1. The *reliability* of a product is the probability that it will continue to work for a certain amount of time before failing. The *h*-hour reliability of the product can be found by evaluating the improper integral

$$\int_h^\infty \frac{1}{\mu} e^{-t/\mu}\, dt \ ,$$

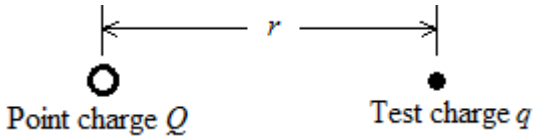
where μ is the mean life of the product.

Find the 15,000-hour reliability of an integrated circuit board that is known to have an average life of 25,000 hours.

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2. Coulomb's Law expresses the force that acts between two electric charges Q and q:

$$F(r) = \frac{1}{4\pi\varepsilon_0}\frac{Qq}{r^2}$$

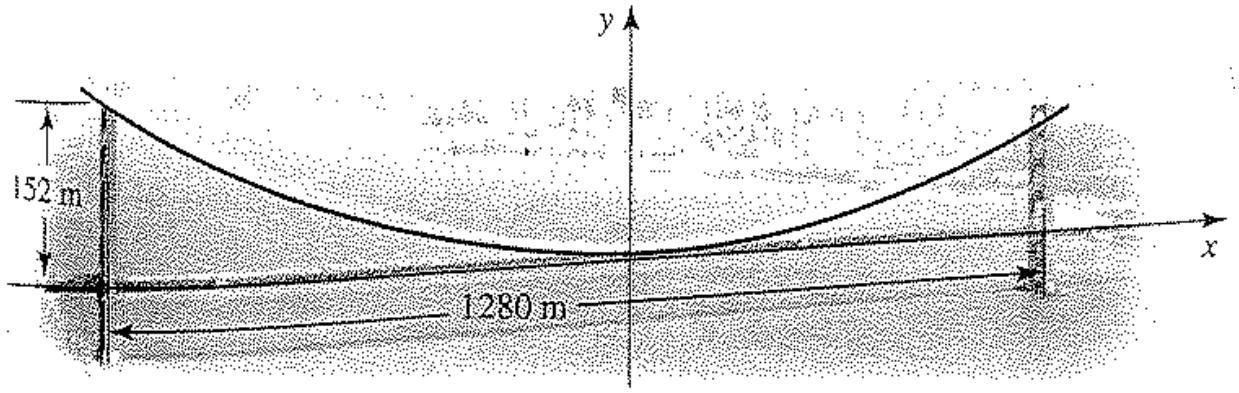


(The constant ε_0 is called the *permittivity of free space*, and is related to the ability of space to support an electric field.)

The *electric potential V* at a distance *R* from charge *Q* is defined as the work done to move a unit test charge *q* (that is, a charge of 1 coulomb) from an infinite distance to a location given by *R*. This means that electric potential is defined as 0 at infinity. Replace *q* with 1 coulomb and evaluate the integral $\int_\infty^R F(r)\, dr$ to find a formula for the electric potential *V*.

In Problems 3 & 4, model the situation with an appropriate integral, and show how you determined what integral to use and how you arrived at your solution. Make a reasonable assumption about precision of measurements and round calculations to an appropriate number of significant figures.

3. The profile of the main cables on a suspension bridge may be modeled by a parabola. The central span of the Golden Gate Bridge is 1280 meters long and 152 meters high. The parabola $y = 0.00037x^2$ gives a good fit to the shape of the cables.



Find the length of the cables that stretch between the tops of the two towers. (Extra credit for evaluating the integral by hand.)

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