

Integral Finish Line

Use antiderivatives to find exact accumulated change.

HIGH SCHOOL • MA.912.C.4.4

MA.912.C.4.4 "Evaluate definite integrals by using the Fundamental Theorem of Calculus."

NAME _____

DATE _____

THE BIG IDEA

To evaluate $\int$ from a to b of $f(x) dx$, find an antiderivative $F(x)$ such that $F'(x)=f(x)$. Then calculate $F(b)-F(a)$, subtracting the value at the lower limit.

WORKED EXAMPLE

Evaluate $\int$ from 11 to 17 of $x dx$.

1. An antiderivative is $F(x)=x^2/2$.
2. $F(17)=289/2$ and $F(11)=121/2$.
3. $F(17)-F(11)=289/2-121/2=84$.

Answer: 84

PRACTICE 6 problems

1 Evaluate $\int$ from 0 to 3 of $x^2 dx$.

ANSWER _____

2 Evaluate $\int$ from -3 to 3 of $x^3 dx$.

ANSWER _____

3 Evaluate $\int$ from 2 to 5 of $(4x-3) dx$.

ANSWER _____

4 Evaluate $\int$ from -4 to 0 of $(x+5) dx$.

ANSWER _____

5 Evaluate $\int$ from 1 to 4 of $3x^2 dx$.

ANSWER _____

6 Evaluate $\int$ from 0 to π of $\sin(x) dx$.

ANSWER _____

APPLY IT Show your work

- 1** An e-bike's velocity is $v(t)=3t+2$ meters per minute, where t is time in minutes. How far does the e-bike travel from $t=0$ to $t=4$?

WORK SPACE

ANSWER _____

- 2** During a gaming tournament, spectators enter at a rate of $r(t)=4t+1$ spectators per minute, where t is minutes after the doors open. How many spectators enter from $t=1$ to $t=3$?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Evaluate $\int$ from -4 to 6 of $|x| dx$. Explain your reasoning by splitting the integral where the expression inside the absolute value changes sign.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Evaluate $\int$ from 0 to 3 of x^2 dx.	9
2	Evaluate $\int$ from -3 to 3 of x^3 dx.	0
3	Evaluate $\int$ from 2 to 5 of $(4x-3)$ dx.	33
4	Evaluate $\int$ from -4 to 0 of $(x+5)$ dx.	12
5	Evaluate $\int$ from 1 to 4 of $3x^2$ dx.	63
6	Evaluate $\int$ from 0 to π of $\sin(x)$ dx.	2

PART 2 • APPLY IT

- 32 meters** Evaluate $\int$ from 0 to 4 of $(3t+2)$ dt. An antiderivative is $(3/2)t^2+2t$, and its value from 0 to 4 is 32.
- 18 spectators** Evaluate $\int$ from 1 to 3 of $(4t+1)$ dt. Using $2t^2+t$ gives $21-3=18$.

CHALLENGE

26; $\int$ from -4 to 0 of $(-x)$ dx + $\int$ from 0 to 6 of x dx = 8+18=26.

Accept equivalent exact forms and correct use of $F(b)-F(a)$. For the challenge, accept a correct split at $x=0$ with an accurate explanation of why $|x|=-x$ for negative x and $|x|=x$ for positive x .