Polynomial calculus and optimisation

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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. Attempt the reasoning and exact calculations by hand. Technology may check a result but cannot replace the written argument.

What you will practise

- Polynomial differentiation, anti-differentiation and applications

Useful starting skills: Year 10 algebra, factorisation, functions, indices, geometry and elementary probability.

The derivative of x^n is $nx^{(n-1)}$ for a polynomial power. Stationary points satisfy $f'(x)=0$, but classifying them needs a sign test or other reasoning.

Anti-differentiation reverses differentiation and introduces an arbitrary constant. An initial or boundary condition selects one curve. Compare endpoints as well as stationary points in a closed-interval optimisation.

Worked example

Differentiate $f(x)=2x^3-5x+4$.

Apply the power rule term-by-term

the constant differentiates to 0.

Answer: $f'(x)=6x^2-5$.

Try it yourself

Name: _____ Date: _____

1. Differentiate $3x^4-2x^2+7$.

2. Find tangent to $y=x^2$ at $x=3$.

Answers and explanations

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

1. $12x^3 - 4x$.

Apply the power rule to each term.

2. $y = 6x - 9$.

Point $(3, 9)$, gradient $2 \times 3 = 6$; use point-gradient form.

Curriculum reference: Mathematical Methods Units 1–2 — Polynomial differentiation, anti-differentiation and applications

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