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| Our first example involves calculating the gravitational force between a point mass **M** and an extended rod of mass **m**, length L, and mass per unit length,http://dev.physicslab.org/img/50ff03bc-15a8-49cb-b9ff-3781f240f9e1.gif.    To begin, divide the rod into a finite (countable) number of segments of mass http://dev.physicslab.org/img/6230e2c2-c0a5-41e7-b800-755206921f6d.gif each located at a distance **x** from **M**.    http://dev.physicslab.org/img/3cb446a1-f249-42cc-ba6f-bcb09fbb793b.gif    Each of these segments will contribute a gravitational force of attraction.    http://dev.physicslab.org/img/77ac0d0c-7d51-460a-acf0-d30460b53e64.gif    If we take the limit as http://dev.physicslab.org/img/94c0c5c9-7891-4035-b80a-0a9f5bcad0ff.gif approaches zero, then our expression for **F** becomes    http://dev.physicslab.org/img/175e4194-63fc-45bf-8a0f-ae4e9673b500.gif    Before we can integrate we must express http://dev.physicslab.org/img/f68d6eed-37dc-48da-94bf-c7f7bf4be2a3.gif in terms of http://dev.physicslab.org/img/d8499f97-70a6-4527-aa9a-6337e2a9e10a.gif.    http://dev.physicslab.org/img/f56feed3-2614-41cd-bf38-0fdfe07d39f1.gif    Substituting and integrating gives us    http://dev.physicslab.org/img/0b344a01-2851-4573-808a-8d4c6d497439.gif    where  http://dev.physicslab.org/img/6f799e0e-091a-4e61-994c-dccb8832df7c.gif. |
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