

Second Fundamental Theorem of Calculus

Differentiate each accumulation function $F(x)$. Give an exact polynomial for $F'(x)$.

1.
$$F(x) = \int_4^{-2x^3 - 2x^2 + 1} -3s^2 + 2s + 2 \, ds$$

2.
$$F(x) = \int_4^x 3s^3 - 4 \, ds$$

3.
$$F(x) = \int_1^x 4s \, ds$$

4.
$$F(x) = \int_2^{-x^2 + 3x - 1} s^2 + 6s - 4 \, ds$$

5.
$$F(x) = \int_2^x -3s \, ds$$

6.
$$F(x) = \int_{-2}^x s^3 + 6s^2 - 3s \, ds$$

7.
$$F(x) = \int_{-4}^{-x+3} 6s + 2 \, ds$$

8.
$$F(x) = \int_0^x 5s^3 \, ds$$

9.
$$F(x) = \int_{-5}^x 3s^2 + 5s \, ds$$

10.
$$F(x) = \int_{-4}^{x^2 + 3x - 2} 2s^2 + 4s + 2 \, ds$$

Second Fundamental Theorem of Calculus

Worked Answer Key

Differentiate each accumulation function $F(x)$. Give an exact polynomial for $F'(x)$.

Here $p(s)$ is the integrand and $g(x)$ is the upper bound.

1.
$$F(x) = \int_4^{-2x^3 - 2x^2 + 1} -3s^2 + 2s + 2 \, ds$$

$$F'(x) = p(g(x))g'(x)$$

$$g'(x) = -6x^2 - 4x$$

$$p(g(x)) = -12x^6 - 24x^5 - 12x^4 + 8x^3 + 8x^2 + 1$$

$$\text{Upper contribution} = 72x^8 + 192x^7 + 168x^6 - 80x^4 - 32x^3 - 6x^2 - 4x$$

The constant lower bound contributes 0.

$$F'(x) = 72x^8 + 192x^7 + 168x^6 - 80x^4 - 32x^3 - 6x^2 - 4x$$

2.
$$F(x) = \int_4^x 3s^3 - 4 \, ds$$

$$F'(x) = p(x)$$

$$p(x) = 3x^3 - 4$$

The constant lower bound contributes 0.

$$F'(x) = 3x^3 - 4$$

3.
$$F(x) = \int_1^x 4s \, ds$$

$$F'(x) = p(x)$$

$$p(x) = 4x$$

The constant lower bound contributes 0.

$$F'(x) = 4x$$

4.
$$F(x) = \int_2^{-x^2 + 3x - 1} s^2 + 6s - 4 \, ds$$

$$F'(x) = p(g(x))g'(x)$$

$$g'(x) = -2x + 3$$

$$p(g(x)) = x^4 - 6x^3 + 5x^2 + 12x - 9$$

$$\text{Upper contribution} = -2x^5 + 15x^4 - 28x^3 - 9x^2 + 54x - 27$$

The constant lower bound contributes 0.

$$F'(x) = -2x^5 + 15x^4 - 28x^3 - 9x^2 + 54x - 27$$

5.
$$F(x) = \int_2^x -3s \, ds$$

$$F'(x) = p(x)$$

$$p(x) = -3x$$

The constant lower bound contributes 0.

$$F'(x) = -3x$$

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Worked Answer Key

Differentiate each accumulation function $F(x)$. Give an exact polynomial for $F'(x)$.

Here $p(s)$ is the integrand and $g(x)$ is the upper bound.

6.
$$F(x) = \int_{-2}^x s^3 + 6s^2 - 3s \, ds$$

$$F'(x) = p(g(x))g'(x)$$

$$g'(x) = -1$$

$$p(g(x)) = -x^3 + 6x^2 + 3x$$

$$\text{Upper contribution} = x^3 - 6x^2 - 3x$$

The constant lower bound contributes 0.

$$F'(x) = x^3 - 6x^2 - 3x$$

7.
$$F(x) = \int_{-4}^{-x+3} 6s + 2 \, ds$$

$$F'(x) = p(g(x))g'(x)$$

$$g'(x) = -1$$

$$p(g(x)) = -6x + 20$$

$$\text{Upper contribution} = 6x - 20$$

The constant lower bound contributes 0.

$$F'(x) = 6x - 20$$

8.
$$F(x) = \int_0^x 5s^3 \, ds$$

$$F'(x) = p(x)$$

$$p(x) = 5x^3$$

The constant lower bound contributes 0.

$$F'(x) = 5x^3$$

9.
$$F(x) = \int_{-5}^x 3s^2 + 5s \, ds$$

$$F'(x) = p(x)$$

$$p(x) = 3x^2 + 5x$$

The constant lower bound contributes 0.

$$F'(x) = 3x^2 + 5x$$

10.
$$F(x) = \int_{-4}^{x^2+3x-2} 2s^2 + 4s + 2 \, ds$$

$$F'(x) = p(g(x))g'(x)$$

$$g'(x) = 2x + 3$$

$$p(g(x)) = 2x^4 + 12x^3 + 14x^2 - 12x + 2$$

$$\text{Upper contribution} = 4x^5 + 30x^4 + 64x^3 + 18x^2 - 32x + 6$$

The constant lower bound contributes 0.

$$F'(x) = 4x^5 + 30x^4 + 64x^3 + 18x^2 - 32x + 6$$