John is earning simple interest on his investment of $250 at the rate of 5% yearly. When will his investment reach $500?
Jane is earning simple interest on her investment of $200 at the rate of 6% yearly. Will her investment catch up with (that is, equal and surpass) John’s\(^1\), and, if so, when will this happen?

**Note** When applying the formulas above (and when calculating the result of any expression involving several operations), always obey the **precedence rules between operations, which determine the order in which they have to be applied**: first evaluate expressions in parentheses, second apply powers and roots, third apply products and quotients, last sums and differences. If in doubt, check Chapter 2 in the book.

### Part II. Polynomials

For the function \( f(x) = x^4 + 2x^2 - 7 \),

1. Determine all its \( y \)-intercepts.\(^2\).
2. Find and fully simplify \( f(3) \).
3. Find and fully simplify \( f(-3) \).
4. Find and fully simplify \( f(a - 1) \), where \( a \) is a generic fixed constant (in other words, \( a \) is to be thought as a fixed number, which we did not specify)

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\(^1\) If we denote Jane’s wealth at time \( t \) by \( J(t) \), and John’s (at the same time \( t \)) by \( j(t) \), we are asking for a time \( t \) such that \( J(t) = j(t) \) (if there is such a \( t \), Jane will have a larger investment than John after that time). **The question is NOT asking for the time when Jane reaches $250 or $500!**

\(^2\) Recall that a \( y \)-intercept is a point where the graph of the function crosses the \( y \)-axis (the vertical axis).
Part III. Powers and Exponential Functions

Make sure you checked the material in Chapter 10 when working on these questions.

4

Simplify as much as possible: \( \frac{3x^3y^2}{8x^2y^7} \)

5

Determine an exponential function of the form \( y = ab^x \) (that is, find \( a \) and \( b \)), whose graph goes through the points \((0, \frac{1}{2})\) and \((3, 4)\)