

# Advanced Placement Calculus

## The Fundamental Theorems of Calculus

The Fundamental Theorems of Calculus  
Trapezoidal Rule

## The Fundamental Theorems of Calculus–Part A

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1. Evaluate:  $\int_0^1 (2x - 1) dx$

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2. Evaluate:  $\int_0^1 (x^4 + x)(4x^3 + 1) dx$

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3. Evaluate:  $\int_1^2 x\sqrt{x-1} dx$

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4. Evaluate:  $\int_0^1 \cos \pi x dx$

5. Evaluate:  $\int_1^4 \frac{1}{x^2} \sqrt{1 + \frac{1}{x}} dx$

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6. Evaluate:  $\int_0^{\pi/3} \frac{\sin x}{\cos^2 x} dx$

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7. Evaluate:  $\int_0^{13} \frac{1}{\sqrt[3]{(1+2x)^2}} dx$

8. Evaluate:  $\int_0^4 \frac{dx}{(x-2)^3}$

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9. Evaluate:  $\int_0^a x\sqrt{x^2+a^2} dx$ ,  $a > 0$  ( $a$  is a constant)

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10. Evaluate:  $\int_{-2}^5 |x-3| dx$

11. Evaluate:  $\int_0^1 \frac{x^3 - 1}{x + 1} dx$

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12. Evaluate:  $\int_0^{\pi/2} \sin 2x dx$

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13. Evaluate:  $\int_1^3 \frac{x}{(3x^2 - 1)^3} dx$

14. Evaluate:  $\int_{-2}^1 (x+2)\sqrt{x+3} \, dx$

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15. Evaluate:  $\int_2^4 \frac{w^4 - w}{w^3} \, dw$

## The Fundamental Theorems of Calculus–Part B

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1. Evaluate:  $\frac{d}{dx} \int_0^x \sqrt{4+t^6} dt$

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2. Evaluate:  $\frac{d}{dx} \int_2^x \frac{1}{t^4+4} dt$

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3. Evaluate:  $\frac{d}{dx} \int_x^3 \sqrt{\sin t} dt$

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4. Evaluate:  $\frac{d}{dx} \int_{-x}^x \frac{1}{3+t^2} dt$

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5. Evaluate:  $\frac{d}{dx} \int_1^{x^3} \sqrt[3]{t^2+1} dt$

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6. Evaluate:  $\frac{d}{dx} \int_2^{\tan x} \frac{1}{1+t^2} dt$

7. Let  $F(x) = \int_2^x \sqrt{3t^2 + 1} dt$ . Find  $F(2)$ ,  $F'(2)$  and  $F''(2)$ .

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8. Let  $F(x) = \int_0^x \frac{\cos t}{t^2 + 3} dt$ . Find  $F(0)$ ,  $F'(0)$  and  $F''(0)$ .

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9. Evaluate:  $\frac{d}{dx} \int_{2x}^{3x} \frac{u-1}{u+1} du$

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10. Evaluate:  $\frac{d}{dx} \int_{\tan x}^{x^2} \frac{1}{\sqrt{2+t^4}} dt$

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11. Evaluate:  $\frac{d}{dx} \int_{\sqrt{x}}^{x^3} \sqrt{t} dt$

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12. Evaluate:  $\frac{d}{dx} \int_{\cos x}^{5x} \cos u^2 du$



13. Given  $F(x) + 3 = \int_5^x (t - 3)^3 dt$ , find  $F(5)$ ,  $F'(5)$  and  $F''(5)$ .

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14. Given  $G(x) = \int_3^x \ln t dt$ , find  $G(3) - G'(3)$ .

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15. Let  $F(x) + 7 = \int_8^x \sqrt{2t^2 - 5} dt$ . Find  $F(8)$ ,  $F'(8)$  and  $F''(8)$ .

## The Trapezoidal Rule

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1. Evaluate  $\int_0^2 x^3 dx$  using the trapezoid rule with  $n = 4$ .

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2. Evaluate  $\int_0^\pi \cos x dx$  using the trapezoid rule with  $n = 4$ .

3. Evaluate  $\int_2^{10} \frac{dx}{1+x}$  using the trapezoid rule with  $n = 8$ .

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4. Evaluate  $\int_2^3 \sqrt{1+x^2} dx$  using the trapezoid rule with  $n = 6$ .