If you've mastered arithmetic, fractions, and the basic algebraic concepts illustrated in the problems below, you are ready for the Art of Problem Solving Online Class, **Math 8: Introduction to Geometry**. (Answers to these problems can be found on the page following the test questions.)

Solving linear equations

1. (a) Find x: $31x + 24 = 365$.
   (b) Find n: $7n - 4 = 2n + 16$.

Simplifying fractions containing algebraic expressions

2. Reduce the following fractions:
   (a) $\dfrac{3x+6}{3}$.
   (b) $\dfrac{n(n-1)}{n(n+1)(r-1)}$.

Addition and subtraction of quotients with different algebraic denominators

3. Write each of the following as a single fraction in simplest terms:
   (a) $\dfrac{1}{mn} + \dfrac{1}{m(2n-2)}$.
   (b) $\dfrac{r}{r-1} - \dfrac{r-1}{r}$.

Multiplication of polynomials and binomials

4. Expand each of the following:
   (a) $(x+2)(x+3)$.
   (b) $(x+y)(x^2+2xy+y^2)$.
   (c) $(x-1)^4$. (Hint: $(x-1)^4 = (x-1)(x-1)^3$.)

Solving polynomial equations

5. (a) Find x: $x^2 - 18x + 80 = 0$.
   (b) Find x: $2x^2 + 5x + 2 = 0$.
   (c) Find x: $x^4 - 13x^2 + 36 = 0$. (Hint: let $y = x^2$.)

Solving inequalities

6. (a) Find the solution set: $2x + 3 \leq 5x - 6$.

   (b) Find the solution set: $|x - 3| > 4$.

   (c) Find the solution set: $|x - 3| \leq 4$.

Don't look at the next page until you've attempted all the problems!

The answers are below. (The answers to problem sets and challenges given in the class will include full detailed solutions as opposed to the mere answers provided below.)

1. (a) $x = 11$
   (b) $n = 4$
2. (a) $x + 2$
   (b) $\frac{n-1}{(n+1)(r-1)}$ or $\frac{n-1}{nr+r-n-1}$.
3. (a) $\frac{3n-2}{mn(2n-2)}$ or $\frac{3n-2}{2mn^2-2mn}$.
   (b) $\frac{2r-1}{r(r-1)}$ or $\frac{2r-1}{r^2-r}$
4. (a) $x^2 + 5x + 6$.
   (b) $x^3 + 3x^2y + 3xy^2 + y^3$.
   (c) $x^4 - 4x^3 + 6x^2 - 4x + 1$.
5. (a) $x = 8, 10$.
   (b) $x = -2, \frac{-1}{2}$.
   (c) $x = -3, -2, 2, 3$.
6. (a) $x \geq 3$.
   (b) $x < -1$ or $x > 7$.
   (c) $-1 \leq x \leq 7$.