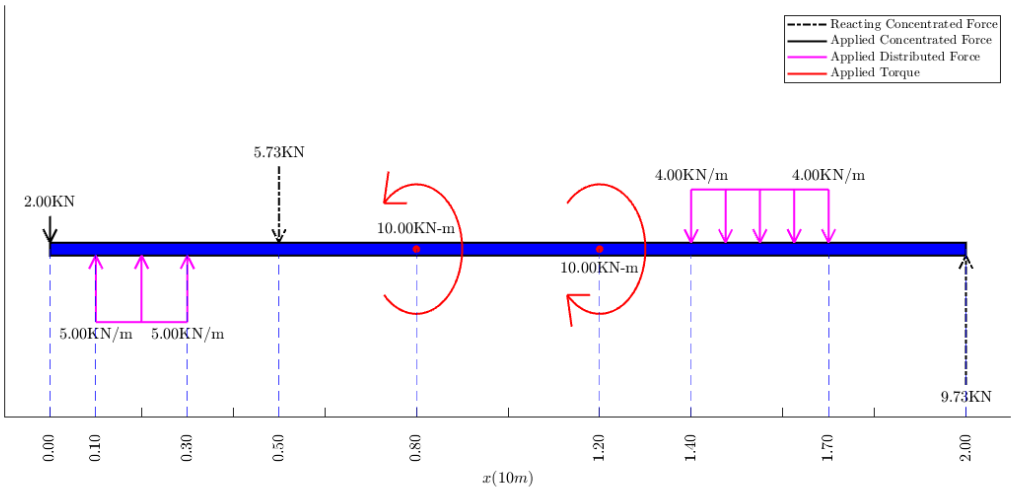
Note

its is important that all concentrated loads and torques are listed in order of locations

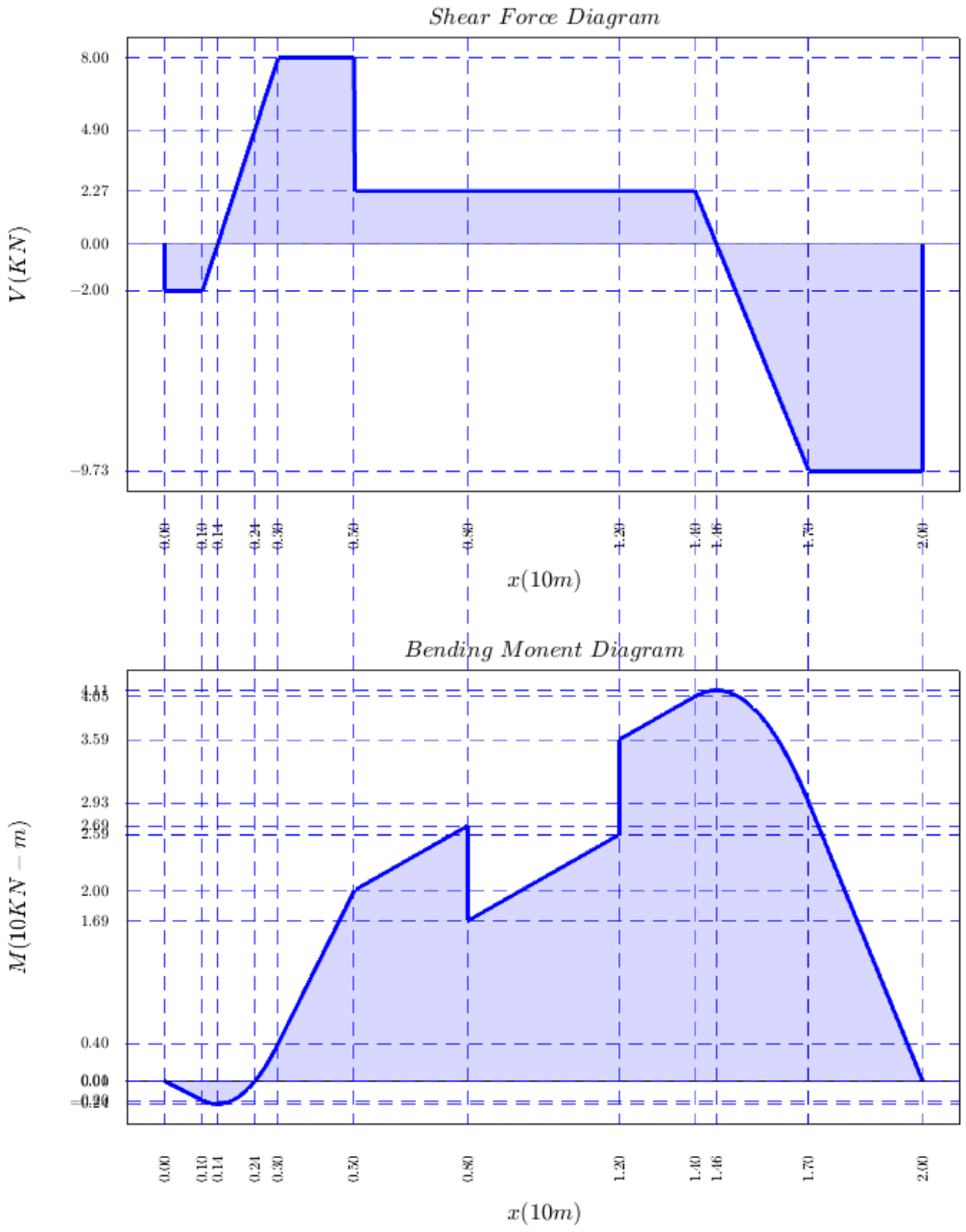
```
%Problem Name
Name1 = 'Prob 1';
% Length and Supports
LengthSupport1 = [20,5,20]; % length  = 20m, supports at 5m and 20m;
% Concetrated Loads
F1 = {'CF',-2,0};  % 2N downward at point 0
% Torques
T1 = {'M',10,8}; T2 = {'M',-10,12}; % ACW 10Nm at point 8m and CW 10Nm
 at point 12
% Distributed Loads
D1 = {'DF',5,[1,3]}; D2 = {'DF',-4,[14,17]}; % Constant 5N/m upwards
 from 1m to 3m and Constant 4N/m downwards from 14m to 17m
% Call the function
SFBM(Name1,LengthSupport1,F1,T1,D1,T2,D2);


%Problem Name
Name2 = 'Prob 2';
% Length and Supports
LengthSupport2 = [9,2,7];
% Concetrated Loads
F2 = {'CF',-400,3};
% Distributed Loads
D3 = {'DF',-400,[0,2]}; D4 = {'DF',-200,[3,9]};
% Call the function
SFBM(Name2,LengthSupport2,F2,D4,D3);
```

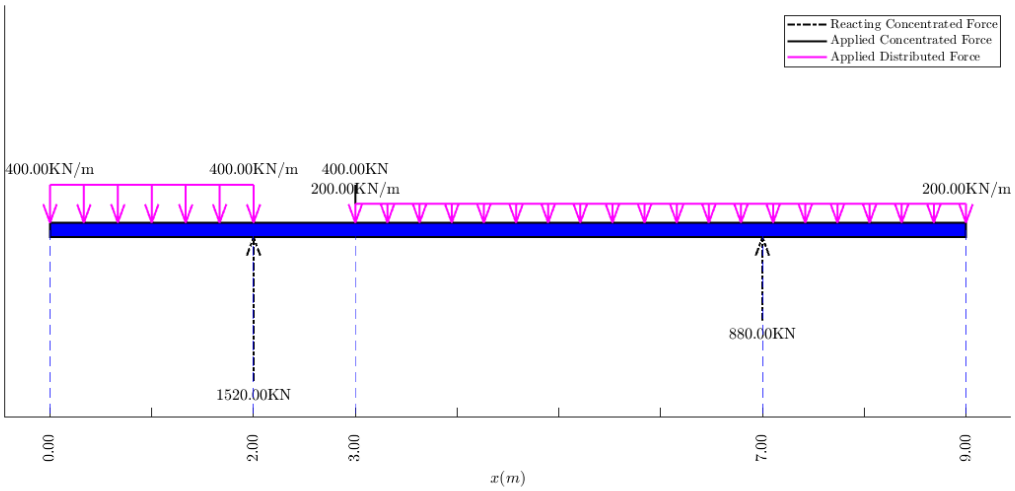
Free Body Diagram



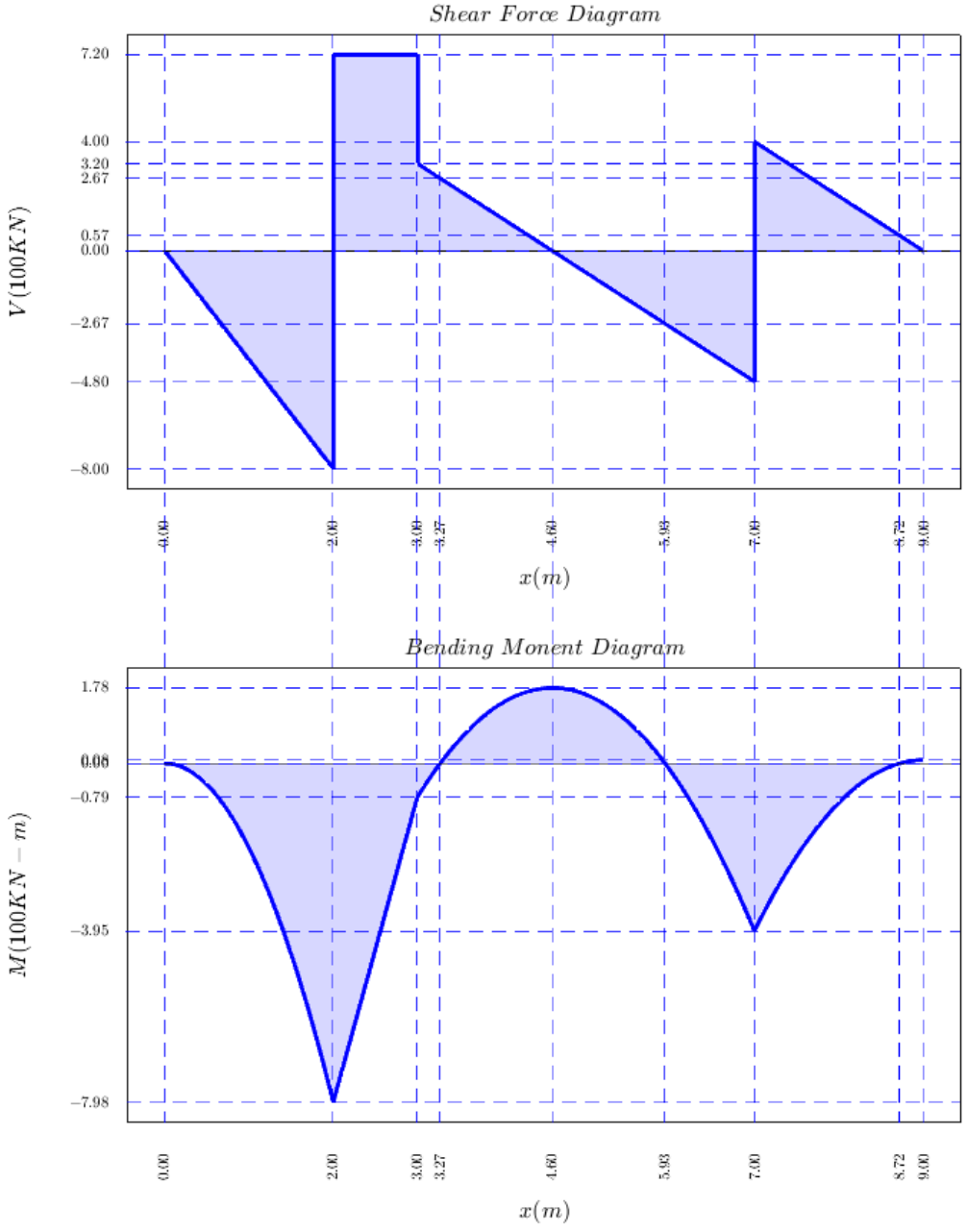
Range	*Equations of Shear Force* :	*Equations of Bending Moment* :
0 *to* 1	-2	$-2x$
1 *to* 3	$5x - 7$	$2.5x^2 - 7x + 2.5$
3 *to* 5	8	$8x - 20$
5 *to* 8	2.267	$2.267x + 8.724$
8 *to* 12	2.267	$2.267x - 1.276$
12 *to* 14	2.267	$2.267x + 8.724$
14 *to* 17	$-4x + 58.267$	$-2x^2 + 58.267x - 383.276$
17 *to* 20	-9.733	$-9.733x + 194.724$


Shear Force Diagram
8.00
4.90
2.27
0.00
−2.00
−9.73
V(KN)
0.00
0.10
0.14
0.24
0.30
0.50
0.80
1.20
1.40
1.46
1.70
2.00
x(10m)
Bending Moment Diagram
4.11
3.59
2.93
2.60
2.00
1.69
0.40
M(10KN − m)
0.00
0.10
0.14
0.24
0.30
0.50
0.80
1.20
1.40
1.46
1.70
2.00
x(10m)

Free Body Diagram



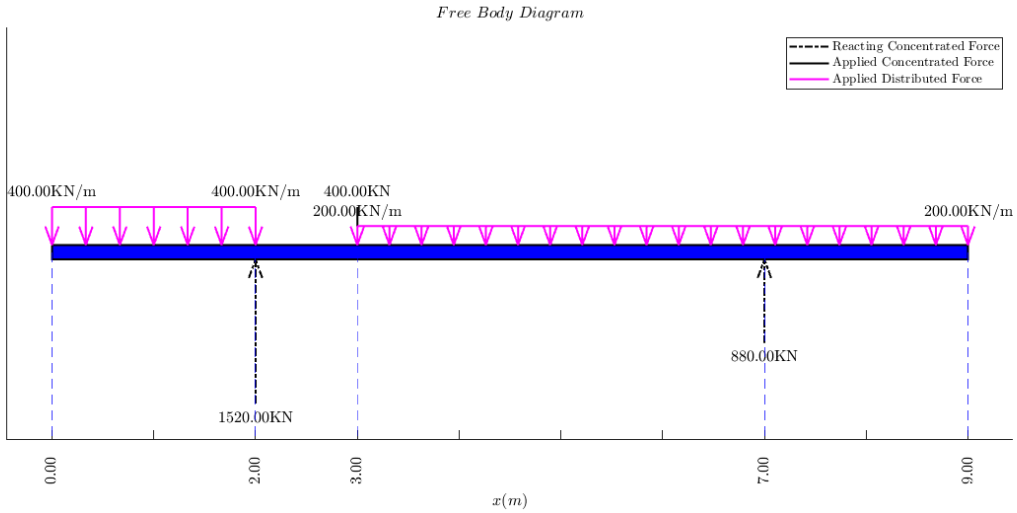
Range	*Equations of Shear Force* :	*Equations of Bending Moment* :
0 *to* 2	$-400x$	$-200x^2$
2 *to* 3	720	$720x - 2236.961$
3 *to* 7	$-200x + 920$	$-100x^2 + 920x - 1938.163$
7 *to* 9	$-200x + 1800$	$-100x^2 + 1800x - 8092.009$


Shear Force Diagram
7.20
4.00
3.20
2.67
0.57
0.00
−2.67
−4.80
−8.00
V(100KN)
0.00
2.00
3.00
3.27
4.60
5.93
7.00
8.72
9.00
x(m)
Bending Moment Diagram
1.78
0.00
−0.79
−3.95
−7.98
M(100KN − m)
0.00
2.00
3.00
3.27
4.60
5.93
7.00
8.72
9.00
x(m)

More Examples from Mechanics of Materials (7th Edition) Ferdinand Beer and Russel Johnston

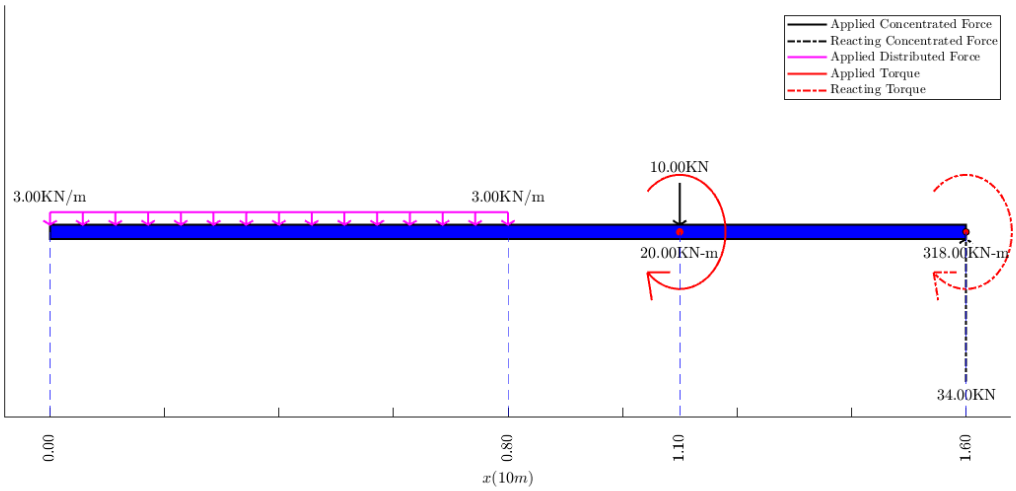
Eaxmple 1

```
Name1 = 'Sample Problem 5_2';
% Length and Supports
LengthSupport1 = [16,16];
% Concetrated Loads
F1_1 = {'CF',-10,11};
% Turning loads, Torque
T1_1 = {'M',-20,11};
% Distributed Loads
D1_1 = {'DF',-3,[0,8]};
% Call the function
SFBM(Name1,LengthSupport1,F1_1,T1_1,D1_1);
```

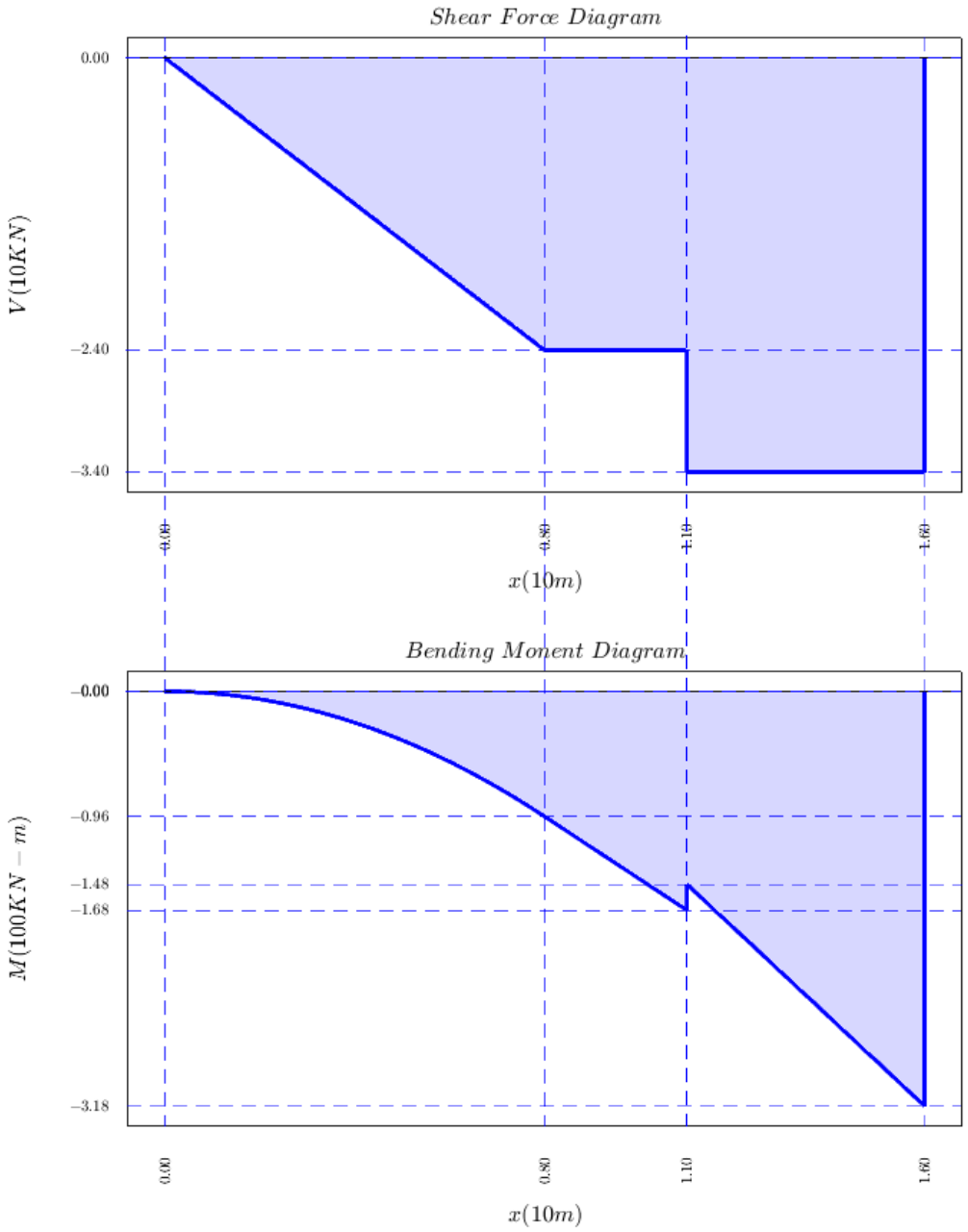


Range	*Equations of Shear Force* :	*Equations of Bending Moment* :
0 *to* 2	$-400x$	$-200x^2$
2 *to* 3	720	$720x - 2236.961$
3 *to* 7	$-200x + 920$	$-100x^2 + 920x - 1938.163$
7 *to* 9	$-200x + 1800$	$-100x^2 + 1800x - 8092.009$

Free Body Diagram



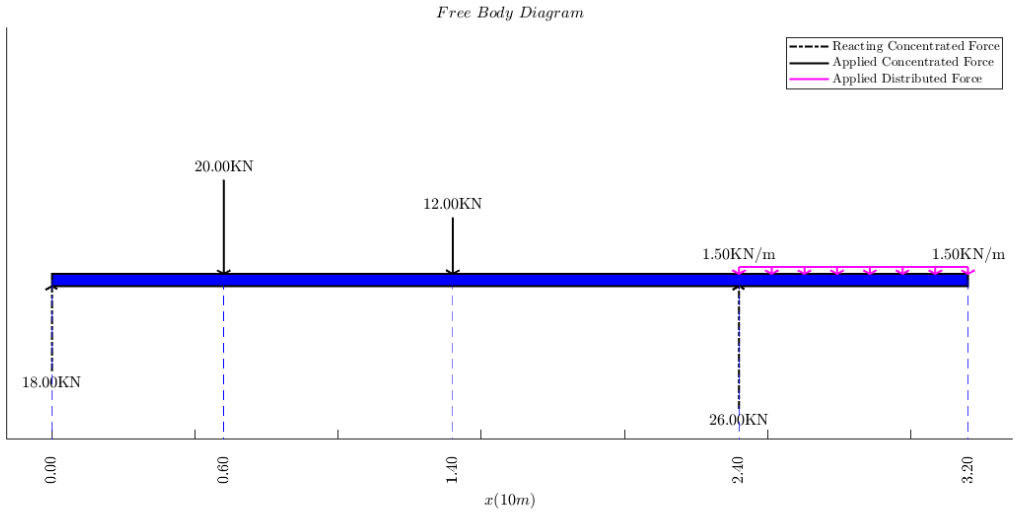
Range	*Equations of Shear Force* :	*Equations of Bending Moment* :
0 *to* 8	$-3x$	$-1.5x^2$
8 *to* 11	-24	$-24x + 96$
11 *to* 16	-34	$-34x + 225.92$



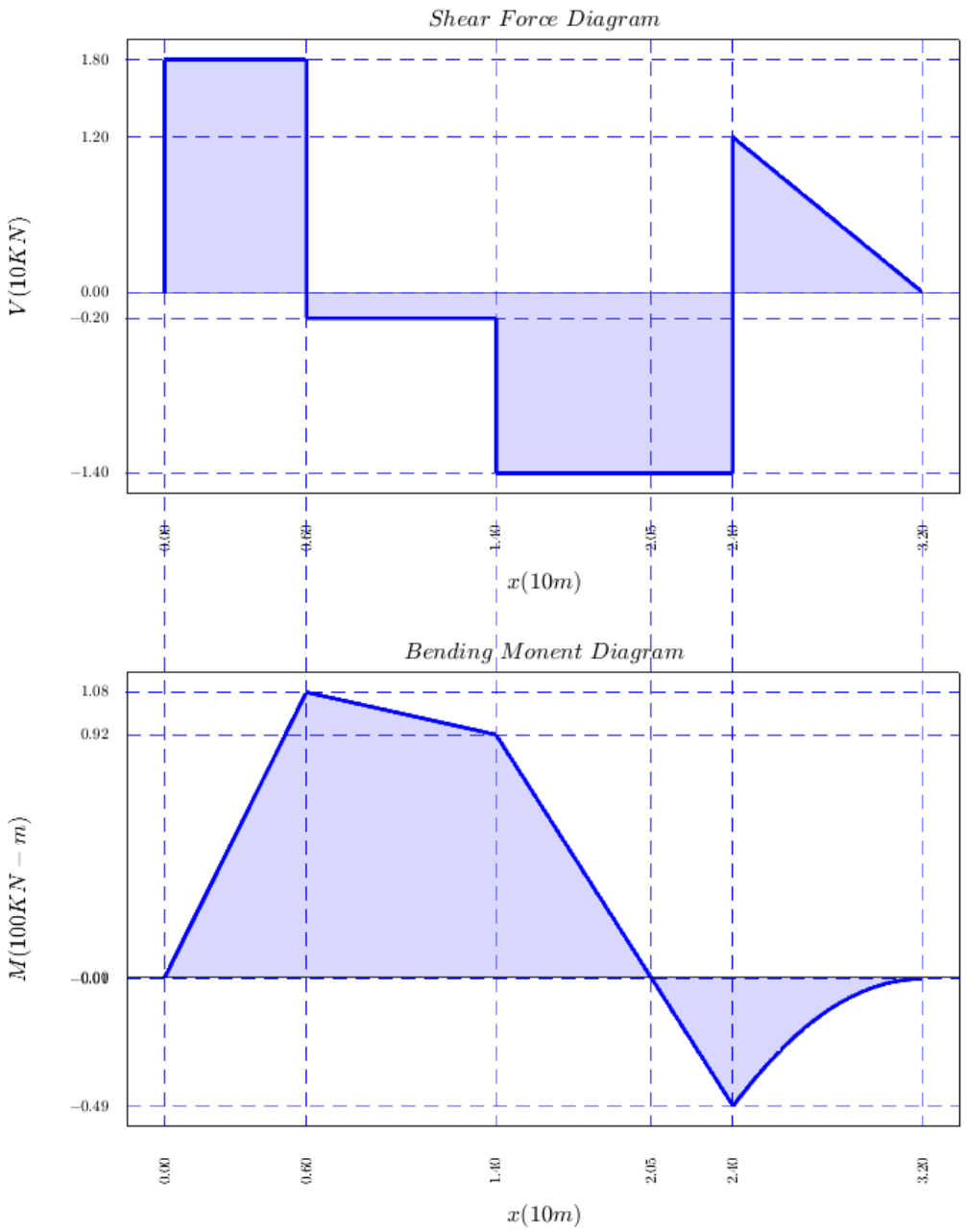
Eaxmple 2

```
Name2 = 'Sample Problem 5_3';
% Length and Supports
LengthSupport2 = [32, 0, 24];
% Concetrated Loads
F2_1 = {'CF',-20,6}; F2_2 = {'CF',-12,14};
% Distributed Loads
```

```
D2_1 = {'DF',-1.5,[24,32]};
% Call the function
SFBM(Name2,LengthSupport2,F2_1,F2_2,D2_1);
```



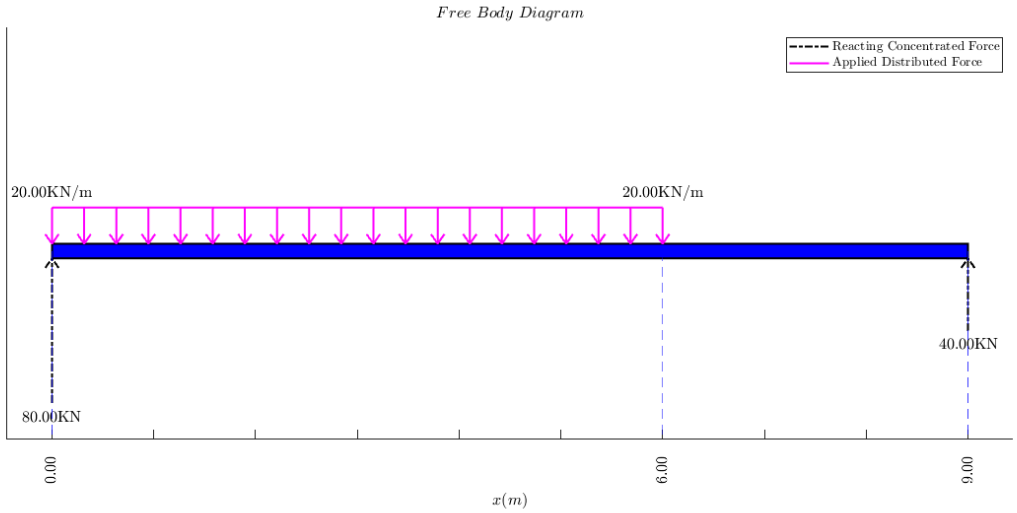
Range	*Equations of Shear Force* :	*Equations of Bending Moment* :
0 *to* 6	18	$18x$
6 *to* 14	-2	$-2x + 119.68$
14 *to* 24	-14	$-14x + 287.488$
24 *to* 32	$-1.5x + 48$	$-0.75x^2 + 48x - 768.512$



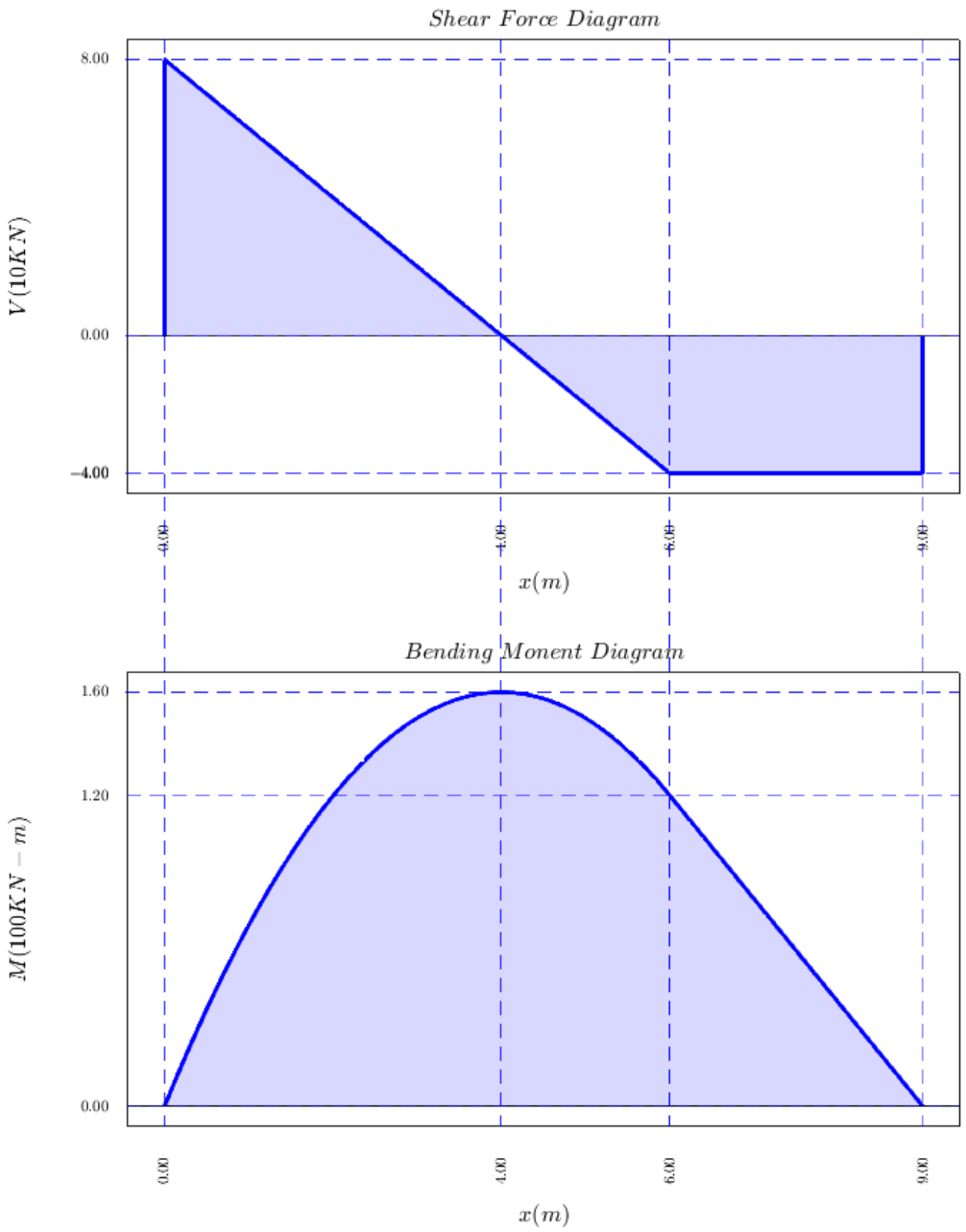
Eaxmple 3

```
Name3 = 'Sample Problem 5_4';
% Length and Supports
LengthSupport3 = [9, 0, 9];
% Distributed Loads
D3_1 = {'DF',-20,[0,6]};
% Call the function
```

```
SFBM(Name3,LengthSupport3,D3_1);
```



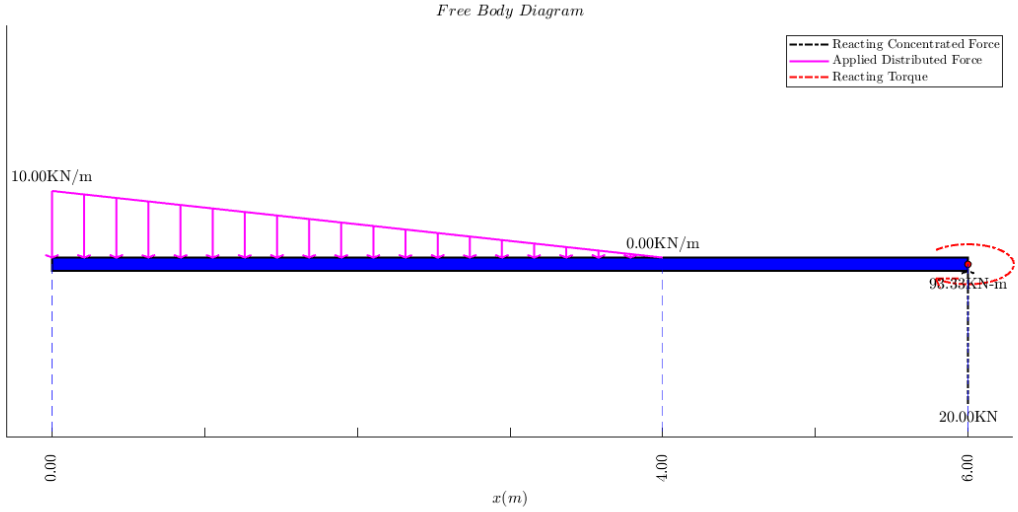
Range	*Equations of Shear Force* :	*Equations of Bending Moment* :
0 *to* 6	$-20x + 80$	$-10x^2 + 80x$
6 *to* 9	-40	$-40x + 360$



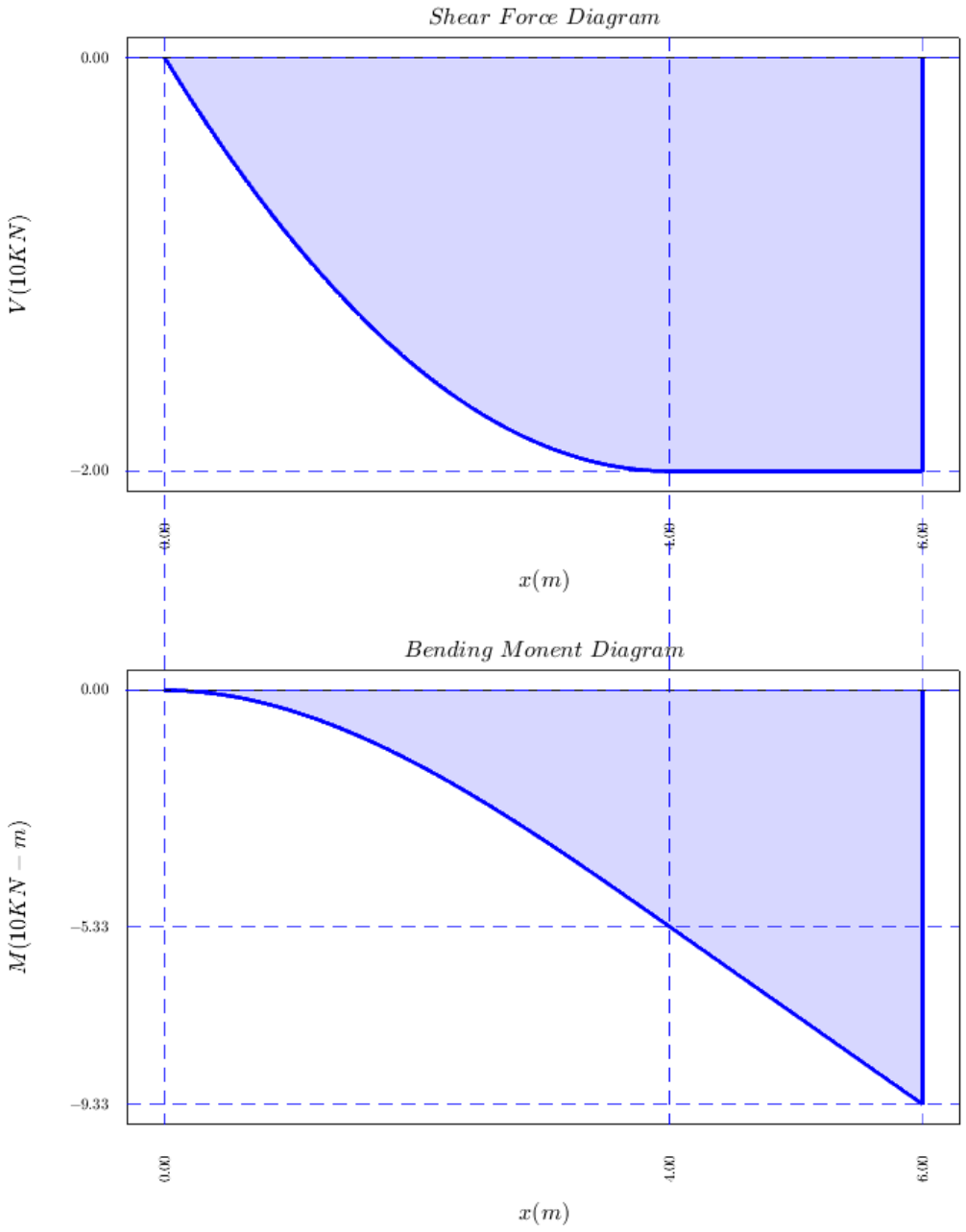
Eaxmple 4

```
Name4 = 'Sample Problem 5_5';
w0 = 10; a = 4; L = 6;
% Length and Supports
LengthSupport4 = [L, L];
% Distributed Loads
D4_1 = {'DF',[-w0,0],[0,a]};
```

```
% Call the function
SFBM(Name4,LengthSupport4,D4_1);
```



Range	*Equations of Shear Force* :	*Equations of Bending Moment* :
0 *to* 4	$1.25x^2 - 10x$	$0.417x^3 - 5x^2$
4 *to* 6	-20	$-20x + 26.667$



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