

The Art of Problem Solving
Pre-Test
Introduction to Geometry

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 book **Introduction to Geometry**. Answers to these problems are on the following page. **Do not use a calculator.**

1. **Solving linear equations.** Sample questions:

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

2. **Simplifying fractions containing algebraic expressions.** Reduce the following fractions:

- (a) $\frac{3x + 6}{3}$.
- (b) $\frac{n(n - 1)}{n(n + 1)(r - 1)}$.

3. **Addition and subtraction of quotients with different algebraic denominators.** Write each of the following as a single fraction in simplest terms:

- (a) $\frac{1}{mn} + \frac{1}{m(2n - 2)}$.
- (b) $\frac{r}{r - 1} - \frac{r - 1}{r}$.

4. **Multiplication of polynomials and binomials.** Expand each of the following:

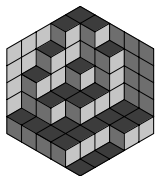
- (a) $(x + 2)(x + 3)$.
- (b) $(x + y)(x^2 + 2xy + y^2)$.
- (c) $(x - 1)^4$. (Hint: $(x - 1)^4 = (x - 1)(x - 1)^3$.)

5. **Solving polynomial equations.** Sample questions:

- (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 $y = x^2$.)

6. **Solving inequalities.** Sample questions:

- (a) Find the solution set: $2x + 3 \leq 5x - 6$.
- (b) Find the solution set: $|x - 3| > 4$.
- (c) Find the solution set: $|x - 3| \leq 4$.



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Answers

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) $-1 \leq x \leq 7$.