

Antiderivatives and the Fundamental Theorem

- 1** Which rule differentiates the nonconstant term of the function below to check whether it is an antiderivative?

$$F(x) = 2x^2 + 120$$

A power rule: $\frac{d}{dx}(x^2) = 2x$

B power rule: $\frac{d}{dx}(x^2) = 2x^2$

C power rule: $\frac{d}{dx}(x^2) = x$

D constant rule: $\frac{d}{dx}(x^2) = 0$

- 2** Which rule applies to the x term of the function below?

$$f(x) = -2x + 7$$

A power rule: $\int x dx = \frac{x^2}{2} + C$

B power rule: $\int x dx = x^2 + C$

C power rule: $\int x dx = 1 + C$

D power rule: $\int x dx = \frac{x^2}{2}$

- 3** Which expression gives the derivative of the function below before simplifying?

$$F(x) = -3x^2 + 121$$

A $-3(2x) + 121$

B $-3(x^2) + 0$

C $-3(x) + 0$

D $-3(2x) + 0$

- 4** Which function has the one below as an antiderivative?

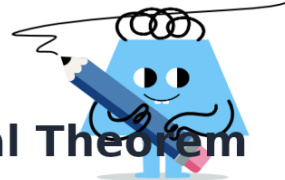
$$F(x) = 2x^2 + 124$$

A $f(x) = 4x$

B $f(x) = 2x$

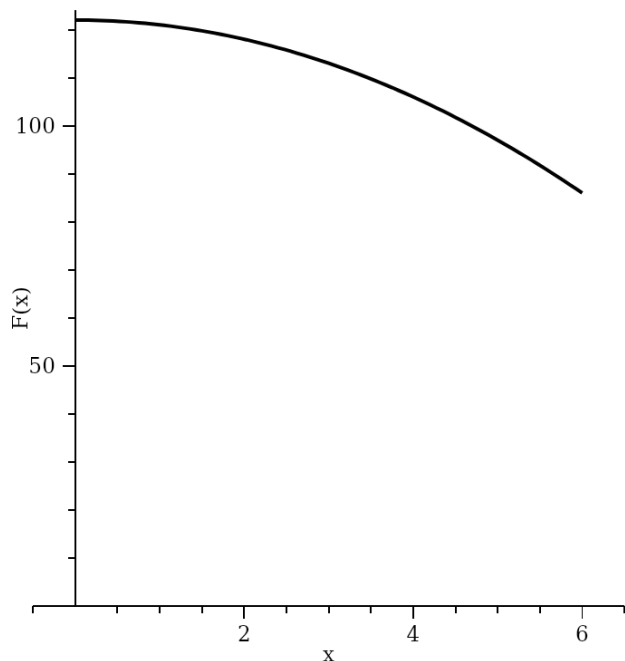
C $f(x) = 4x^2$

D $f(x) = 4x + 124$



Antiderivatives and the Fundamental Theorem

- 5 The graph shows $F(x)$ on $[0, 6]$. For $x > 0$ in this interval, what can be concluded about $f(x)$ if F is an antiderivative of f ?



A

F increases; f is negative

B

F decreases; f is negative

C

F increases; f is positive

D

F decreases; f is positive

- 6 Which expression sets up the general antiderivative before simplifying?

$$f(x) = 4x + 5$$

A

$$4\left(\frac{x^2}{2}\right) + 5x$$

B

$$4\left(\frac{x^2}{2}\right) + 5 + C$$

C

$$4(x^2) + 5x + C$$

D

$$4\left(\frac{x^2}{2}\right) + 5x + C$$

- 7 Find the general antiderivative of the function below.

$$f(x) = 6x + 1$$

A

$$3x^2 + 1 + C$$

B

$$3x^2 + 1x$$

C

$$3x^2 + 1x + C$$

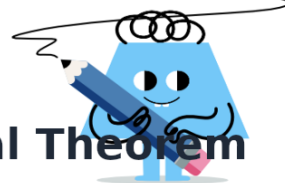
D

$$6x^2 + 1x + C$$

- 8 How is the constant of integration determined from the initial condition below?

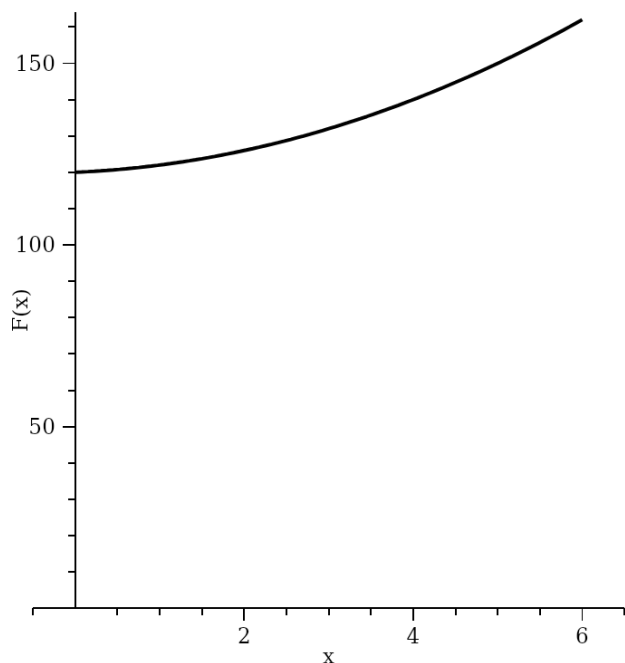
$$F'(x) = 4x + 9, \quad F(2) = 146$$

A Substitute $x = 2$ into $F'(x)$ and solve for C B Set $C = 0$ for every antiderivativeC Substitute $x = 2$ into $F(x)$ and solve for C D Set $C = F(2) = 146$



Antiderivatives and the Fundamental Theorem

- 9 The graph shows one antiderivative F of f . Which expression describes the entire family of antiderivatives of the same f ?



- A $F(x) + C$, for any real constant C
- B $F(x) + Cx$, for any real constant C
- C $C F(x)$, for any real constant C
- D $F(x + C)$, for any real constant C

- 10 Which equation determines the constant of integration?

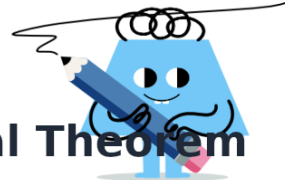
$$F'(x) = 2x + 7, \quad F(2) = 138$$

- A $138 = 1(2^2) + 7 + C$
- B $138 = 1(2^2) + 7(2) + C$
- C $138 = 1(2^2) + 7(2)$
- D $138 = 2(2) + 7 + C$

- 11 Find the particular antiderivative satisfying the initial condition below.

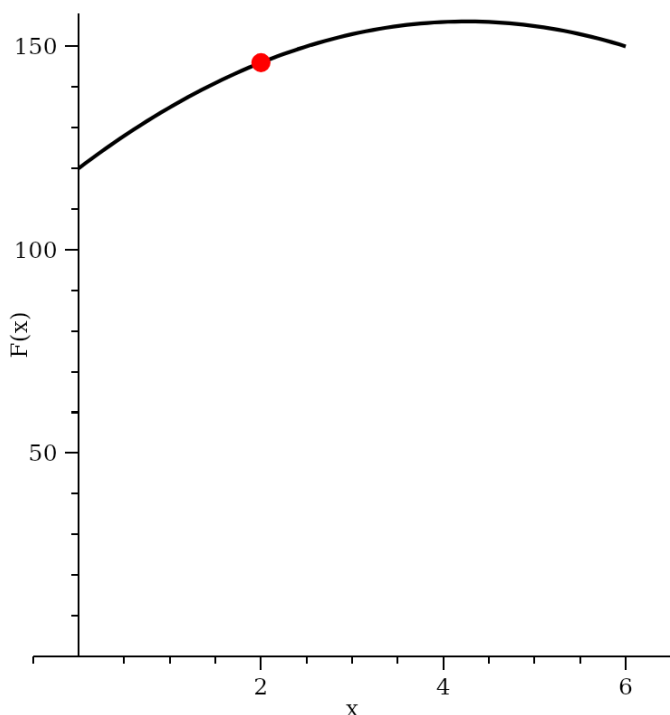
$$F'(x) = -6x + 7, \quad F(2) = 122$$

- A $F(x) = -6x^2 + 7x + 120$
- B $F(x) = -3x^2 + 7x + 120$
- C $F(x) = -3x^2 + 7x + 122$
- D $F(x) = -3x^2 + 7x + 123$



Antiderivatives and the Fundamental Theorem

12 The graph of $F(x)$ marks $(2, 146)$. Given $F'(x) = -4x + 17$ and $F(x) = -2x^2 + 17x + C$, what is C ?



A

146

B

154

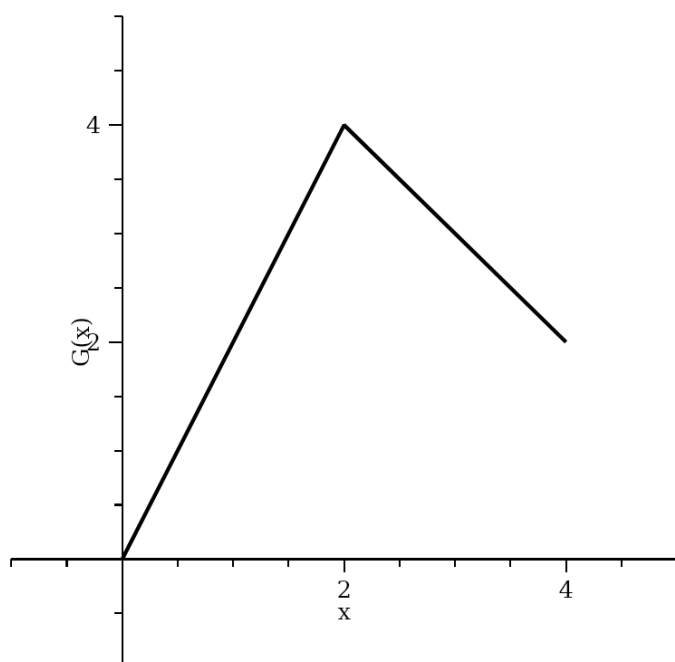
C

120

D

121

13 The graph shows $G(x) =$ the integral of $f(t)$ from 0 to x . What is $f(3)$?
Use the slope of G on the second interval.



A

2

B

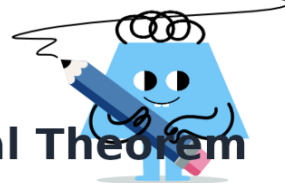
-1

C

1

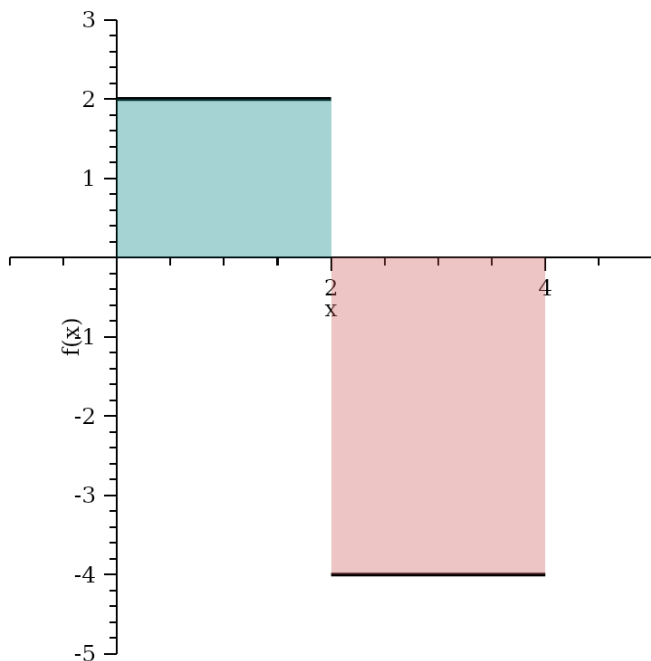
D

-2



Antiderivatives and the Fundamental Theorem

- 14** The graph shows $f(x)$, the rate on two intervals of width 2. If $G(x)$ = the integral of $f(t)$ from 0 to x , what is $G(4)$? Use signed accumulation.



A

-4

B

12

C

-12

D

4

- 15** Which statement explains the Fundamental Theorem of Calculus for the function below?

$$f(t) = 2t - 11, \quad G(x) = \int_2^x f(t) dt$$

A

$$G'(x) = f(x) = 2x - 11$$
$$G(2) = 0$$

B

$$G'(x) = f(x) = 2x - 11$$
$$G(2) = 1$$

C

$$G'(x) = f(2) = -7$$
$$G(2) = 0$$

D

$$G'(x) = -f(x) = -2x + 11$$
$$G(2) = 0$$

- 16** Which expression evaluates the definite integral using the antiderivative below?

$$F(x) = 2x^2 + 4x + 120, \quad \int_1^3 F'(x) dx$$

A

$$F(1) - F(3)$$

B

$$F(3) + F(1)$$

C

$$f(3) - f(1)$$

D

$$F(3) - F(1)$$

- 17** Evaluate the definite integral using the antiderivative below.

$$F(x) = -1x^2 + 3x + 120, \quad \int_3^1 F'(x) dx$$

A

120

B

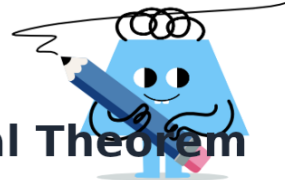
122

C

-2

D

2



Antiderivatives and the Fundamental Theorem

- 18** Which substitution sets up the definite integral using the antiderivative below?

$$F(x) = 1x^2 + 6x + 120, \quad \int_1^3 F'(x) dx$$

A $(1(3^2) + 6(3) + 120) - (1(1^2) + 6(1) + 120)$

B $(1(3^2) + 6(3) + 120) + (1(1^2) + 6(1) + 120)$

C $(2(3) + 6) - (2(1) + 6)$

D $(1(1^2) + 6(1) + 120) - (1(3^2) + 6(3) + 120)$

- 19** Which rule finds the accumulation function below?

$$F(t) = 2t^2 + 7t + 120, \quad G(x) = \int_1^x F'(t) dt$$

A $F(1) - F(x)$

B $F(x) + F(1)$

C $F(x) - F(1)$

D $F(x)$

- 20** What is the derivative of the accumulation function below?

$$G(x) = \int_x^3 (3t + 9) dt$$

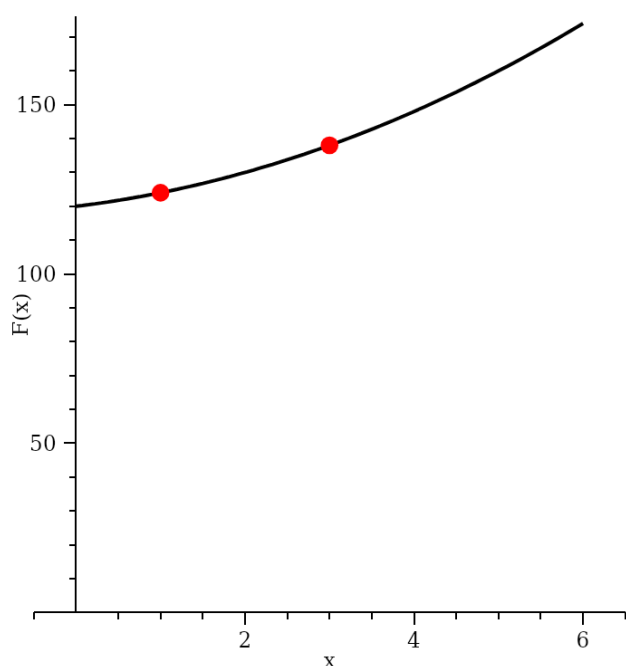
A $3x - 9$

B $3x + 9$

C $-3x + 9$

D $-3x - 9$

- 21** The graph shows F , an antiderivative of f , with $F(1) = 124$ and $F(3) = 138$ marked. What is the signed integral of $f(x)$ from 1 to 3?

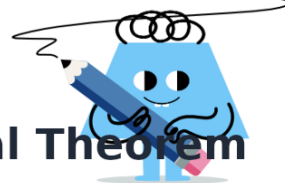


A 14

B -14

C 138

D 124



Antiderivatives and the Fundamental Theorem

22 How do you set up the accumulation function using the antiderivative below?

$$F(t) = 1t^2 + 8t + 120, \quad G(x) = \int_1^x F'(t) dt$$

A $(1x^2 + 8x + 120) + (1(1^2) + 8(1) + 120)$

B $(1x^2 + 8x + 120) - (1(1^2) + 8(1) + 120)$

C $(1(1^2) + 8(1) + 120) - (1x^2 + 8x + 120)$

D $(1x^2 + 8x + 120) - (2(1) + 8)$

23 Find the accumulation function below.

$$F(t) = -2t^2 + 13t + 120, \quad G(x) = \int_1^x F'(t) dt$$

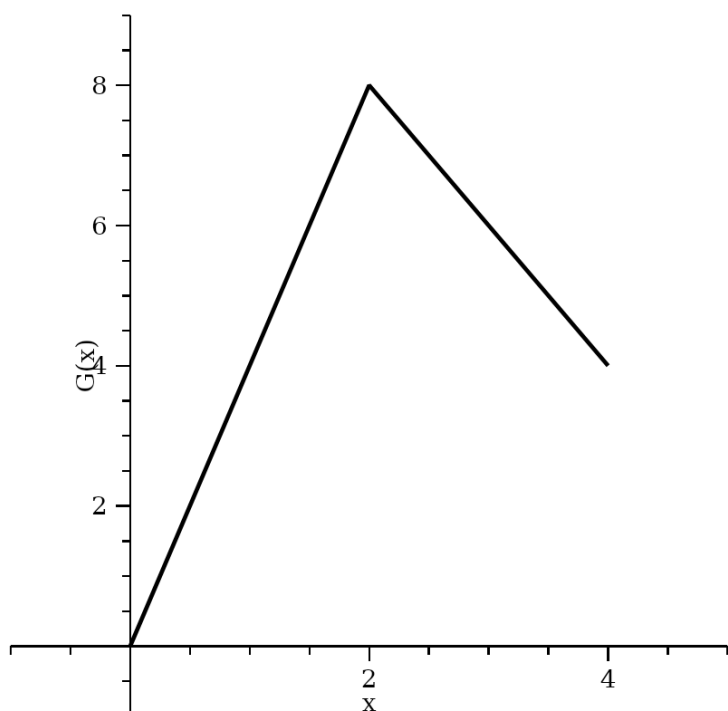
A $G(x) = -2x^2 + 13x - 11$

B $G(x) = -2x^2 + 13x + 11$

C $G(x) = 2x^2 - 13x + 11$

D $G(x) = -2x^2 + 13x$

24 The graph shows $G(x)$, the signed accumulation of $f(t)$ from 0 to x . What is $G(4)$?

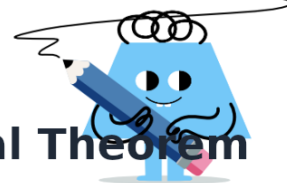


A -4

B 12

C 8

D 4



Antiderivatives and the Fundamental Theorem

25 What is the derivative of the accumulation function below?

$$G(x) = \int_3^x (-2t + 7) dt$$

A

$$-2x - 7$$

B

$$2x - 7$$

C

$$-2x + 7$$

D

$$2x + 7$$

26 What is the derivative of the function below?

$$G(x) = \int_2^{x^2} (-2t + 3) dt$$

A

$$-2x^2 + 3$$

B

$$2x(-2x^2 + 3)$$

C

$$-2x(-2x^2 + 3)$$

D

$$2x(-2x + 3)$$

27 What is the derivative of the function below?

$$G(x) = \int_{x^2}^3 (3t + 6) dt$$

A

$$2x(3x^2 + 6)$$

B

$$-3x^2 + 6$$

C

$$-2x(3x^2 + 6)$$

D

$$-(3x + 6)$$

28 What is the derivative of the function below?

$$G(x) = \int_x^{x^2} (2t + 4) dt$$

A

$$(2x^2 + 4) - (2x + 4)$$

B

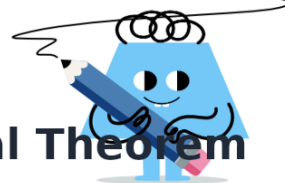
$$2x(2x^2 + 4) - (2x + 4)$$

C

$$2x(2x^2 + 4) + (2x + 4)$$

D

$$(2x + 4) - 2x(2x^2 + 4)$$



Antiderivatives and the Fundamental Theorem

29 For $x > 0$, which method finds the general antiderivative of the expression below?

$$-42x^{1/2}$$

- A use the logarithm rule for x^{-1}
- B divide by the original exponent, then add C
- C increase the exponent by 1, divide by the new exponent, then add C
- D increase the exponent by 1 without dividing, then add C

30 For x real, which step sets up the general antiderivative of the expression below?

$$-36$$

- A $\frac{-36x^{0+1}}{0+1} + C$
- B $\frac{-36x^{0+1}}{0+1}$
- C $\frac{-36x^{0+2}}{0+2} + C$
- D $\frac{-36}{0+1} + C$

31 For x real, which method finds the general antiderivative of the expression below?

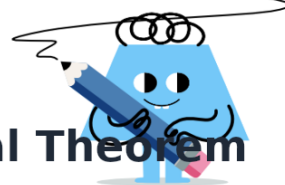
$$6x^2 + 2x + 2$$

- A integrate each term separately but multiply by each new exponent instead of dividing, then add C
- B integrate each term separately and retain its signed multiple, without C
- C integrate each term separately, retain its signed multiple, then add C
- D multiply the three terms together before integrating, then add C

32 For $x > 0$, find the general antiderivative of the expression below?

$$36x^{1/2}$$

- A $36x^{1/2} + C$
- B $24x^{3/2} + C$
- C $36x^{1/2+2} + C$
- D $24x^{3/2}$



Antiderivatives and the Fundamental Theorem

- 33** For x real, which step sets up the general antiderivative of the expression below?

$$6x^2 + 2x + 2$$

- | | | | |
|---|--|---|--|
| A | $6\frac{x^3}{3} - 2\frac{x^2}{2} + 2x + C$ | B | $6\frac{x^3}{3} + 2\frac{x^2}{2} + 2x + C$ |
| C | $6\frac{x^3}{3} + 2\frac{x^2}{2} + 2x$ | D | $6\frac{x^3}{3} + 2\frac{x^2}{2} + 2 + C$ |

- 34** For x real, find the general antiderivative of the expression below?

$$21x^2 + 6x + 7$$

- | | |
|---|-------------------------|
| A | $7x^3 + 3x^2 + 7x + C$ |
| B | $21x^3 + 6x^2 + 7x + C$ |
| C | $7x^3 + 3x^2 + 7x$ |
| D | $7x^3 - 3x^2 + 7x + C$ |

- 35** For x real, which method finds the general antiderivative of the expression below?

$$3 * 10^x$$

- | | |
|---|---|
| A | divide the constant multiple by the base, then add C |
| B | retain the constant multiple, divide by the logarithm of the base, then add C |
| C | treat the exponential as a power of x , then add C |
| D | retain the constant multiple and divide by the logarithm of the base, without C |

- 36** For x real, which step sets up the general antiderivative of the expression below?

$$5 * 5^x$$

- | | | | |
|---|-------------------------------------|---|---------------------------------|
| A | $\frac{5 \cdot 5^x}{5} + C$ | B | $\frac{5 \cdot 5^x}{\ln 5} + C$ |
| C | $\frac{5 \cdot 5^{x+1}}{\ln 5} + C$ | D | $\frac{5 \cdot 5^x}{\ln 5}$ |

- 37** For x real, find the general antiderivative of the expression below?

$$8 * 2^x$$

- | | |
|---|----------------------------------|
| A | $\frac{8 \cdot 2^x}{\ln 2} + C$ |
| B | $-\frac{8 \cdot 2^x}{\ln 2} + C$ |
| C | $8 \cdot 2^x (\ln 2) + C$ |
| D | $\frac{8 \cdot 2^x}{\ln 2}$ |

- 38** For x where the denominator is nonzero, find the general antiderivative of the expression below?

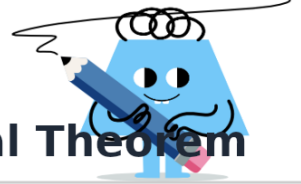
$$\frac{1}{x}$$

- | | | | |
|---|---------------|---|-------------------|
| A | $\ln x $ | B | $\frac{1}{x} + C$ |
| C | $\ln x + C$ | D | $\ln 1 + C$ |

- 39** What is the exact value of the definite integral below?

$$\int_0^3 2x(x^2 + 2)^3 dx$$

- | | | | |
|---|----------|---|---------|
| A | 14625/4 | B | 14625 |
| C | -14625/4 | D | 14641/4 |



Antiderivatives and the Fundamental Theorem

40 For x where the denominator is nonzero, which method finds the general antiderivative of the expression below?

$$\frac{3x^2}{x^3 + 3}$$

A

integrate the numerator and denominator separately

B

identify $\frac{f'(x)}{f(x)}$, then use $\ln|f(x)| + C$

C

identify $\frac{f'(x)}{f(x)}$, then use $\ln|f'(x)| + C$

D

apply the ordinary power rule with exponent -1

41 For x where the denominator is nonzero, which step sets up the general antiderivative of the expression below?

$$\frac{2x}{x^2 + 1}$$

A

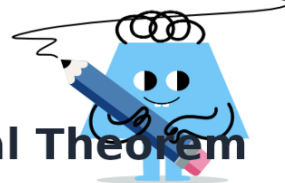
identify $f(x) = x^2 + 1$, $f'(x) = 2x$
use $\ln|2x| + C$

B

identify $f(x) = x^2 + 1$, $f'(x) = 2x$
use $\frac{1}{x^2 + 1} + C$

C

identify $f(x) = x^2 + 1$, $f'(x) = 2x$
use $\ln|x^2 + 1| + C$



Antiderivatives and the Fundamental Theorem

- 42** On an interval where $\csc^2 x$ is defined, which method finds the general antiderivative of the expression below?

$$4(\csc^2 x)$$

- A differentiate the trigonometric expression instead, then add C
- B recognize the derivative of $-\cot x$
retain the constant multiple, then add C
- C recognize the derivative of $\cot x$
retain the constant multiple, then add C
- D recognize the derivative of $-\cot x$ but omit C

- 43** On an interval where $\cos x$ is defined, which step sets up the general antiderivative of the expression below?

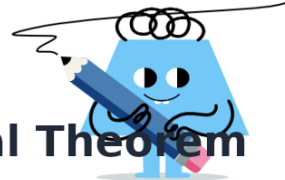
$$3(\cos x)$$

- A $3(\sin x) + C$
- B $3(\cos x) + C$
- C $3(-\sin x) + C$
- D $3(\sin x)$

- 44** For x real, find the general antiderivative of the expression below?

$$3 * 3x^2 * (x^3 + 6)^2$$

- A $\frac{3 * (x^3 + 6)^3}{3} + C$
- B $3 * (x^3 + 6)^3 + C$
- C $\frac{3 * (x^3 + 6)^3}{3}$
- D $-\frac{3 * (x^3 + 6)^3}{3} + C$



Antiderivatives and the Fundamental Theorem

45 On an interval where $\csc^2 x$ is defined, find the general antiderivative of the expression below?

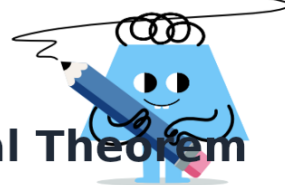
$$2(\csc^2 x)$$

A	$2(\cot x) + C$
B	$2(\csc^2 x) + C$
C	$-2\cot x + C$
D	$-2\cot x$

46 For x real, which substitution method finds the general antiderivative of the expression below?

$$3 * 3x^2 * (x^3 + 8)^4$$

A	choose $u = x^3 + 8$, $du = 3x^2 dx$ then integrate $3u^4$ and add C
B	choose $u = x^3 + 8$, $du = 3x^2 dx$ then integrate $3u^4$ without C
C	choose $u = x^3 + 8$, then differentiate u^4 instead of integrating
D	choose $u = 3x^2$, then integrate u^4 with C

**Antiderivatives and the Fundamental Theorem**

47 For x real, which step sets up the general antiderivative of the expression below?

$$3x^2 * (x^3 + 3)^5$$

A

$$\text{let } u = x^3 + 3, du = 3x^2 dx$$

$$\text{integrate } \frac{u^5}{u} du$$

B

$$\text{let } u = x^3 + 3, du = 3x^2 dx$$

$$\text{integrate } u^6 du$$

C

$$\text{let } u = x^3 + 3, du = 3x^2 dx$$

$$\text{integrate } u^5 du$$

48 Which method evaluates the definite integral below?

$$\int_0^2 2x(x^2 + 2)^1 dx$$

A

$$\text{set } u = x^2 + 2,$$

$$\text{change bounds to } u \in [6, 2]$$

B

$$\text{set } u = x^2 + 2,$$

$$\text{keep } x \in [0, 2] \text{ as the } u \text{ bounds}$$

C

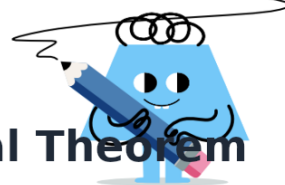
$$\text{set } u = 2x,$$

$$\text{then keep the original bounds in the } u \text{ integral}$$

D

$$\text{set } u = x^2 + 2,$$

$$\text{change bounds from } x \in [0, 2] \text{ to } u \in [2, 6]$$



Antiderivatives and the Fundamental Theorem

49 Which step sets up the evaluation of the definite integral below?

$$\int_1^3 2x(x^2 + 6)^4 dx$$

A

let $u = x^2 + 6$, $du = 2x dx$

$$\left[\frac{(x^2 + 6)^5}{5} \right]_1^3$$

B

let $u = x^2 + 6$, $du = 2x dx$

$$\left[\frac{u^5}{5} \right]_1^3$$

C

let $u = x^2 + 6$, $du = 2x dx$

$$\left[\frac{(x^2 + 6)^5}{5} \right]_3^1$$

D

let $u = x^2 + 6$, $du = 2x dx$

$$\left[\frac{(x^2 + 6)^4}{5} \right]_1^3$$

50 For x where the denominator is nonzero, which method finds the general antiderivative of the expression below?

$$\frac{(x + 8)(x + 1)}{x + 1}$$

A

cancel both numerator factors and leave $\frac{1}{x + 1}$

B

cancel $x + 1$ only when $x \neq -1$
then integrate $x + 8$

C

integrate the numerator and denominator separately

D

use the logarithm of the denominator without checking its numerator