Suspension Bridge

Karin Rodriguez

McLennan Community College

Faculty Sponser: Gail Illich

Definition

- the deck is hung below suspension cables on vertical suspenders
- The basic structural components of a suspension bridge system
  - stiffening girders/trusses
  - main suspension cables
  - main towers
  - anchorages for the cables

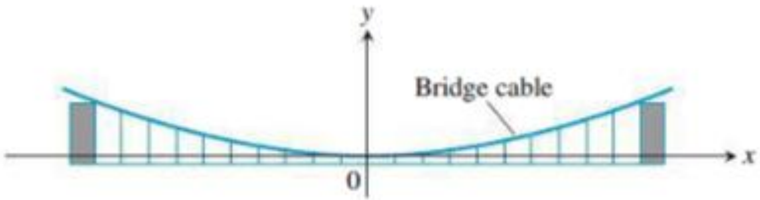
History

- Bridges of all shapes and forms were established throughout history but the suspension bridge is a reliable work of engineering that has maintained its durability.
- The earliest versions conceived in the 15th century but modern designs in 1959.
- Wood and rope to steel and wire

70. Suspension bridge cables hang in parabolas The suspension bridge cable shown in the accompanying figure supports a uniform load of w pounds per horizontal foot. It can be shown that if H is the horizontal tension of the cable at the origin, then the curve of the cable satisfies the equation

$$\frac{dy}{dx} = \frac{w}{H}x.$$

Show that the cable hangs in a parabola by solving this differential equation subject to the initial condition that $y = 0$ when $x = 0$.



Problem

Work

1) Write the equation as an integral
2) Using the constant multiple integral property, you can remove the constant *w/H*
3) Evaluate the integral *x dx*
4) Multiply the constant with the evaluated integral and include the constant *C*
5) Substitute y and x for 0
6) Solve and prove the equation

$$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{w}{H}x \qquad \int \frac{w}{H}x \cdot \mathrm{d}x \qquad \frac{w}{H}\int x \cdot \mathrm{d}x$$

$$y = \frac{w}{H} \cdot \frac{x^2}{2} \qquad y = \frac{wx^2}{2H} + C$$

When y = 0 and x = 0

$$0 = \frac{w(0)^2}{2H} + C \qquad 0 = C$$

$y = \dfrac{wx^2}{2H}$ is the parabolic equation

Future applications

- Maintenance and building materials.
- The cables and supports need careful evaluations over time and bridge itself faces the elements
- Material determine how strong and durable a bridge will be

Google slides vs PowerPoint

Both formats are good but google slides does not allow you to type equations while PowerPoint allows for more editing and more proper equations

$$\frac{dy}{dx} = \frac{w}{H}x \qquad \int \frac{w}{H}x \cdot dx \qquad \frac{w}{H}\int x \cdot dx$$

$$y = \frac{w}{H} \cdot \frac{x^2}{2} \qquad y = \frac{wx^2}{2H} + C$$

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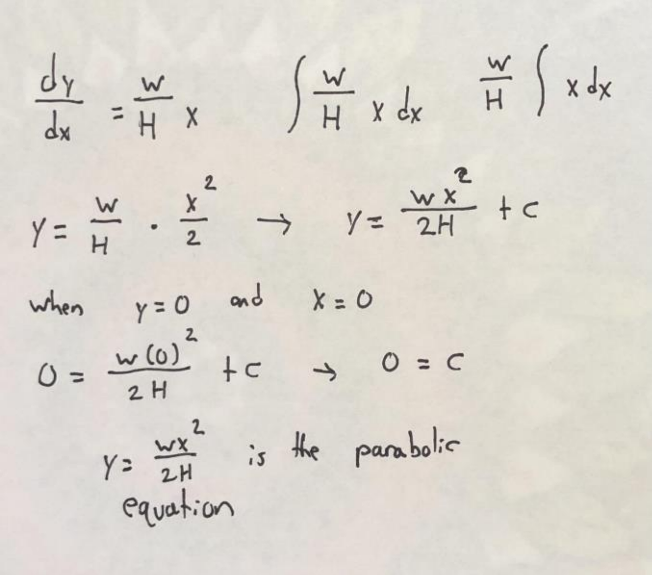

Sources

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