Using and Solving Formulas

Worked Examples

If you put *P* dollars into an interest-bearing account and leave it there, the amount of money *A* in the account after *t* years is given by the formula

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Here *r* is the annual interest rate, expressed as a decimal, and *n* is the number of compounding periods per year.

If you put $1000 into an account that earns 1.5% interest per year, compounded monthly, then how much money is in the account after 4 years?

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Reading the problem carefully tells us what all the letters stand for. A is the amount at the end, which is what we want to know. P is the amount we deposit (P stands for principal) – in this example, it's \$1000. r is the interest rate, expressed as a decimal; in this example, $r = 0.015$. n is the number of compounding periods per year – this is compounded monthly, so $n = 12$. t is the number of years, which we're told is 4.

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There will be $1,061.80 in the account at the end of 4 years.

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You can compute this step by step, if you want to. But don't round your answers until the very end of the problem. If you have an algebraic calculator (like a TI-84), you can type this in directly – just make sure you use parentheses to preserve the order of operations.

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Now suppose we want to put our money in an account and have $5000 by the end of three years. Depending on the interest rate, we will need different amounts to start. This is a good time to solve this formula for *P*, our starting amount:

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Solve this formula for *P*.

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$

$$P = \frac{A}{\left(1+\frac{r}{n}\right)^{nt}}$$

The new formula expresses the same relationship among principal, amount in the account, interest rate, compounding periods and length of time – but now it reflects our new focus on “how much should I start with?”

Heron's formula gives the area of any triangle in terms of its side lengths (so you don't have to know its height). The formula is

$$A = \sqrt{s(s-a)(s-b)(s-c)},$$

where *a*, *b*, and *c* are the three side lengths and *s* is the "semiperimeter," or $s = \frac{1}{2}(a+b+c)$.

Find the area of a triangle with side lengths 3 cm, 8 cm, and 9 cm.

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Note that the formula has the right units for area. First we multiply 4 lengths, so that gives us length units to the 4th power. Then we take the square root, so we get square units for the area.

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Then we can find
$$A = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{10(10-3)(10-8)(10-9)} = \sqrt{140} \cong 11.83 cm^2.$$

The area of this triangle is about 11.83 square centimeters.