Areas, average values and accumulated change

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A sample from this topic. The complete topic collection contains three different resources and worked solutions.

Read the worked example, then show each step in the practice questions. Show the mathematical steps. A calculator, graphing tool or CAS may be used to check results where useful.

What you will practise

• Applications of integration

Useful starting skills: Mathematical Methods Units 1–2 functions, algebra, probability and introductory calculus.

A definite integral gives signed accumulation. Geometric area requires positive contributions and may need splitting at intersections or axis crossings.

The average value of f over [a, b] is $(1/(b-a))\int_a^b f(x)dx$. When integrating a rate, interpret units and add the initial quantity if required.

Worked example

Find area between $y=x$ and $y=x^2$ on [0, 1].

The line is above the parabola; integrate $x-x^2$ to obtain 1/2-1/3.

Answer: 1/6.

Try it yourself

Name: _____ Date: _____

1. Find area under $y=2x+1$ from 0 to 3.

2. Find signed integral and geometric area of $y=x$ on $[-1, 1]$.

Answers and explanations

Check the method as well as the final answer. An alternative correct method is also valid.

1. 12 square units.

$\int(2x+1)dx=x^2+x$; evaluate at 3.

2. Signed 0; area 1.

Odd symmetry cancels the signed integral; two triangles each have area 1/2.

Curriculum reference: Mathematical Methods Units 3–4 — Applications of integration

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