How to do rram and lram

posted Jan 25, 2017, 9:47 am by Sydney B Riemann amounts is a way of estimating area using rectangles. There are three different methods to make these problems - using the left end points, the right end points or the intermediate points. To make these problems, you add values together in a space and multiply them by the distance between points. posted January 22, 2017, 10:26 AM by Sydney B x11.1 1.21.31.4f'(x)810121314.5Use an intermediate amount riemann with two subst and values from the table for the approximate posted Jan 22, 2017, 9:53 am by Sydney B posted Jan 22, 2017, 9:38 am from Sydney B [updated Jan 22, 2017, 10:18 am] t(seconds) 01020304 050607080v(t) (feet per second)51422293540444749 Rock A has positive speed after being launched upwards from an initial height of 0 feet in time t= In 1 second. The rocket speed is recorded for selected t values above the built-in 0≤ t ≤ 80 seconds, as shown in the table above.1. Use Riemann amounts with 3 subdivisions of equal length to pre-impose posted January 22, 2017, 9:09 a.m. by Sydney B [updated Jan 22, 2017, 9:53 am] posted Jan 22, 2017, 8:52 am by Sydney B [update Jan 22, 2017, 8:53 AM] Right Reimann Sum ReLedimann Sum Approximate the area under a curve with the rectangular approach method. Enter a function, f(x), change the x1 and x2 boundaries, and then select a right, left, or middle point rectangular approach technique. Change n to adjust the number of rectangles. Page 2 Approach the area under a curve with the rectangular approach method. Enter a function, f(x), change the x1 and x2 boundaries, and then select a right, left, or middle point rectangular approach technique. Change n to adjust the number of rectangles. Page 2 If you see this message, it means that we have difficulty uploading external resources to our website. If you are behind a web filter, make sure that the *.kastatic.org and *.kasandbox.org are unblocked. Integration is the best way to find the area from a curve to the axis: we get a formula for an accurate answer. But integration can sometimes be difficult or impossible to do! Don't worry though, because we can add a lot of slices to get an approximate answer. Let's get out of here! Examples Let's use f(x) = ln(x) from x = 1 to x = 4 We can actually incorporate this and get the actual answer of 2.5451774447956 .... But imagine we can't, and the only thing we can do calculate the values of Ln(x): in x =1: ln(1) = 0 in x =2: ln(2) = 0.693147 ... etc Let's use a slice width of 1 to make it easy to see what's going on (but smaller slices are better). And there are a few different methods that we can use: Left Rectangular Approach Method (LRAM) This method uses rectangles whose height is the most left value. The ranges are: x=1 to 2: ln(1) × 1 = 0 × 1 = 0 x=2 to 3: ln(2) × 1 = 0.693147... × 1 = 0,693147... x=3 to 4: ln(3) × 1 = = × 1 = 1,098612 ... Adding these up takes 1.791759, much lower than 2.545177. Why? Because we're missing this whole area between the tops of the rectangles and the curve. This is exacerbated by a curve that is constantly increasing. When a curve goes up and down more, the error is usually less. Right Rectangular Approach Method (RRAM) Now we calculate the height of the rectangle using the correct value. The ranges are: x=1 to 2: ln(2) × 1 = 0.693147... × 1 = 0,693147... x=2 to 3: ln(3) × 1 = 1.098612... × 1 = 1,098612 ... x=3 to 4: ln(4) × 1 = 1.386294... × 1 = 1,386294... Adding these up takes 3.178054, which is now much higher than 2.545177, because we have included areas between the tops of the rectangles and the curve. Midpoint Rectangular Approach Method (MRAM) We can also use the middle point! The ranges are: x=1 to 2: ln(1.5) × 1 = 0.405465... × 1 = 0,405465... x=2 to 3: ln(2.5) × 1 = 0.916291... × 1 = 0,916291... x=3 to 4: ln(3.5) × 1 = 1.252763... × 1 = 1,252763... Adding these up takes 2.574519 ..., which is quite close to 2.545177. Trapezoidal rule We can use both sides for a triangular effect at the top, which usually make trapezoids. The calculation only calculates the average of the values left and right. The ranges are: x=1 to 2: ln(1) + ln(2) 2 × 1 = 0 + 0.693147...2 × 1 = 0.346573... x=2 to 3: ln(2) + ln(3)2 × 1 = 0.693147... + 1,098612...2 × 1 = 0,895879... x=3 to 4: ln(3) + ln(4)2 × 1 = 1.098612... + 1,386294...2 × 1 = 1,242453... Adding these up takes 2.484907, which is still a little lower than 2.545177, mainly because the curve is hollowed down during space. Notice that in practice each value is used twice (except the first and last) and then the total amount is divided by 2: ln(1) + ln(2) 2 × 1 + ln(2) + ln(3) 2 × 1 + ln(3) + ln(4) 2 × 1 1 1 2 × (ln(1) + ln(2) + ln(2) + ln(3) + ln(3)) 1 2 × (ln(1) + 2 ln(2) + 2 ln(3) + ln(4) So we can have a generic formula : Dx 2 × (f(x0) + 2f(x1) + 2f(x2) + ... 2f(xn-1) + f(xn)) By the way, this method is only the average of left and right Methods: Trapezoidal Approach = LRAM + RRAM 2 Note: the previous 4 methods are also called Riemann Amounts after the mathematician Bernhard Riemann. Simpson's Rule An improvement on the trapezoidal rule is Simpson's rule. It is based on the use of parabols at the top instead of straight lines. Parables often get quite close to the actual curve: It sounds difficult, but we end up with a formula like trapezoidal type (but we divide by 3 and use a 4,2,4,2,4 pattern of factors): Dx 3 × (f(x0) + 4f(x1) + 2f(x2) + ... 4f(xn-1) + f(xn)) But: n must It's still. So let's take 6 slices 0.5 each: 0.5 3 × (f(1) + 4f(1.5) + 2f(2) + 4f (2.5) + 2f(3) + 4f(3.5) + f(4)) Connecting values of ln(1) etc gives: 0.5 3 × (15.2679 ...) 2.544648... This is a great result compared to 2.545177.... Plus and Minus When the curve is below the axis, the value of the integral is negative! So we get a net worth. If we want a total area (let's say we wanted to paint it) we can use the absolute abs value (). Alternatively, manually find out where the curve crosses the axis, and then edit separate integrals and reverse the negatives before adding. Error and accuracy Let's compare it all: f(x)=ln(x) N = 3 N = 6 N = 100 LRAM Estimate Error Estimate 1.791759 0.753418 2.183140 0.362037 2.5243 27 0.020850 RRAM 3.178054 -0.632877 2.876287 -0.331110 2.565916 -0.020739 MRAM 2.57451 9 -0.029342 2.552851 -0.007674 2.545206 -0.000029 Banking rule 2.484907 0.060271 2.52971 30.015464 2.545121 0.000055 Simpson Rule (N must still be) 2.544648 0.000529 2.545177 <0.000001 Simpson rule rules! And it's just as easy to use as others. Of course a different function will produce different results. Why don't you try one yourself? Maximum error In practice we will not know the actual answer ... How do we know how good our assessment is? You can get a good feel by trying different slice backs. And there are also these formulas for maximum approach error (these are for the worst case and the actual error will probably be much smaller): For Midpoint: | E| = K(b-a)3 24n2 For trapezoids: | E| = K(b-a)3 12n2 For Simpson: | E| = M(b-a)5 180n4 When: | E| is the absolute value of the maximum error (could be plus or minus) a is the beginning of space b is the end of space n is the number of slices K is the largest second derivative during the interval. M is the largest fourth derivative during space. (By greatest we mean the maximum absolute value.) a, b and n is easy, but how can we find K and M? Let's find some derivatives first. we will need them: 1st derivative: f'(x) = 1/x 2nd derivative: f'(x) = −1/x2 3rd derivative: f(3)(x) = 2/x 3 4th derivative: f(4)(x) = −6/x4 5th derivative: f(5)(x) = 24/x5 The largest K could be at start, finally, or somewhere in between: Start: f''(1) = −1/12 = −1 End: f''(4) = −1/42 = −1/16 Intermediate: use the 3rd derivative to see if there are zeros in the space of 1 to 4, which could mean a change of direction. Did f(3) (x) = 0 between 1 and 4? Not. So the maximum is at the beginning or the end. So K = 1 (maximum absolute value) Same for M, but higher derivatives: Start: f(4)(1) = −6/14 = −6 End: f(4)(4) = −6/44= −6/256 Intermediate: use the 5th derivative to see if there are zeros in space 1 to 4. f(5)(x) = 24/x5 equals zero between 1 and 4; Not. So M = 6 (maximum absolute value) For just 6 slices, the maximum errors are: Midpoint: | E| = 1(4-1)3 24×62 = 0,03125 | E| = 1(4-1)3 12×62 = 0,0625 Simpson's: | E| = 6(4-1)5 180×64 = 0.00625 Shapes we know The curve may have a shape we know, and we can use geometry types such as these examples: f(x) = 2 − x, from 0 to 2 A = = × 2 × 2 = 2 f(x) = 2, from 0 to 3 A = 2 × 3 = 6 f(x) = √(1 − x2), from −1 to +1 A = p r2 / 2 = p/2 Conclusion We can estimate the area under a curve by slicing a function above There are many ways to find the area of each slice, such as: Left Rectangular Approach Method (LRAM) Right Rectangular Approach Method (RRAM) Midpoint Rectangular Approach Method (MRAM) Trapezoidal Rule Simpson's Rule Rule We can use error types to find the biggest possible error in our assessment Basic types of geometry can sometimes help us find areas below the curve

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