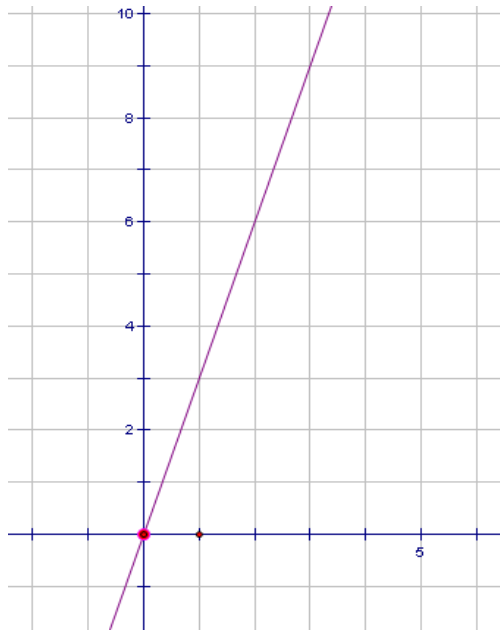




SECTION 5.3
THE FUNDAMENTAL THEOREM
OF CALCULUS

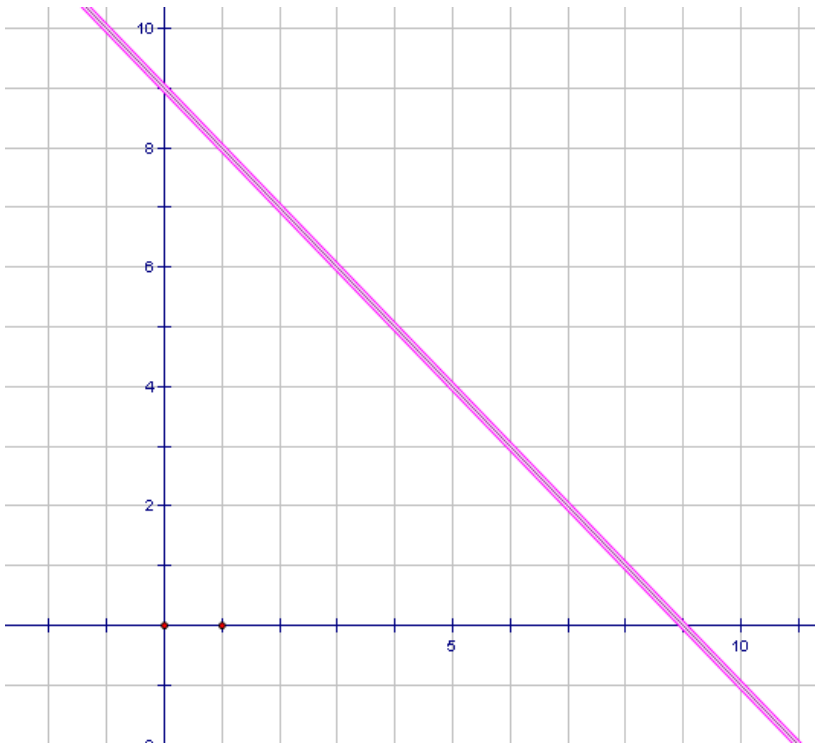
- Find the area under $y = 3x$ on the interval $[0, x]$



X	Area of triangle
1	
2	
x	



- Find the area under $y = -x + 9$ on the interval $[0, x]$



X	Area of trapezoid
1	
2	
x	



CONCLUSION

- Function is the derivative of the Area under the function
- Area is antiderivative of the function
- Therefore, Integrals are antiderivatives!!!!
- The Fundamental Theorem of Calculus unites Differential and Integral Calculus.



The Fundamental Theorem of Calculus, Part 2

If f is continuous at every point of $[a, b]$, and if F is any antiderivative of f on $[a, b]$, then

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



EVALUATE $\int_0^2 (x^3 - 9x^2) dx$

Constant cancels out, so we don't need to write the C's when evaluating definite integrals.



PRACTICE

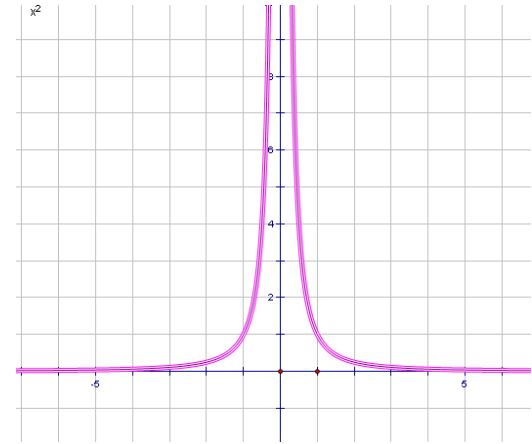
$$\int_1^4 x^3 dx$$

$$\int_5^7 2x^4 dx$$



TRY ANOTHER

$$\int_{-1}^3 \frac{1}{x^2} dx$$



Graph is above the x-axis, so integral should not be negative. What's wrong?

Graph is not continuous on the interval $[-1, 3]$, so we can't use the FTC.

What does your calculator say?



TWO MORE

$$\int_3^8 (x + 1)^2 dx$$

$$\int_1^4 |2x - 4| dx$$



CLARIFICATION

- A definite integral $\int_a^b f(x)dx$ is a number
- An indefinite integral $\int f(x)dx$ is a function (or family of functions)

