

Differential calculus

Use derivatives to find gradients, tangent equations and stationary points of polynomial functions.

Differentiate each term

For a polynomial term ax^n , the derivative is anx^{n-1} . A constant differentiates to zero. In this guide the power rule is used for polynomial functions.

Interpret the derivative

At $x = a$, $f'(a)$ is the tangent gradient. Solve $f'(x) = 0$ for stationary points, then substitute each x value into $f(x)$ for its y coordinate.

Formula sheet

$$d(ax^n)/dx = anx^{n-1}$$

$$\text{Tangent: } y - f(a) = f'(a)(x - a)$$

Worked example

Find the tangent to $f(x) = x^2 + 3x$ at $x = 1$.

1. Differentiate: $f'(x) = 2x + 3$.
2. Gradient at $x = 1$: $f'(1) = 5$.
3. Point on the graph: $f(1) = 4$, so $(1; 4)$.
4. Tangent: $y - 4 = 5(x - 1)$, hence $y = 5x - 1$.

Try it yourself

1. Differentiate $f(x) = 3x^3 - 4x + 7$.
2. Find the stationary point of $f(x) = x^2 - 6x + 2$.

Check your answers

1. $f'(x) = 9x^2 - 4$.
2. $f'(x) = 2x - 6 = 0$ gives $x = 3$; $f(3) = -7$. The point is $(3; -7)$.

Common mistake

A derivative gives the gradient, not the y coordinate. Use the original function to find the point.

Source and scope

Original Pass Papers ZA revision notes; curriculum reference linked below.

Updated 2026-10-28. Selected revision topics, not an official examination paper. Check your teacher's scope.

Official DBE curriculum / textbook reference

Read online: <https://passpapers.co.za/study/revision/grade-12-mathematics-differential-calculus>