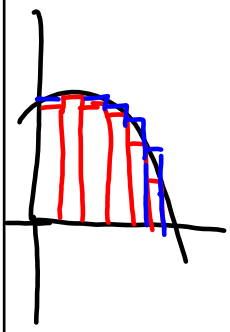
AP Calculus Sec 4.4 part 2

Mean Value Theorem for Integrals - somewhere between inscribed and circumscribe rectangles there is a rectangle whose area is precisely equal to the area under the curve.



$$\int_a^b f(x)\,dx = f(c)(b-a)$$

height of rectangle; width of rectangle

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$$\frac{\int_a^b f(x)\,dx}{(b-a)} = \frac{f(c)(b-a)}{(b-a)}$$

$$\frac{1}{b-a}\int_a^b f(x)\,dx = f(c)$$

Used to find the average value

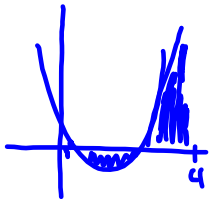
ex. Find the average value of $f(x) = 3x^2 - 2x$ on $[1,4]$

$$\frac{1}{4-1}\int_1^4 (3x^2-2x)\,dx$$

$$\frac{1}{3}\left[\frac{3x^3}{3} - \frac{2x^2}{2}\right]_1^4$$

$$\frac{1}{3}\left[x^3 - x^2\right]_1^4 = \frac{1}{3}\left[(64-16)-(1-1)\right]$$

$$\frac{1}{3}[48] = 16$$



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Find the average value of the function over the interval.

51. $f(x) = 9 - x^2, \quad [-3, 3]$

53. $f(x) = x^3, \quad [0, 1]$

55. $f(x) = \sin x, \quad [0, \pi]$

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