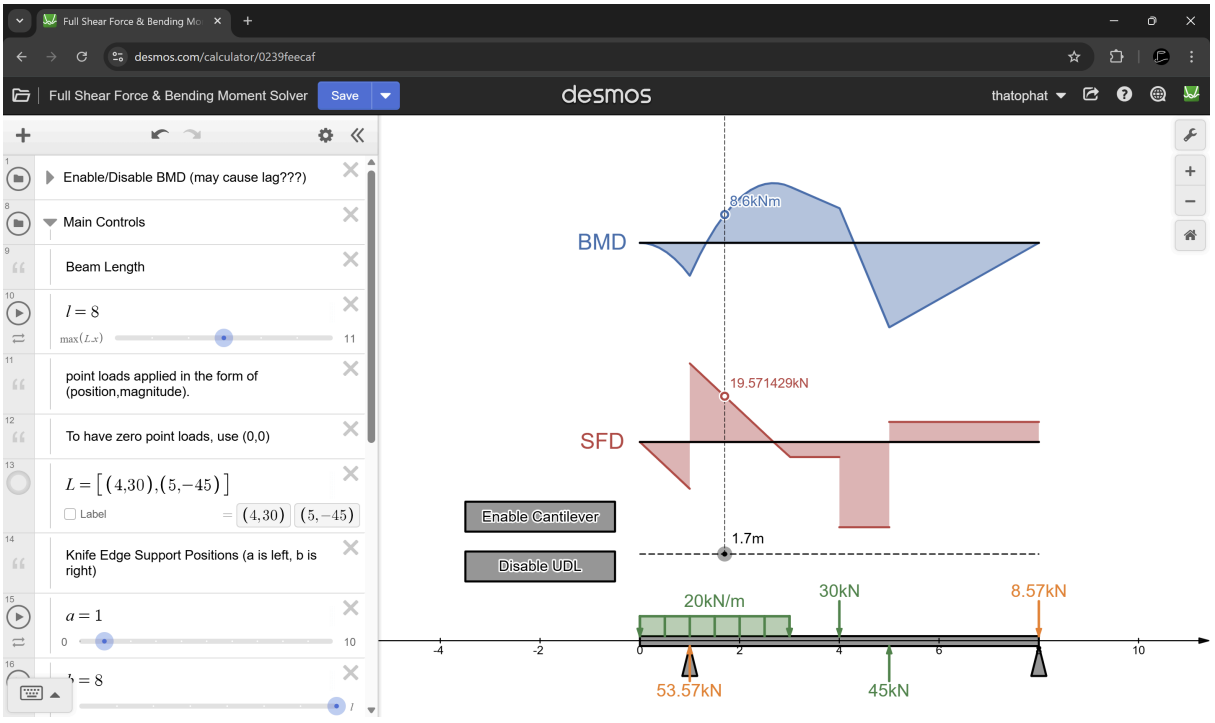
MECH2 SFBM Calculator (use guide)

the calculator: https://www.desmos.com/calculator/0239feecaf



What does this do?

→ This calculator takes in the loading conditions of a beam, along with its properties, and provides scale graphs of the shear force and bending moment diagrams.

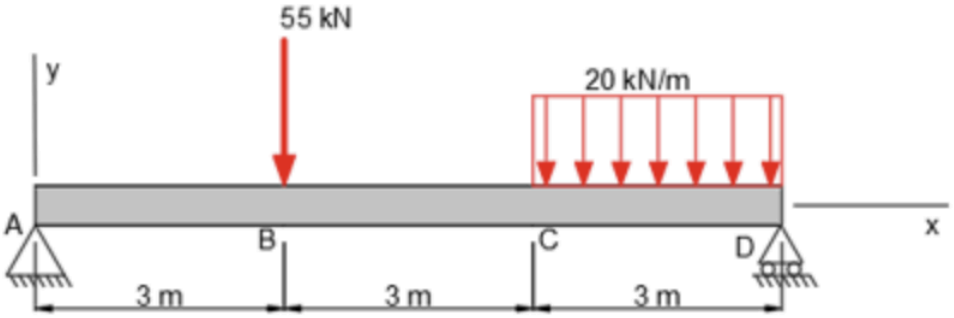
What are the limits of this?

→ Currently, only knife edge or cantilever beams are supported, with only point loads or UDLs. There is also only a maximum of one UDL allowed. Couples, non-uniform distributed loads, or multiple UDLs are not supported.

How do i use it?

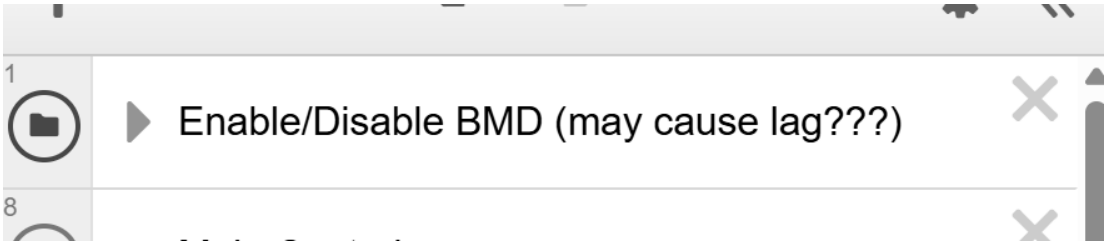
Example with knife edge supports, point loads and UDLs.

Say we wanted to find the SF and BM diagrams of this beam:



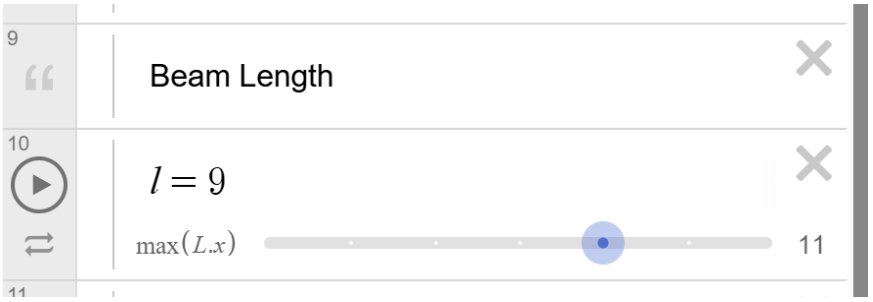
0. Disable BMD

   the BMD is calculated using integrals and is thus slow to compute and may be laggy. You may click the folder icon on the left to disable the BMD, which makes the other steps faster



1. Beam Length

   The length of the beam is 9m, hence set $l = 9$ here:



   l is set to be a positive integer, but can be non-integer values.

2. Point Loads

In the example, there is a point load 3m to the left of A and is 55kN.

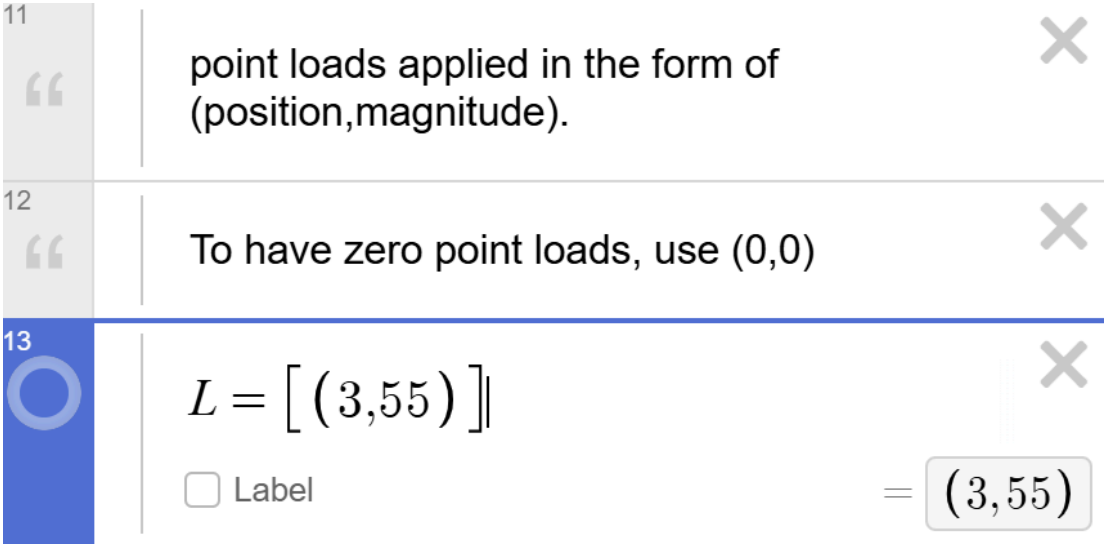
To express this in the calculator, write every point load as a pair of coordinates, of

$$(\text{position from left side of beam}, \text{magnitude of force applied})$$

where the magnitude is negative if the force is upwards.

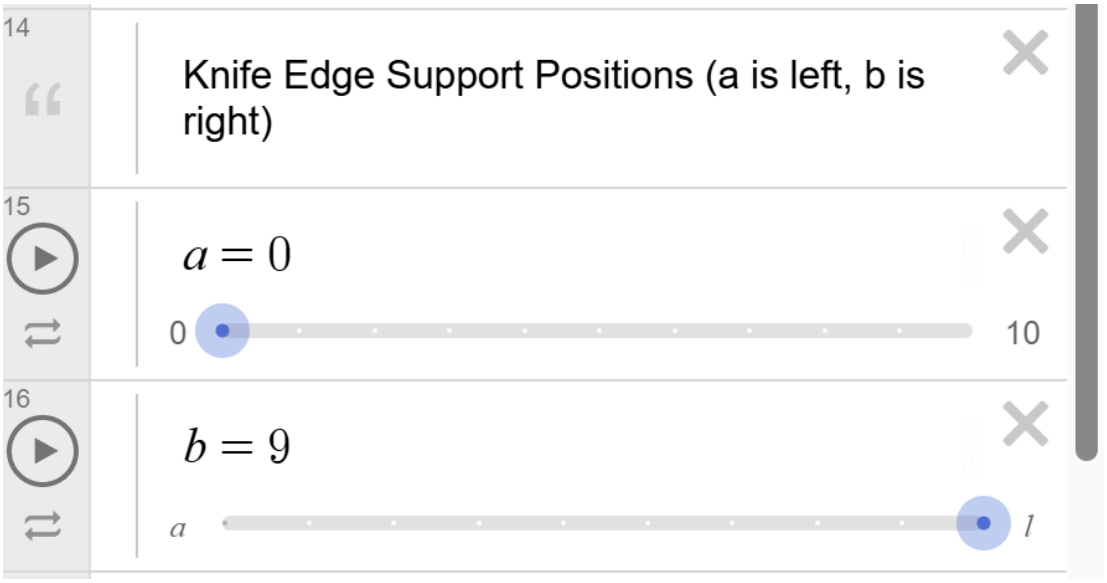
Thus, the point load at B in the question is represented as (3,55).

Then, write all of the point load coordinates in the list L.



3. Knife Edge Supports

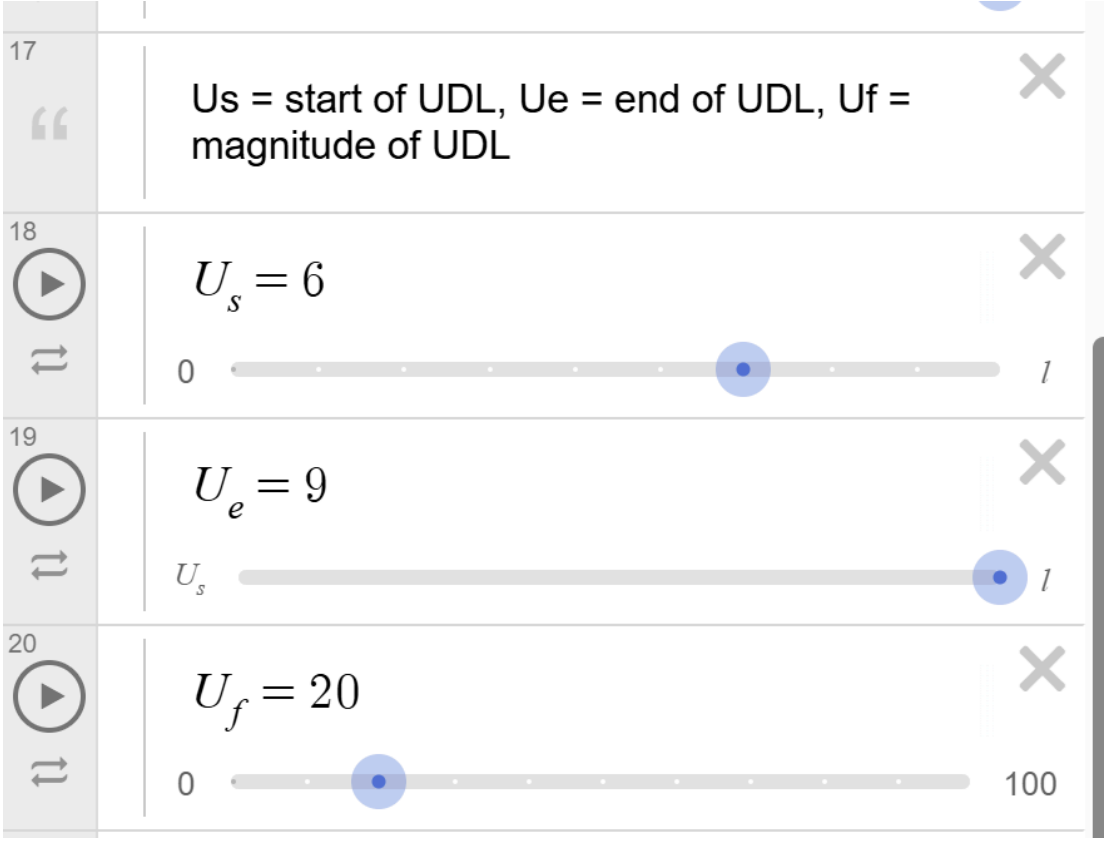
   the values a and b represent the position of the knife edge supports along the beam. a is the leftmost support, which in this case is at the left end of the beam, thus $a = 0$. the right support is at the rightmost end of the beam, thus we drag the b slider all the way to the right so that $b = l$.



4. UDL

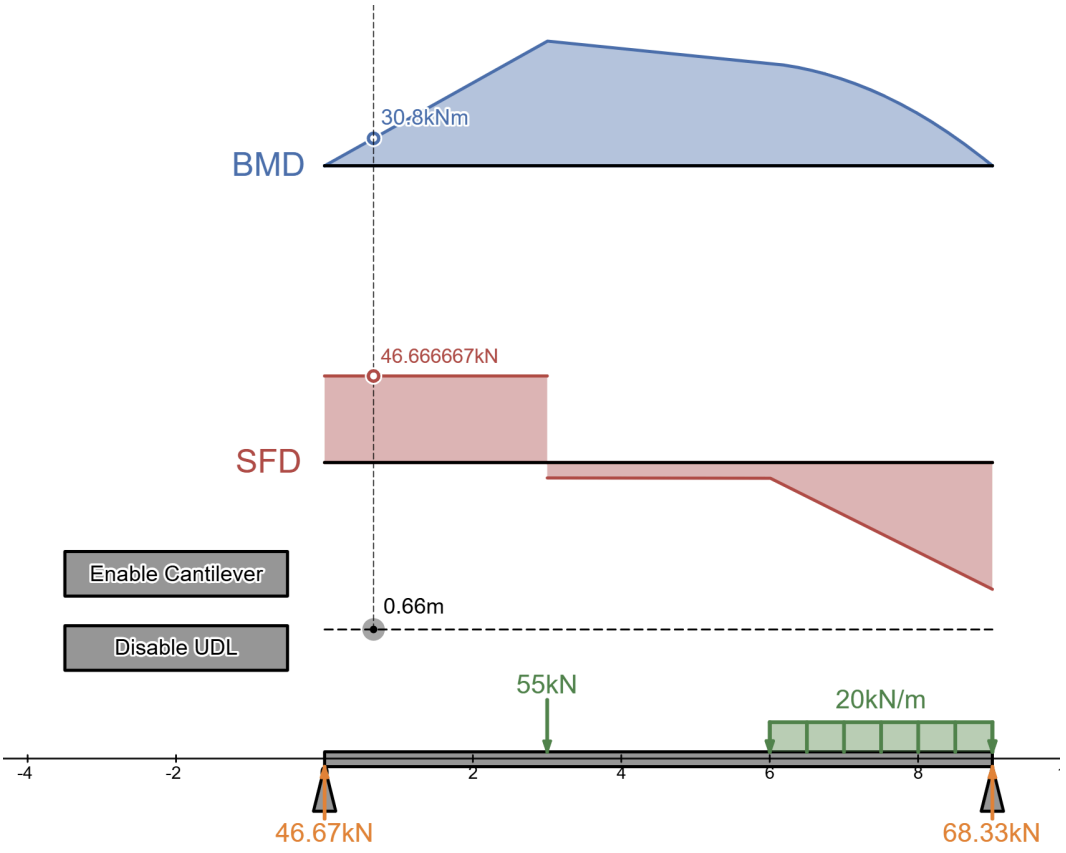
   The diagram shows a 20kN/m UDL from C to D, aka from 6m to the left of the beam to 9m to the left of the beam. We use the U values $[U_s, U_e, U_f]$ to set the position and magnitude of the UDL.

   Since the UDL starts from 6m to the left of the beam, we set $U_s = 6$, and since it ends at 9m to the left of the beam, we set $U_e = 9$. Then, the magnitude is set with $U_f = 20$.



5. profit

   Now, re-enable the BMD and you can view your to-scale SFD and BMD diagrams!



   The calculator finds the reaction forces for you, as well as the shear force or bending moment at any point along the beam, by dragging the black point.

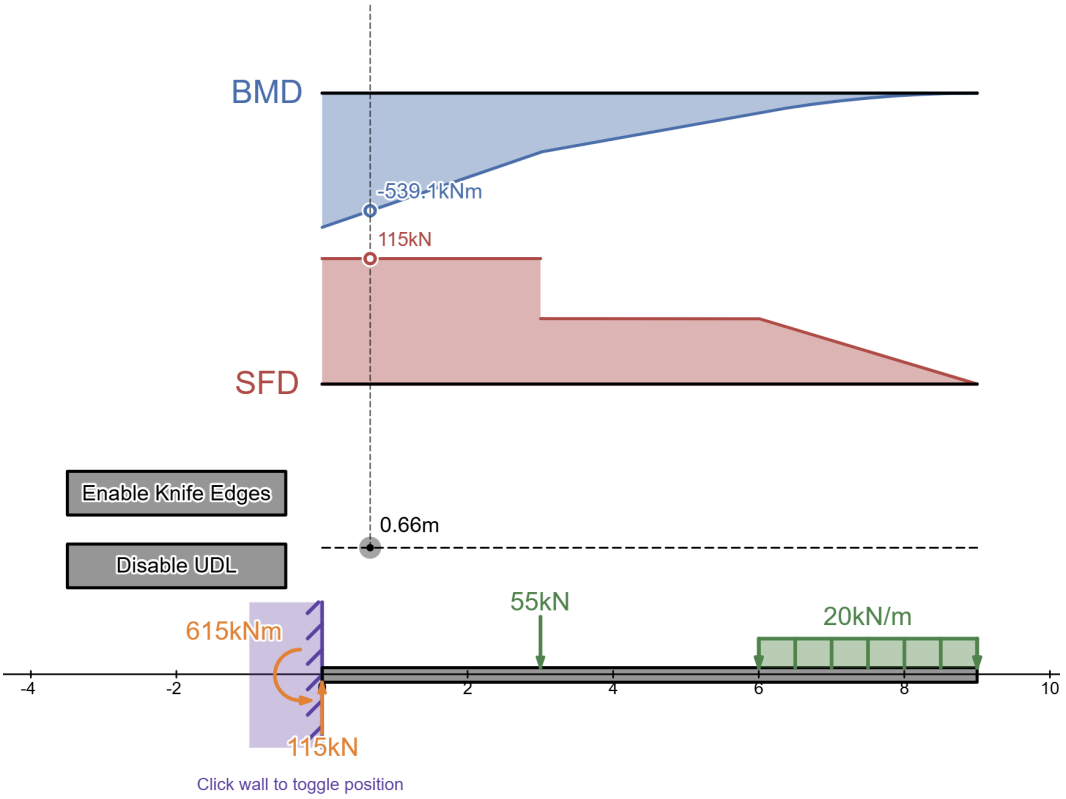
Other buttons

On the right are two buttons, that can be used for other problems.

The disable UDL button removed the UDL, if the question only involves point loads.

The “Enable Cantilever” button is for problems involving cantilevers, and gives you the reaction force and couple of the fixed end.

If the cantilever’s fixed end is on the other side, clicking the purple wall toggles the position, and moves it to the other side, recalculating accordingly.



And that's it!

I found that making this resource gave me a better understanding of what SFBM diagrams were actually measuring, and helped me to check my tutorial answers, since SFBM diagrams are typically not given in the answer keys.