# MATH120: Antiderivatives and Integrals

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Name: ________________________________ Date: ________________ Score: / 30

### Learning Objectives

- Calculate the mean, median, mode, and range of a data set
- Compute sample variance and standard deviation
- Construct quartiles, the IQR, and identify outliers
- Describe the shape, center, and spread of a distribution

*Simplify each expression completely. Show all steps and circle your final answer.*

## Antiderivatives

**1.** Find the antiderivative (indefinite integral): integral of 6x^1 dx.

$$\int 6x^1\,dx$$

Answer: ____________________________________________

**2.** The marginal cost function is MC(x) = 2x^2. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 2x^2\,dx$$

Answer: ____________________________________________

**3.** Find the antiderivative (indefinite integral): integral of 1x^4 dx.

$$\int 1x^4\,dx$$

Answer: ____________________________________________

**4.** The marginal cost function is MC(x) = 4x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 4x^1\,dx$$

Answer: ____________________________________________

**5.** Find the antiderivative (indefinite integral): integral of 4x^3 dx.

$$\int 4x^3\,dx$$

Answer: ____________________________________________

**6.** The marginal cost function is MC(x) = 3x^3. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 3x^3\,dx$$

Answer: ____________________________________________

**7.** Find the antiderivative (indefinite integral): integral of 2x^4 dx.

$$\int 2x^4\,dx$$

Answer: ____________________________________________

**8.** The marginal cost function is MC(x) = 2x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 2x^1\,dx$$

Answer: ____________________________________________

**9.** Find the antiderivative (indefinite integral): integral of 5x^2 dx.

$$\int 5x^2\,dx$$

Answer: ____________________________________________

**10.** The marginal cost function is MC(x) = 3x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 3x^1\,dx$$

Answer: ____________________________________________

**11.** Find the antiderivative (indefinite integral): integral of 5x^2 dx.

$$\int 5x^2\,dx$$

Answer: ____________________________________________

**12.** The marginal cost function is MC(x) = 5x^2. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 5x^2\,dx$$

Answer: ____________________________________________

**13.** Find the antiderivative (indefinite integral): integral of 1x^3 dx.

$$\int 1x^3\,dx$$

Answer: ____________________________________________

**14.** The marginal cost function is MC(x) = 2x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 2x^1\,dx$$

Answer: ________________________________________

**15.** Find the antiderivative (indefinite integral): integral of 1x^3 dx.

$$\int 1x^3\,dx$$

Answer: ________________________________________

**16.** The marginal cost function is MC(x) = 4x^3. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 4x^3\,dx$$

Answer: ________________________________________

## Definite integrals

**17.** Evaluate the definite integral: integral from 2 to 2 of x^2 dx.

$$\int_2^2 x^2\,dx$$

Answer: ________________________________________

**18.** Find the area under the curve f(x) = x^2 from x = 1 to x = 3.

$$\int_1^3 x^2\,dx$$

Answer: ________________________________________

**19.** Evaluate the definite integral: integral from 1 to 3 of x^3 dx.

$$\int_1^3 x^3\,dx$$

Answer: ________________________________________

**20.** Find the area under the curve f(x) = x^1 from x = 1 to x = 3.

$$\int_1^3 x^1\,dx$$

Answer: ________________________________________

**21.** Evaluate the definite integral: integral from 0 to 5 of x^2 dx.

$$\int_0^5 x^2\,dx$$

Answer: ______________________________________________

**22.** Find the area under the curve f(x) = x^1 from x = 1 to x = 4.

$$\int_1^4 x^1\,dx$$

Answer: ______________________________________________

**23.** Evaluate the definite integral: integral from 0 to 5 of x^3 dx.

$$\int_0^5 x^3\,dx$$

Answer: ______________________________________________

**24.** Find the area under the curve f(x) = x^1 from x = 1 to x = 4.

$$\int_1^4 x^1\,dx$$

Answer: ______________________________________________

**25.** Evaluate the definite integral: integral from 1 to 3 of x^2 dx.

$$\int_1^3 x^2\,dx$$

Answer: ______________________________________________

**26.** Find the area under the curve f(x) = x^2 from x = 0 to x = 4.

$$\int_0^4 x^2\,dx$$

Answer: ______________________________________________

**27.** Evaluate the definite integral: integral from 0 to 5 of x^2 dx.

$$\int_0^5 x^2\,dx$$

Answer: ______________________________________________

**28.** Find the area under the curve f(x) = x^2 from x = 1 to x = 3.

$$\int_1^3 x^2\,dx$$

Answer: ______________________________________________

**29.** Evaluate the definite integral: integral from 1 to 2 of x^3 dx.

$$\int_1^2 x^3 \, dx$$

Answer: ____________________________________________

**30.** Find the area under the curve f(x) = x^1 from x = 0 to x = 2.

$$\int_0^2 x^1 \, dx$$

Answer: ____________________________________________

# MATH120: Antiderivatives and Integrals

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ANSWER KEY & SOLUTIONS

*Topics: Antiderivatives, Definite integrals. All answers verified by independent computation.*

## Solutions

## Antiderivatives

**1.** Find the antiderivative (indefinite integral): integral of 6x^1 dx.

$$\int 6x^1\,dx$$

→ *Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*

→ *integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{6}{2}x^2 + C \;\Rightarrow\; \text{coeff} = 3$

---

**2.** The marginal cost function is MC(x) = 2x^2. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 2x^2\,dx$$

→ *TC(x) = integral of MC(x) dx = integral of 2x^2 dx.*

→ *= 2/3x^3 + C.*

**Answer:** $\frac{2}{3}x^3 + C \;\Rightarrow\; \text{coeff} = 2/3$

---

**3.** Find the antiderivative (indefinite integral): integral of 1x^4 dx.

$$\int 1x^4\,dx$$

→ *Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*

→ *integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{1}{5}x^5 + C \;\Rightarrow\; \text{coeff} = 1/5$

---

**4.** The marginal cost function is MC(x) = 4x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 4x^1\,dx$$

→ *TC(x) = integral of MC(x) dx = integral of 4x^1 dx.*

→ *= 2x^2 + C.*

**Answer:** $\frac{4}{2}x^2 + C \;\Rightarrow\; \text{coeff} = 2$

---

**5.** Find the antiderivative (indefinite integral): integral of 4x^3 dx.

$$\int 4x^3\,dx$$

→ *Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*

→ *integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{4}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 1$

---

**6.** The marginal cost function is MC(x) = 3x^3. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 3x^3\, dx$$

*→ TC(x) = integral of MC(x) dx = integral of 3x^3 dx.*
*→ = 3/4x^4 + C.*

**Answer:** $\frac{3}{4}x^4 + C \Rightarrow \text{coeff} = 3/4$

---

**7.** Find the antiderivative (indefinite integral): integral of 2x^4 dx.

$$\int 2x^4\, dx$$

*→ Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*
*→ integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{2}{5}x^5 + C \Rightarrow \text{coeff} = 2/5$

---

**8.** The marginal cost function is MC(x) = 2x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 2x^1\, dx$$

*→ TC(x) = integral of MC(x) dx = integral of 2x^1 dx.*
*→ = 1x^2 + C.*

**Answer:** $\frac{2}{2}x^2 + C \Rightarrow \text{coeff} = 1$

---

**9.** Find the antiderivative (indefinite integral): integral of 5x^2 dx.

$$\int 5x^2\, dx$$

*→ Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*
*→ integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{5}{3}x^3 + C \Rightarrow \text{coeff} = 5/3$

---

**10.** The marginal cost function is MC(x) = 3x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 3x^1\, dx$$

*→ TC(x) = integral of MC(x) dx = integral of 3x^1 dx.*
*→ = 3/2x^2 + C.*

**Answer:** $\frac{3}{2}x^2 + C \Rightarrow \text{coeff} = 3/2$

---

**11.** Find the antiderivative (indefinite integral): integral of 5x^2 dx.

$$\int 5x^2\,dx$$

→ *Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*
→ *integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{5}{3}x^3 + C \;\Rightarrow\; \text{coeff} = 5/3$

---

**12.** The marginal cost function is MC(x) = 5x^2. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 5x^2\,dx$$

→ *TC(x) = integral of MC(x) dx = integral of 5x^2 dx.*
→ *= 5/3x^3 + C.*

**Answer:** $\frac{5}{3}x^3 + C \;\Rightarrow\; \text{coeff} = 5/3$

---

**13.** Find the antiderivative (indefinite integral): integral of 1x^3 dx.

$$\int 1x^3\,dx$$

→ *Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*
→ *integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{1}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 1/4$

---

**14.** The marginal cost function is MC(x) = 2x^1. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 2x^1\,dx$$

→ *TC(x) = integral of MC(x) dx = integral of 2x^1 dx.*
→ *= 1x^2 + C.*

**Answer:** $\frac{2}{2}x^2 + C \;\Rightarrow\; \text{coeff} = 1$

---

**15.** Find the antiderivative (indefinite integral): integral of 1x^3 dx.

$$\int 1x^3\,dx$$

→ *Power rule for integration: integral of x^n dx = x^(n+1)/(n+1) + C.*
→ *integral of {a}x^{n} dx = ({a}/{n+1})x^{new_exp210} + C = {answer_antideriv210}x^{new_exp210} + C.*

**Answer:** $\frac{1}{4}x^4 + C \;\Rightarrow\; \text{coeff} = 1/4$

---

**16.** The marginal cost function is MC(x) = 4x^3. Find the total cost function TC(x) by finding the antiderivative. (Leave + C for the constant.)

$$\int 4x^3\,dx$$

*→ TC(x) = integral of MC(x) dx = integral of 4x^3 dx.*
*→ = 1x^4 + C.*

**Answer:** $\frac{4}{4}x^4 + C \Rightarrow \text{coeff} = 1$

## Definite integrals

**17.** Evaluate the definite integral: integral from 2 to 2 of x^2 dx.

$$\int_{2}^{2} x^2\, dx$$

→ *FTC: integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*

→ *= ({hi_pow} - {lo_pow}) / {n+1} = {answer_defint210}.*

**Answer:** $\frac{8-8}{3} = 0$

---

**18.** Find the area under the curve f(x) = x^2 from x = 1 to x = 3.

$$\int_{1}^{3} x^2\, dx$$

→ *Area = integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*

→ *= ({hi_pow} - {lo_pow}) / ({n+1}) = {answer_defint210} square units.*

**Answer:** $\frac{27-1}{3} = 26/3$

---

**19.** Evaluate the definite integral: integral from 1 to 3 of x^3 dx.

$$\int_{1}^{3} x^3\, dx$$

→ *FTC: integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*

→ *= ({hi_pow} - {lo_pow}) / {n+1} = {answer_defint210}.*

**Answer:** $\frac{81-1}{4} = 20$

---

**20.** Find the area under the curve f(x) = x^1 from x = 1 to x = 3.

$$\int_{1}^{3} x^1\, dx$$

→ *Area = integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*

→ *= ({hi_pow} - {lo_pow}) / ({n+1}) = {answer_defint210} square units.*

**Answer:** $\frac{9-1}{2} = 4$

---

**21.** Evaluate the definite integral: integral from 0 to 5 of x^2 dx.

$$\int_{0}^{5} x^2\, dx$$

→ *FTC: integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*

→ *= ({hi_pow} - {lo_pow}) / {n+1} = {answer_defint210}.*

**Answer:** $\frac{125-0}{3} = 125/3$

---

**22.** Find the area under the curve f(x) = x^1 from x = 1 to x = 4.

$$\int_1^4 x^1\,dx$$

→ *Area = integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
→ *= ({hi_pow} - {lo_pow}) / ({n+1}) = {answer_defint210} square units.*

**Answer:** $\frac{16-1}{2} = 15/2$

---

**23.** Evaluate the definite integral: integral from 0 to 5 of x^3 dx.

$$\int_0^5 x^3\,dx$$

→ *FTC: integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
→ *= ({hi_pow} - {lo_pow}) / {n+1} = {answer_defint210}.*

**Answer:** $\frac{625-0}{4} = 625/4$

---

**24.** Find the area under the curve f(x) = x^1 from x = 1 to x = 4.

$$\int_1^4 x^1\,dx$$

→ *Area = integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
→ *= ({hi_pow} - {lo_pow}) / ({n+1}) = {answer_defint210} square units.*

**Answer:** $\frac{16-1}{2} = 15/2$

---

**25.** Evaluate the definite integral: integral from 1 to 3 of x^2 dx.

$$\int_1^3 x^2\,dx$$

→ *FTC: integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
→ *= ({hi_pow} - {lo_pow}) / {n+1} = {answer_defint210}.*

**Answer:** $\frac{27-1}{3} = 26/3$

---

**26.** Find the area under the curve f(x) = x^2 from x = 0 to x = 4.

$$\int_0^4 x^2\,dx$$

→ *Area = integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
→ *= ({hi_pow} - {lo_pow}) / ({n+1}) = {answer_defint210} square units.*

**Answer:** $\frac{64-0}{3} = 64/3$

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**27.** Evaluate the definite integral: integral from 0 to 5 of x^2 dx.

$$\int_0^5 x^2\,dx$$

*→ FTC: integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
*→ = ({hi_pow} - {lo_pow}) / {n+1} = {answer_defint210}.*

**Answer:** $\frac{125-0}{3} = 125/3$

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**28.** Find the area under the curve f(x) = x^2 from x = 1 to x = 3.

$$\int_1^3 x^2\,dx$$

*→ Area = integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
*→ = ({hi_pow} - {lo_pow}) / ({n+1}) = {answer_defint210} square units.*

**Answer:** $\frac{27-1}{3} = 26/3$

---

**29.** Evaluate the definite integral: integral from 1 to 2 of x^3 dx.

$$\int_1^2 x^3\,dx$$

*→ FTC: integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
*→ = ({hi_pow} - {lo_pow}) / {n+1} = {answer_defint210}.*

**Answer:** $\frac{16-1}{4} = 15/4$

---

**30.** Find the area under the curve f(x) = x^1 from x = 0 to x = 2.

$$\int_0^2 x^1\,dx$$

*→ Area = integral from {lo} to {hi} of x^{n} dx = [x^{n+1}/({n+1})] from {lo} to {hi}.*
*→ = ({hi_pow} - {lo_pow}) / ({n+1}) = {answer_defint210} square units.*

**Answer:** $\frac{4-0}{2} = 2$

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