Applications of Riemann Sums

1. We wish to use Riemann sums to find the area under the curve $y=sin⁡(x)$, $0\leq x\leq π$ using LHS and 2 divisions
	1. Draw the graph of$y=sin⁡(x)$ and the two rectangles that will be used to approximate the area.
	2. Define *n,* $∆x$and identify the $x\_{i}$ used for each division
	3. Fill in the following table numerically

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | height | width | area |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

* 1. Fill in the same table using $x\_{i}$ and$ ∆x$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | height | width | area |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

* 1. Express the approximation of the total area as a numeric sum.
	2. Express the approximation of the total area as a symbolic sum.
	3. Convert the symbolic sum in part f to a Riemann Sum in the form $\sum\_{i=1}^{n}…∆x$
	4. Take the limit of part g to find an integral expression representing the precise area. Solve this integral to find the precise distance.
1. We wish to use Riemann sums to find the distance travelled from x=0 to x= 8 hours when the velocity is given by *v(x) = 2x+1 miles/hr*. We will start with 2 divisions and will use the minimum x-value to approximate the distance travelled in each division.
	1. Define *n,* $∆x$and identify the $x\_{i}$ used for each division
	2. Fill in the following table numerically

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | duration | velocity | distance |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

* 1. Fill in the same table using $x\_{i}$ and$ ∆x$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | duration | velocity | distance |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

* 1. Express the approximation of the total distance as a numeric sum.
	2. Express the approximation of the total distance as a symbolic sum.
	3. Convert the symbolic sum in part e to a Riemann Sum in the form $\sum\_{i=1}^{n}…∆x$
	4. Take the limit of part f to find an integral expression representing the precise distance. Solve this integral to find the precise distance.
1. We wish to use Riemann sums to find the distance travlled from x=0 s to x= 3 sec when the velocity is given by $v\left(x\right)=2x-3x^{2} ft/sec$. We will start with 3 divisions and will use the minimum x-value to approximate the distance travelled in each division.
	1. Define *n,* $∆x$and identify the $x\_{i}$ used for each division
	2. Fill in the following table numerically

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | duration | velocity | distance |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

* 1. Fill in the same table using $x\_{i}$ and$ ∆x$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | duration | velocity | distance |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

* 1. Express the approximation of the total distance as a numeric sum.
	2. Express the approximation of the total distance as a symbolic sum.
	3. Convert the symbolic sum in part e to a Riemann Sum in the form $\sum\_{i=1}^{n}…∆x$
	4. Take the limit of part f to find an integral expression representing the precise distance. Solve this integral to find the precise distance.
1. We wish to use Riemann sums to find the gallons of liquid that have entered a tank from x=0 s to x= 15 sec when the flow rate is given by *f(x) = 2x + 3 gallons/sec*. We will start with 3 divisions and will use the minimum value to approximate the number of gallons of each division.
	1. Define *n,* $∆x$and identify the $x\_{i}$ used for each division
	2. Fill in the following table numerically

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | duration | Flow rate | gallons |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

* 1. Fill in the same table using $x\_{i}$ and$ ∆x$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | duration | Flow rate | gallons |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

* 1. Express the approximation of the total gallons as a numeric sum.
	2. Express the approximation of the total gallons as a symbolic sum.
	3. Convert the symbolic sum in part e to a Riemann Sum in the form $\sum\_{i=1}^{n}…∆x$
	4. Take the limit of part f to find an integral expression representing the precise number of gallons. Solve this integral to find the precise number of gallons.
1. We wish to use Riemann sums to find the length of the curve $f\left(x\right)=x^{2}$ from *x = 1* to *x = 5* using the Left-Hand Side Rule (LHS) with 2 divisions.
	1. Sketch the graph *y = f(x)* and draw the tangent line segments you will use to approximate the length labeling the point used, the horizontal and the vertical distance for each division.
	2. Fill in the following table numerically

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | Horizontal distance | Vertical Distance | Length of curve  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

* 1. Fill in the same table using $x\_{i}$ and$ ∆x$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | Horizontal distance | Vertical Distance | Length of curve |
| 1 |  |  |  |  |
| 2 |  |  |  |  |

* 1. Express the approximation of the total length as a numeric sum.
	2. Express the approximation of the total length as a symbolic sum.
	3. Convert the symbolic sum in part e to a Riemann Sum in the form $\sum\_{i=1}^{n}…∆x$
	4. Take the appropriate limit to express the exact length of the curve as an integral. (No need to evaluate)
1. We wish to use Riemann sums to find the length of the curve $f\left(x\right)=x^{3}$ from *x = 1* to *x = 4* using the Left-Hand Side Rule (LHS) with 3 divisions.
	1. Sketch the graph *y = f(x)* and draw the tangent line segments you will use to approximate the length labeling the point used, the horizontal and the vertical distance for each division.
	2. Fill in the following table numerically

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | Horizontal distance | Vertical Distance | Length of curve  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

* 1. Fill in the same table using $x\_{i}$ and$ ∆x$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Division | *x-*value used | Horizontal distance | Vertical Distance | Length of curve |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

* 1. Express the approximation of the total length as a numeric sum.
	2. Express the approximation of the total length as a symbolic sum.
	3. Convert the symbolic sum in part e to a Riemann Sum in the form $\sum\_{i=1}^{n}…∆x$
	4. Take the appropriate limit to express the exact length of the curve as an integral. (No need to evaluate)