# Tangents to Polynomials at an Arbitrary Point p

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*(Based on exercises from "Elementary Functions," SMSG, Yale, 1961)*

## Problem

Given a polynomial and a number p,

(a) find the equation of the tangent to the polynomial at x=p;

(b) graph the tangent and the polynomial on the same set of axes.

## Example

$y = 1 + 2\,x - x^2 + 2\,x^3; \quad p = 4$

(a) As in the previous laboratory handout, rewrite the polynomial in powers of (x-4):

$1 + 2\,x - x^2 + 2\,x^3 = 121 + 90(x-4) + 23(x-4)^2 + 2(x-4)^3.$

Now omit all terms with powers of (x-4) higher than the first:

Answer: $121 + 90(x-4)$

(b) Plot both:

```
> plot([1+2*x-x^2+2*x^3,121+90*(x-4)],x=2..6);
```

## Exercises

1. $y = 3 + 4\,x + 2\,x^2 + x^3$ ; $p = 2$
2. $y = 4\,x^3 + x^2 + 3\,x$ ; $p = 3$
3. $y = 3 + 2\,x^3 + 4\,x^2$ ; $p = -3$
4. $y = 4\,x^3 - 3\,x^2 + 2\,x + 1$ ; $p = -4$