

The Art of Problem Solving Online Classes
Do You Know
Algebra 1?

This diagnostic test consists of two parts, **Fundamentals** and **Problem Solving**. If you can solve nearly all of the **Fundamentals** problems and at least half of the **Problem Solving** problems, then the Art of Problem Solving Online Class **Algebra 1** would only serve as a review for you. Answers to these problems are included at the end of this document. Do not use a calculator.

Fundamentals

1. **Solving Linear Equations.** Solve each of the following:

(a) $3x - 7 = 9 - x$

(b) $\frac{7-2r}{3} = 4r$

2. **Proportion.**

(a) If x and y are directly proportional and $x = 8$ when $y = 20$, then what is y when $x = 40$?

(b) If x and y are inversely proportional and $x = 8$ when $y = 20$, then what is y when $x = 40$?

3. **Systems of Equations.**

(a) Find all values of r and s such that $r - s = 5$ and $3r - 5s = 9$.

(b) Find all values of p and q such that $3p + 7q = 1$ and $5p = 14q + 53$.

4. **Graphing Lines.**

(a) What is the slope of the line through $(3, 4)$ and $(-1, 3)$?

(b) What is the slope of the graph of $3x - 4y = 7$?

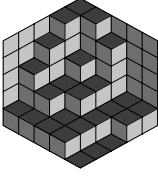
(c) Find the slope-intercept form of the equation of the line through $(5, -2)$ and $(-1, 6)$.

5. **Introductory Quadratics.** Find all solutions to the following equations:

(a) $4x^2 = 81$

(b) $x^2 + 8x + 12 = 0$

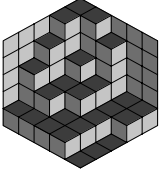
(c) $x^2 - 3x - 88 = 0$



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Problem Solving

6. A box containing 3 oranges, 2 apples, and one banana weighs 15 units. Another box containing 5 oranges, 7 apples, and 2 bananas weighs 44 units. A third box containing 1 orange, 3 apples, and 5 bananas weighs 26 units. How much does each fruit weigh?
7. Find z if $\frac{3}{1 - \frac{2}{z}} = 3z$.
8. At a certain time, Janice notices that her digital watch reads a minutes after two o'clock. Fifteen minutes later, it reads b minutes after three o'clock. She is amused to note that a is six times the value of b . What time was it when she looked at her watch for the second time?
9. Calvin and Susie are running for class president. Of the first 80% of the ballots that are counted, Susie receives 53% of the votes and Calvin receives 47%. At least what percentage of the remaining votes must Calvin receive to catch up to Susie in the election?
10. The golden ratio is the largest number g such that $\frac{g}{g+1} = \frac{1}{g}$. Find $g(g-1)$.
11. A line passing through the points $(2a+2, 3a^2)$ and $(3a+4, 5a^2)$ has slope $a+3$. Find all possible values of a .
12. Describe all values of x that satisfy $7-3x < x-1 \leq 2x+9$.



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The answers to Do You Know Algebra 1 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) $x = 4$, (b) $r = \frac{1}{2}$
2. (a) 100, (b) 4
3. (a) $(r, s) = (8, 3)$, (b) $(p, q) = (5, -2)$
4. (a) $\frac{1}{4}$, (b) $\frac{3}{4}$, (c) $y = -\frac{4}{3}x + \frac{14}{3}$
5. (a) $x = \frac{9}{2}$, $x = -\frac{9}{2}$; (b) $x = -2$, $x = -6$; (c) $x = 11$, $x = -8$
6. Oranges weigh 1 unit, apples weigh 5 units, and bananas weigh 2 units.
7. 3
8. 3:09
9. 62%
10. 1
11. -1 , 6
12. $x > 2$