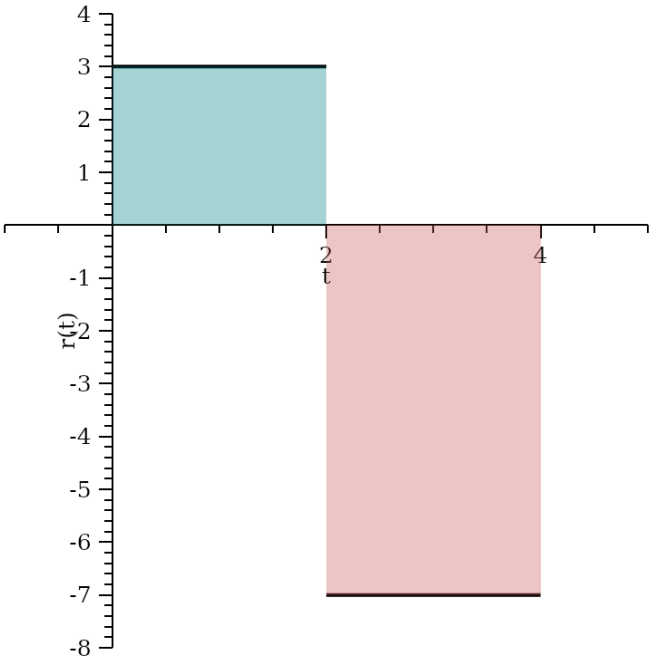
Name

Numerical Approximation of Integrals

1 For this step graph $r(t)$, what does $\int_0^{4} r(t)\,dt$ represent?



A Area above the t-axis minus area below it over the stated bounds

B The sum of positive areas above and below the t-axis

C Only the first shaded region above the t-axis

D The slope of r(t) at the upper limit

2 Which family does the indefinite integral below denote?

$$\int 80x\,dx$$

A $40x^2$

B $40x + C$

C $80x^2 + C$

D $40x^2 + C$

3 Which notation denotes the family below?

$$F(x) = 29x^2 + C$$

A $\int 58x\,dx = 29x^2$

B $\int 58x\,dx = 29x^2 + C$

C $\int 29x\,dx = 29x^2 + C$

D $\int 58\,dx = 29x^2 + C$

4 Evaluate the integral below using symmetry.

$$\int_{-38}^{38} |x|\,dx$$

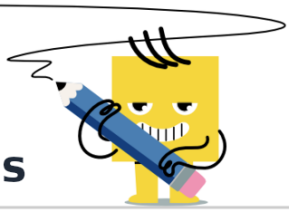
A 1444

B 2888

C -1444

D 0

Name



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5 Which expression is equivalent to the integral below for any integrable function?

$$\int_0^{20} f(t)\,dt$$

A $-\int_{20}^{0} f(t)\,dt$

B $-\int_{0}^{20} f(t)\,dt$

C $\int_{20}^{0} f(t)\,dt$

D $\int_{0}^{20} 2f(t)\,dt$

6 For the function and integral below, which split is equivalent?

$$f(t) = t, \quad \int_0^{40} f(t)\,dt$$

A $\int_0^{20} f(t)\,dt + \int_{20}^{40} f(t)\,dt$

B $\int_0^{20} f(t)\,dt - \int_{20}^{40} f(t)\,dt$

C $2\int_0^{20} f(t)\,dt$

D $\int_0^{20} f(t)\,dt + \int_0^{40} f(t)\,dt$

7 Is the equation below true for every integrable function? Why?

$$\int_0^{16} f(t)\,dt + \int_{16}^{0} f(t)\,dt = 0$$

A Yes; reversing the bounds negates the integral.

B No; their sum always equals twice the first integral.

C Yes; both integrals must individually be zero.

D No; reversing bounds preserves the sign.

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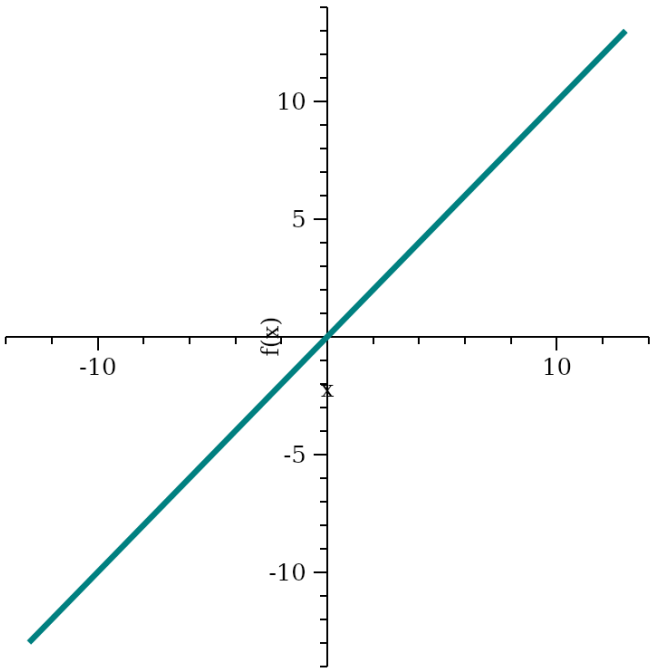
8 The graph shows f(x)=x on [-13,13]. Which symmetry gives its signed integral?



A

Odd: equal positive and negative halves cancel to zero

B

Neither: use only the right half

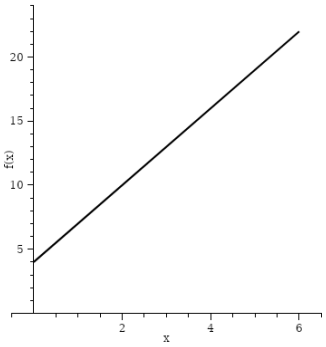
C

Odd: the two halves add as positive areas

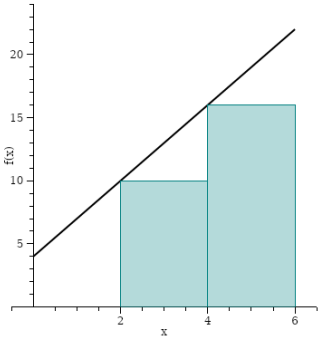
D

Even: the signed integral is twice the contribution from the right half.

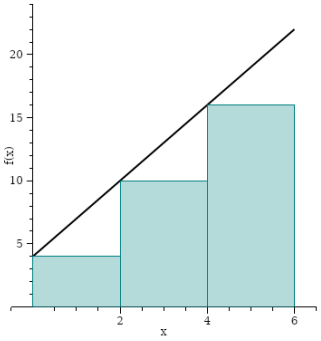
9 Which diagram shows the left-endpoint Riemann sum for f(x) on [0, 6] using 3 equal-width rectangles?



A



B



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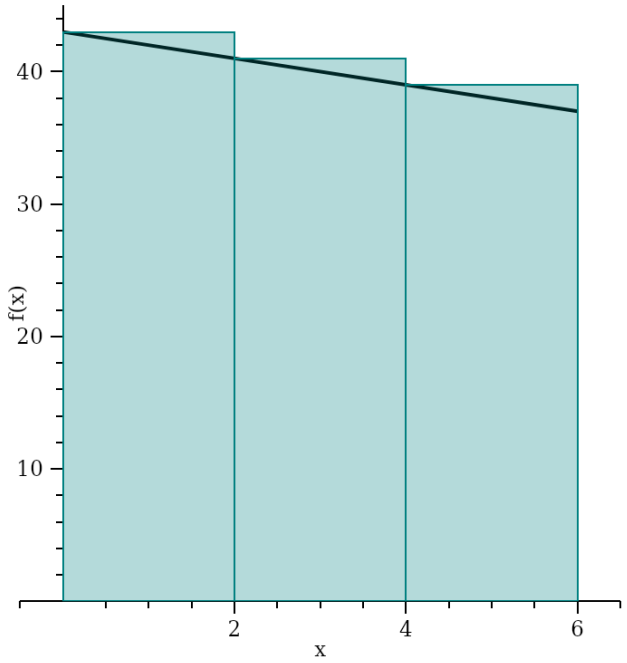
Numerical Approximation of Integrals

10 The graph shows f(x) and a left-endpoint Riemann sum using 3 equal-width rectangles on [0, 6]. How does this sum compare with the area under f(x)?



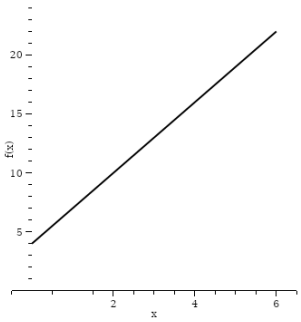
A
underestimate

B
cannot be determined

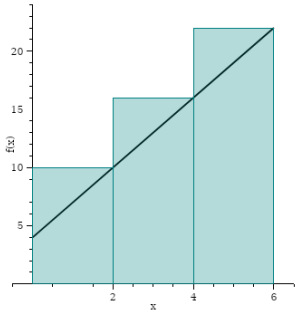
C
overestimate

D
exact

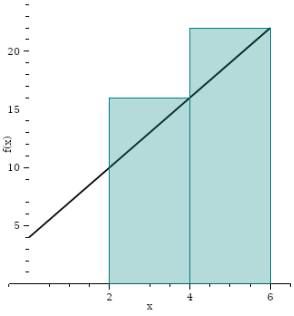
11 Which diagram shows the right-endpoint Riemann sum for f(x) on [0, 6] using 3 equal-width rectangles?



A



B



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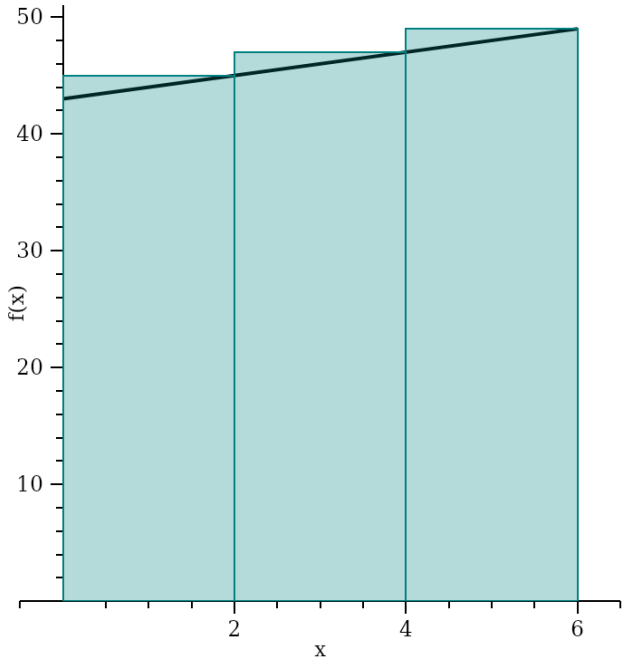
Numerical Approximation of Integrals

12 The graph shows f(x) and a right-endpoint Riemann sum using 3 equal-width rectangles on [0, 6]. How does this sum compare with the area under f(x)?



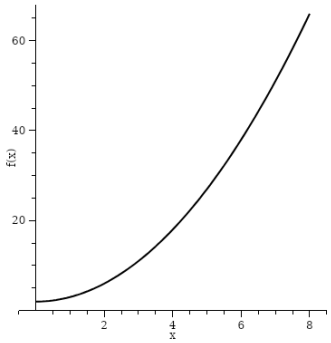
A
overestimate

B
underestimate

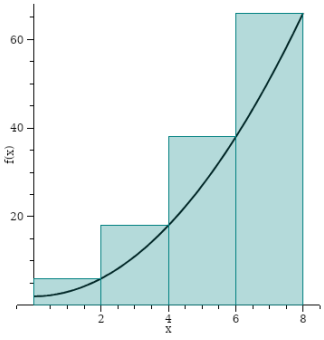
C
cannot be determined

D
exact

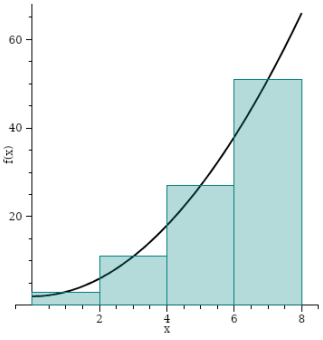
13 Which diagram shows the midpoint approximation for f(x) on [0, 8] using 4 equal-width panels?



A



B



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Numerical Approximation of Integrals

14 The table gives x: 0, 1, 2, 3, 4, 5, 6, 7, 8 and f(x): 3, 4, 7, 12, 19, 28, 39, 52, 67, respectively. Which expression sets up the midpoint approximation on [0, 8] using 4 equal-width panels?

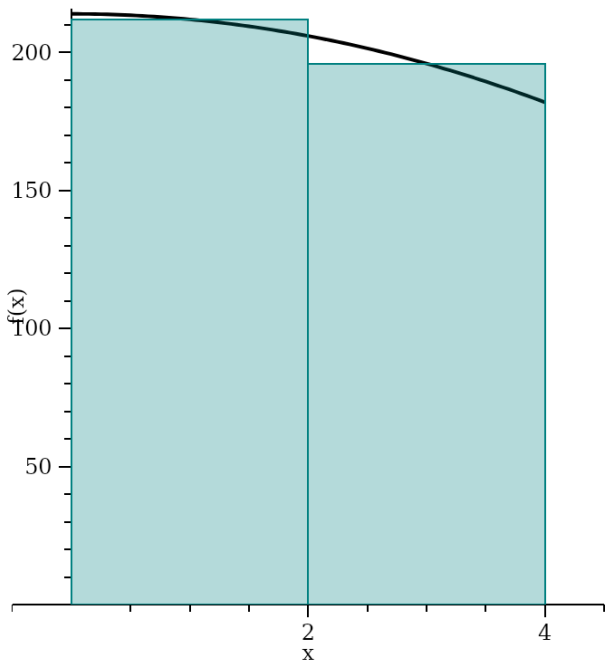
A	1(3 + 2(7) + 2(19) + 2(39) + 67)
B	2(3 + 7 + 19 + 39)
C	2(7 + 19 + 39 + 67)
D	2(4 + 12 + 28 + 52)

15 Use 5 equal-width panels and the midpoint rule for the function and interval below. What is the resulting approximation?

$$f(x) = 2x^2 + 5, \quad 0 \le x \le 10$$

A	710	B	730
C	530	D	930

16 The graph shows f(x) and a midpoint approximation on [0, 4] using 2 equal-width panels. How does this approximation compare with the area under f(x)?



A	underestimate
B	exact
C	overestimate
D	cannot be determined

17 The table gives x: 0, 1, 2, 3, 4 and f(x): 2, 4, 10, 20, 34, respectively. Which expression sets up the trapezoidal approximation on [0, 4] using 2 equal-width panels?

A	$2(2+10)$
B	$2(10+34)$
C	$2(4+20)$
D	$1(2+2(10)+34)$

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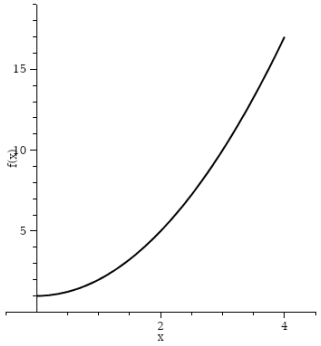
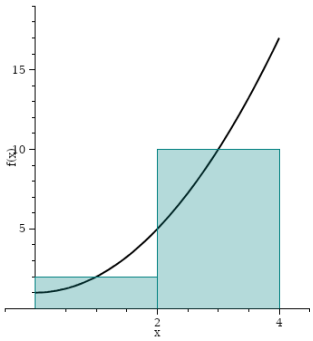
Numerical Approximation of Integrals

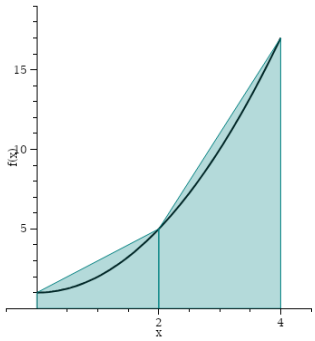
18 Which diagram shows the trapezoidal approximation for f(x) on [0, 4] using 2 equal-width panels?



A



B



19 Use the trapezoidal rule with the subintervals below. What is the resulting approximation?

$$f(x) = 2x^2 + 5, \quad [0, 6], \ [6, 8]$$

A 728	B 584
C 456	D 184

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

$$F(x) = 1x^2 + 123$$

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

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

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

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

21 Find the general antiderivative of the function below.

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

A	$-6x^2 + 1x + C$
B	$-3x^2 + 1x + C$
C	$-3x^2 + 1 + C$
D	$-3x^2 + 1x$

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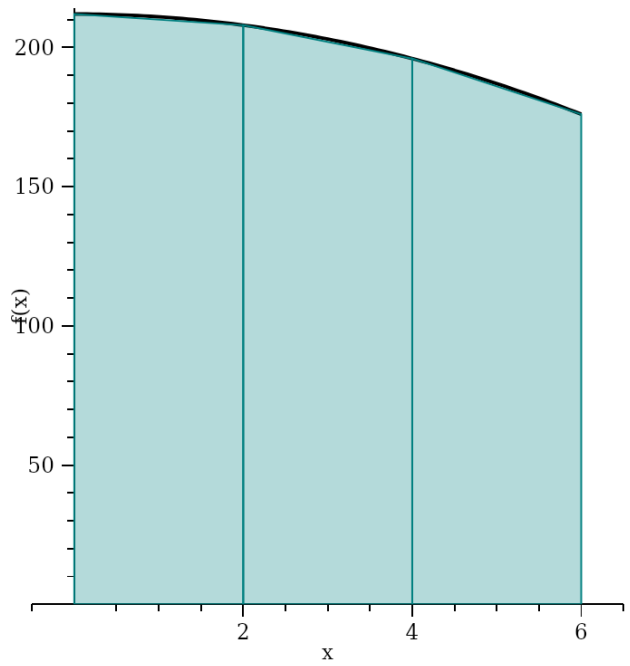
Numerical Approximation of Integrals

22 The graph shows f(x) and a trapezoidal approximation on [0, 6] using 3 equal-width panels. How does this approximation compare with the area under f(x)?



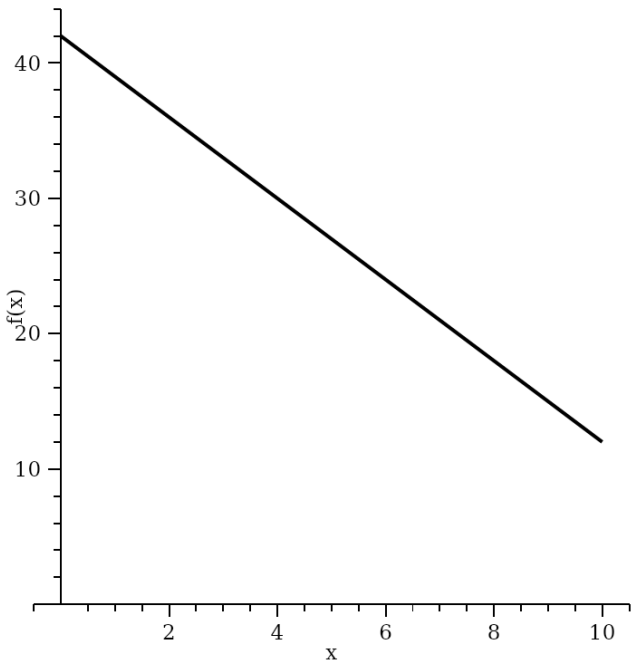
A underestimate

B cannot be determined

C exact

D overestimate

23 The graph shows a monotone f(x) on [0, 10]. For 5 equal-width panels, which statement correctly compares the left- and right-endpoint sums with the area under f(x)?



A left: overestimate; right: overestimate

B left: underestimate; right: underestimate

C left: underestimate; right: overestimate

D left: overestimate; right: underestimate

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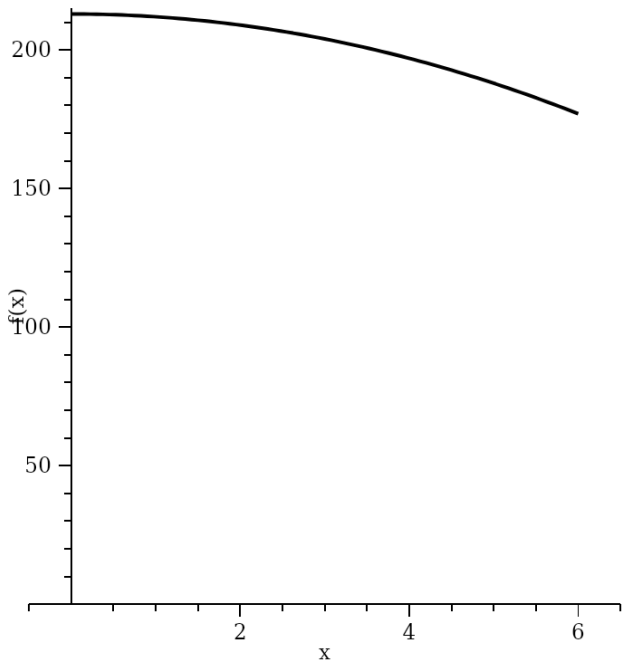
Numerical Approximation of Integrals

24 The graph shows f(x) on [0, 6]. For 3 equal-width panels, which statement correctly compares the midpoint and trapezoidal approximations with the area under f(x)?



A
midpoint: overestimate; trapezoid: underestimate

B
midpoint: overestimate; trapezoid: overestimate

C
midpoint: underestimate; trapezoid: underestimate

D
midpoint: underestimate; trapezoid: overestimate

25 Which expression gives the derivative of the function below before simplifying?

$$F(x) = -1x^2 + 120$$

A $-1(2x) + 120$

B $-1(x^2) + 0$

C $-1(2x) + 0$

D $-1(x) + 0$

26 Which function has the one below as an antiderivative?

$$F(x) = 3x^2 + 122$$

A $f(x) = 3x$

B $f(x) = 6x$

C $f(x) = 6x + 122$

D $f(x) = 6x^2$

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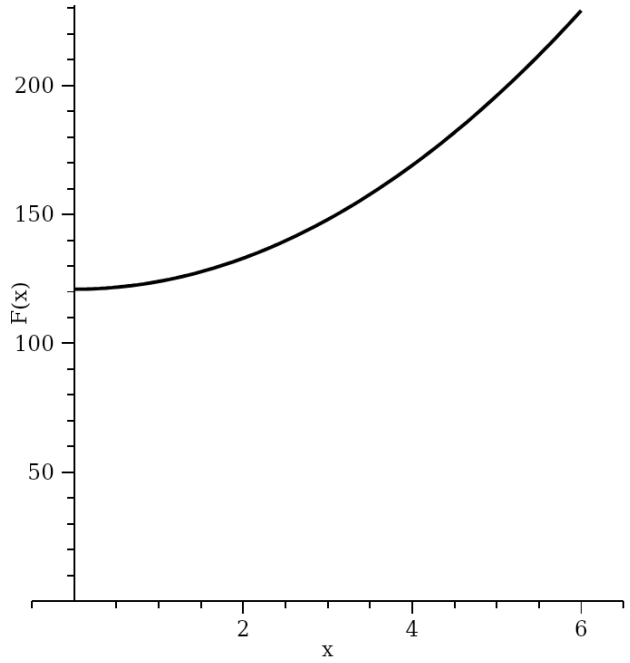
Numerical Approximation of Integrals

27 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 increases; f is positive

C
F decreases; f is negative

D
F decreases; f is positive

28 Which rule applies to the x term of the function below?

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

A
$\text{power rule}: \int x\,dx = 1 + C$

B
$\text{power rule}: \int x\,dx = \frac{x^2}{2}$

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

D
$\text{power rule}: \int x\,dx = x^2 + C$

29 Which expression sets up the general antiderivative before simplifying?

$$f(x) = -4x + 1$$

A
$-4(x^2) + 1x + C$

B
$-4(\frac{x^2}{2}) + 1x + C$

C
$-4(\frac{x^2}{2}) + 1 + C$

D
$-4(\frac{x^2}{2}) + 1x$

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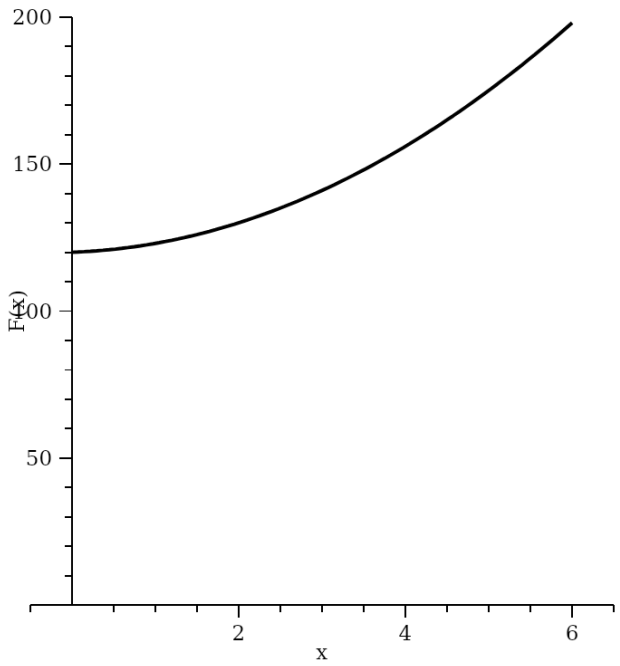
30 The graph shows one antiderivative F of f. Which expression describes the entire family of antiderivatives of the same f?



A F(x + C), for any real constant C

B F(x) + C, for any real constant C

C C F(x), for any real constant C

D F(x) + Cx, for any real constant C

31 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 = F(2) = 146

C Substitute x = 2 into F'(x) and solve for C

D Set C = 0 for every antiderivative

32 Which equation determines the constant of integration?

$$F'(x) = -4x + 7, \quad F(2) = 126$$

A $126 = -2(2^2) + 7(2)$

B $126 = -2(2^2) + 7 + C$

C $126 = -4(2) + 7 + C$

D $126 = -2(2^2) + 7(2) + C$

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33 Find the particular antiderivative satisfying the initial condition below.

$$F'(x) = 4x + 11, \quad F(2) = 150$$

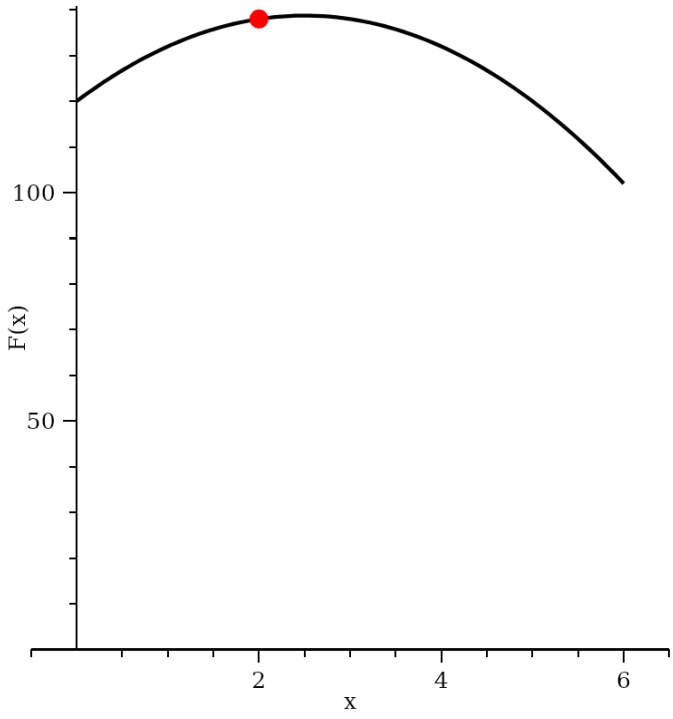
A $F(x) = 2x^2 + 11x + 151$

B $F(x) = 2x^2 + 11x + 120$

C $F(x) = 2x^2 + 11x + 150$

D $F(x) = 4x^2 + 11x + 120$

34 The graph of F(x) marks (2, 138). Given F'(x) = -6x + 15 and F(x) = -3x^2 + 15x + C, what is C?



A 138

B 150

C 121

D 120

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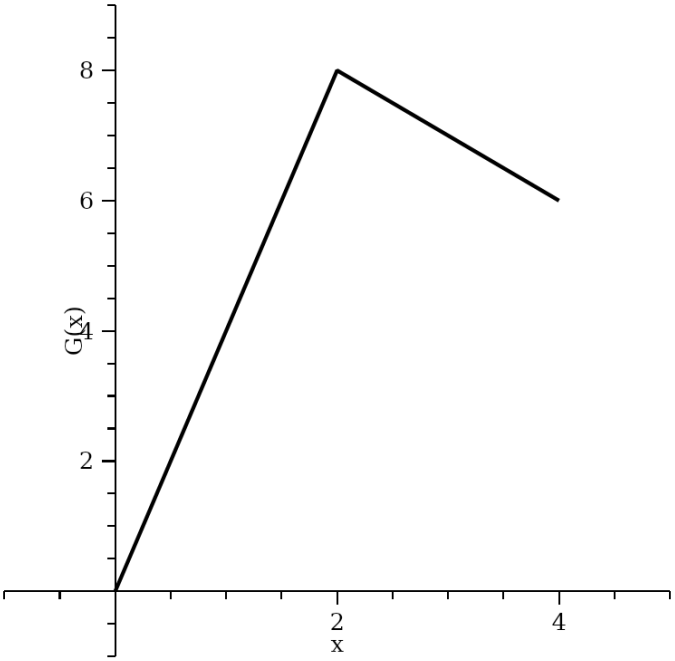
Numerical Approximation of Integrals

35 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.



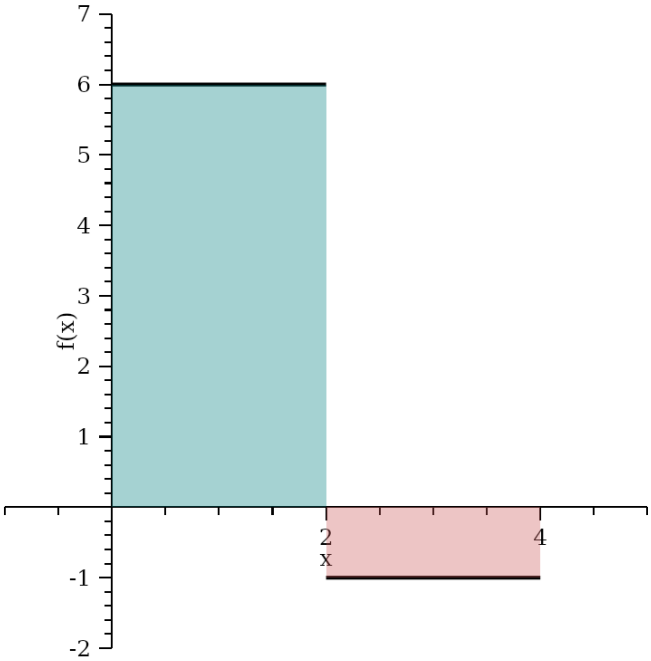
A
4

B
-1

C
1

D
-4

36 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
14

B
-14

C
12

D
10