Classical Mechanics
Phy 235, Lecture 08.

Frank L. H. Wolfs
Department of Physics and Astronomy
University of Rochester

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February 1 (my father's birthday): the flood of 1953.

2

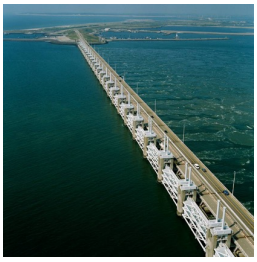
In 1953, my father was in the army and was sent to rescue people and rebuild dikes.

3

20 days after the flood: plans were developed. **De Delta Werken** were completed in 1997.

4

An example: Oosterscheldekering, 9 km long.



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After constructing the pillars, flood the construction area and pick up the pillars.

6

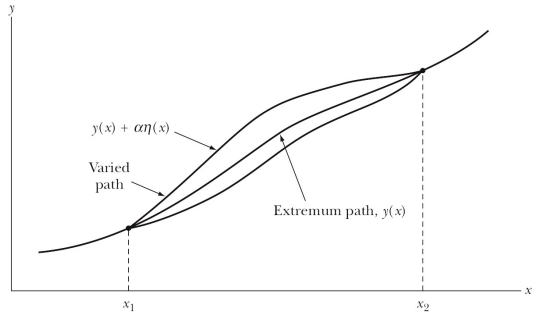
Laying a carpet.
Putting down pillars.

7

Done.

8

Calculus of Variations.



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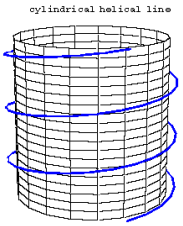
Problem 6.4

- Show that the geodesic on the surface of a right circular cylinder is a segment of a helix.



https://www.encyclopediaofmath.org/index.php/Helical_line

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2 Minute 19 Second Intermission.

- Since paying attention for 1 hour and 15 minutes is hard when the topic is physics, let's take a 2 minute 19 second intermission.
- You can:
  - Stretch out.
  - Talk to your neighbors.
  - Ask me a quick question.
  - Enjoy the fantastic music.

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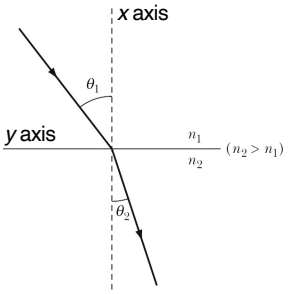
Problem 6.7

- Consider light passing from one medium with index of refraction n_1 into another medium with index of refraction n_2.
- Use Fermat's principle to minimize time, and derive the law of refraction:

$$n_1 \sin\theta 1 = n_2 \sin\theta 2.$$



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Second Euler's Equation.

- The first version of Euler's equation is:

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$

- The second version of Euler's equation is useful when f does not explicitly depend on x.
- The second version of Euler's equation is:

$$\frac{\partial f}{\partial x} - \frac{d}{dx}\left(f - y'\frac{\partial f}{\partial y'}\right) = 0$$

- When f does not explicitly depend on x this equation becomes:

$$f - y'\frac{\partial f}{\partial y'} = \text{constant}$$

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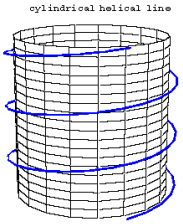
Problem 6.4

- Show that the geodesic on the surface of a right circular cylinder is a segment of a helix.
- Now use Euler's second equation.



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More than one dependent variable.

- Consider the function f which depends on several dependent variables y_1, y_2, y_3, etc.
- In this case, to minimize the path integral of f, the dependent variables must satisfy the following condition:

$$\frac{\partial f}{\partial y_i} - \frac{d}{dx}\left(\frac{\partial f}{\partial y_i'}\right) = 0$$

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ENOUGH FOR TODAY?

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