Brain Teaser Time!

Let 'x' and 'y' be two variables that are equal (x=y). From these two variables, I can prove that 2 is equal to 1:

steps

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 1              x = y            Given.
 2            x*x = x*y          Left-multiply both sides by x
 3        x*x-y*y = x*y-y*y      Subtract (y*y) from both sides
 4    (x-y)*(x+y) = (x-y)*y      Factor (x-y) from both sides
 5          (x+y) = y            Cancel (x-y) from both sides
 6          (y+y) = y            Replace x with y (given, see line 1)
 7             2y = y            Simplify (y+y) to 2y
 8              2 = 1            Answer:  2 is equal to 1
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What is wrong with this logic (besides that 2 is equal 1, that much is true!)? Name the step or steps and why it is wrong.

a. Discuss how the integration of a function can be viewed as the limit of an infinite sum.

b. Explain with example integration by parts.