4D2 FTC2

The second Fundamental Theorem of Calculus states that if f is continuous, and $F(x) = \int_a^x f(t)\ dt$, then

$$F'(x) = \frac{d}{dx}\int_a^x f(t)\ dt = f(x)$$

Integrate to find F as a function of x, then differentiate the result to demonstrate the Second Fundamental Theorem of Calculus.

75. $F(x) = \displaystyle\int_0^x (t + 2)\, dt$

79. $F(x) = \displaystyle\int_{\pi/4}^x \sec^2 t\, dt$

Use the Second Fundamental Theorem of Calculus to find $F'(x)$.

81. $F(x) = \displaystyle\int_{-2}^x (t^2 - 2t)\, dt$

87. $F(x) = \displaystyle\int_x^{x+2} (4t + 1)\, dt$

89. $F(x) = \int_0^{\sin x} \sqrt{t}\, dt$

Remember that the indefinite integral of the velocity function is the position function. On an interval, the definite integral gives us **displacement.**

$$\int_a^b v(t)\, dt = s(b) - s(a) = displacement$$

In the following problems, the velocity function of a particle moving along a straight line is given in feet per second. Find (a) the displacement and (b) the total distance that the particle travels over the given interval.

97. $v(t) = 5t - 7, \quad 0 \le t \le 3$

98. $v(t) = t^2 - t - 12, \quad 1 \le t \le 5$