LESSON MAKER PRO

Integral Property Quest

Use integral rules to combine, split, and reverse intervals.

HIGH SCHOOL · MA.912.C.4.6

MA.912.C.4.6 "Evaluate or solve problems using the properties of definite integrals. Properties are limited to the following:"

NAME _____ DATE _____

INTEGRAL RULES

An integral over a whole interval equals the sum of integrals over adjoining intervals. Reversing the bounds changes the sign, and an integral can distribute across sums and constant multiples. The integral from a value to itself is zero.

WORKED EXAMPLE

Given integral from 2 to 6 of f(x) dx = 9 and integral from 2 to 6 of g(x) dx = -3, evaluate integral from 2 to 6 of [2f(x) - g(x)] dx.

1. Distribute the integral: 2(integral from 2 to 6 of f(x) dx) - integral from 2 to 6 of g(x) dx.
2. Substitute the known values: 2(9) - (-3).
3. Simplify: 18 + 3 = 21.

Answer: 21

PRACTICE 6 problems

1 Given integral from 1 to 4 of p(x) dx = 7, find integral from 4 to 1 of p(x) dx.

ANSWER _____

2 Given integral from -5 to 1 of q(x) dx = -8, find integral from -5 to -5 of q(x) dx.

ANSWER _____

3 Given integral from 0 to 4 of r(x) dx = 5 and integral from 4 to 7 of r(x) dx = -1, find integral from 0 to 7 of r(x) dx.

ANSWER _____

4 Given integral from -4 to 5 of s(x) dx = 12 and integral from -4 to 1 of s(x) dx = 8, find integral from 1 to 5 of s(x) dx.

ANSWER _____

5 Given integral from 4 to 8 of h(x) dx = -7, find integral from 4 to 8 of -5h(x) dx.

ANSWER _____

6 Given integral from -8 to -1 of u(x) dx = 15 and integral from -8 to -1 of v(x) dx = -4, find integral from -8 to -1 of [u(x) + v(x)] dx.

ANSWER _____

APPLY IT Show your work

1 During a livestream, r(t) is the rate of change in viewers, in viewers per minute. The stream has 240 viewers at t = 0. Given integral from 0 to 5 of r(t) dt = 18 and integral from 5 to 11 of r(t) dt = -7, how many viewers are watching at t = 11?

WORK SPACE

ANSWER _____

2 A student's phone battery changes at rate b(t), measured in percentage points per hour. At t = 1, the battery is 34%. Given integral from 7 to 1 of b(t) dt = -16, what is the battery percentage at t = 7?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Given integral from -7 to -1 of f(x) dx = 4, integral from -1 to 5 of f(x) dx = 13, and integral from -7 to 5 of g(x) dx = -8, evaluate integral from 5 to -7 of [4f(x) + 5g(x)] dx.

WORK SPACE AND ANSWER

ANSWER KEY

Integral Property Quest

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Given integral from 1 to 4 of p(x) dx = 7, find integral from 4 to 1 of p(x) dx.	**-7**
2	Given integral from -5 to 1 of q(x) dx = -8, find integral from -5 to -5 of q(x) dx.	**0**
3	Given integral from 0 to 4 of r(x) dx = 5 and integral from 4 to 7 of r(x) dx = -1, find integral from 0 to 7 of r(x) dx.	**4**
4	Given integral from -4 to 5 of s(x) dx = 12 and integral from -4 to 1 of s(x) dx = 8, find integral from 1 to 5 of s(x) dx.	**4**
5	Given integral from 4 to 8 of h(x) dx = -7, find integral from 4 to 8 of -5h(x) dx.	**35**
6	Given integral from -8 to -1 of u(x) dx = 15 and integral from -8 to -1 of v(x) dx = -4, find integral from -8 to -1 of [u(x) + v(x)] dx.	**11**

PART 2 · APPLY IT

1. **251 viewers** Combine the adjoining intervals to get a net viewer change of 18 + (-7) = 11. Add 11 to the starting total of 240.
2. **50%** Reverse the bounds, so integral from 1 to 7 of b(t) dt = 16. Add 16 percentage points to 34%.

CHALLENGE

-28

Accept equivalent notation for definite integrals and correct intermediate expressions. For the word problems, accept answers that include the correct numerical result with appropriate units.