

# INTRODUCTION

The **Algebra 2 Word Problems MathSet** is organized according to the following 13 units:

1. Linear Equations
2. Quadratic Equations
3. Formulas
4. Number Theory
5. Functions, Graphs, and Variations
6. Measures in Right Triangles
7. Coordinate Geometry
8. Parabolic Functions/Relations
9. Conics
10. Sine and Cosine Functions
11. Higher Degree Equations
12. Sequences and Series
13. Cumulative Review

Questions are provided at two levels of difficulty. Most units contain worksheets of problems at both levels, however Units 4 and 12 contain only Level A problems and Unit 9 includes only Level B problems.

There are over 400 traditional word problems with numerous graphics. Detailed solutions for all questions are provided.

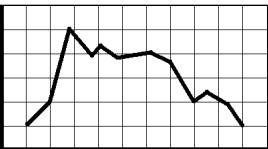
The questions in this math set are a subset of the questions available in the Algebra 2 Word Problems TestBank.

**1 LINEAR EQUATIONS****Level A**

1. **A.** A boy walks for  $x$  hours at  $3\frac{1}{2}$  mph and bicycles for  $(5 - x)$  hours at  $9\frac{1}{2}$  mph. If the total distance traveled is  $d$  miles, express  $d$  in terms of  $x$ .
- B.** Find the value of  $d$  when  $x = \frac{3}{4}$ .
- C.** Find the value of  $x$  for which  $d = 38\frac{1}{2}$ .
2. A rectangle is  $x$  inches wide and  $(x + 3)$  inches long. Between it and an outer rectangle is a border which is 2 inches wide on each side.
- A.** Write the dimensions of the outer rectangle.
- B.** Obtain the area of the border in terms of  $x$  in simplest form.
- C.** Find the value of  $x$  for which the area of the border is 172 square inches.
3. **A.** If 10 pounds of candy costing 60 cents per pound are mixed with 40 lb. of candy costing 90 cents per pound, find the cost per pound of the mixture.
- B.** If  $x$  pounds of candy costing 60 cents per pound are mixed with  $(50 - x)$  lb. of candy costing 90 cents per pound, express in terms of  $x$  in simplest form the cost of one pound of the mixture.
- C.** Find the value of  $x$  for which the cost of one pound of the mixture is 69 cents.
4. **A.** A man invests  $\$x$  at  $2\frac{1}{2}\%$  and  $\$(5000 - x)$  at  $5\frac{1}{2}\%$ . If  $\$I$  is the total annual income from the investments, express  $I$  in terms of  $x$  in simplest form.
- B.** Find the total income when  $x = 1500$ .
- C.** Find the value of  $x$  for which the total income is  $\$194$ .
5. **A.** If  $x$  pounds of a 30% acid solution are mixed with  $(100 - x)$  pounds of a 50% acid solution, and  $A$  represents the number of pounds of acid in the mixture, express  $A$  in terms of  $x$ .
- B.** Find the value of  $x$  for which the mixture forms a 42% solution of the acid.
6. **A.** Write an expression for the total value of  $x$  pounds of tea at 65 cents per pound and  $y$  pounds of tea at 80 cents per pound.
- B.** If the tea in part **A** is mixed and sold at a profit of 25%, write an expression for the total selling price.
7. The length of a room exceeds its width by 4 feet. A rug covers the floor except for a border 2 feet wide all around it. If the area of the border is 68 square feet, find the area of the rug.
8. A boy completes a 30-mile trip in 3 hours 45 minutes, cycling part of the distance at an average speed of 10 mph and walking the rest at an average rate of  $2\frac{1}{2}$  mph. Find the number of miles walked.
9. A boy skates across a pond, with the wind, at a speed of 12 mph, and returns against the wind at a speed of 4 mph. If he takes 45 minutes for the round trip, find the width of the pond. Also find the boy's average speed on the round trip.
10. A boy bought some oranges at the rate of 6 for 15 cents, and made a profit of 66 cents by selling them at a rate of 5 for 18 cents. How many oranges did he buy?

**5 FUNCTIONS, GRAPHS, AND VARIATIONS****Level A**

1. A circle of radius 5 units is tangent to the  $y$ -axis at  $(0, -3)$ .  
Give the coordinates of the center of the circle(s).
2. A circle of radius 2 units is tangent to both axes. Give the coordinates of the center of the circle(s). Consider all possible cases.
3. If a point is on the  $x$ -axis, then its ordinate is zero.  
Give the converse of this statement. Is the converse true?
4. The diagram shows a record of the temperature at any time from 8 a.m. to 5 p.m. on a certain day at a weather station. If the independent variable represents time and the dependent variable represents temperature, does the graph define a function? Explain.
 

Degrees										
	8	9	10	11	12	1	2	3	4	5
	A.M.					P.M.				
5.
  - A. Does the perimeter of a square vary directly as the length of one of its sides?
  - B. What is the constant of variation?
6. If  $y$  varies as  $x$ , and  $y = 20$  when  $x = 12$ :
  - A. express  $y$  in terms of  $x$ ,
  - B. find the value of  $x$  when  $y = 7.5$ ,
  - C. describe the change in the value of  $y$  which accompanies an increase of 50% in the value of  $x$ .
7.
  - A. Write the formula for the circumference of a circle.
  - B. Does the circumference vary directly as the radius?
  - C. What is the value of the constant of variation?
8.
  - A. If  $y$  varies directly as  $x$ , and  $y = 10$  when  $x = 4$ , what is the value of the constant of variation?
  - B. If the same relationship were expressed in the form " $x$  varies directly as  $y$ ," what would be the value of the constant of variation?
9. If  $y$  varies as  $x$ , and  $y = 4$  when  $x = 2$ , write the rule relating  $y$  and  $x$ . Draw the graph of the function defined by the rule.
10. If  $y$  varies as  $x$ , and  $y = 6$  when  $x = 2$ , write the rule relating  $y$  and  $x$ . Draw the graph of the function defined by the rule.

**6 MEASURES IN RIGHT TRIANGLES****Level B**

1. If a regular pentagon is inscribed in a circle, what angle is formed by the radii to two successive vertices of the pentagon? Find the perimeter of a regular pentagon inscribed in a circle of radius 15.0 inches.
2. A regular polygon of 9 sides is inscribed in a circle of radius 10.0 inches. Find the perimeter of the polygon to three significant figures.
3. A regular octagon is inscribed in a circle of radius 25.0 inches. Find the perimeter of the octagon.
4. A diagonal of a rectangle divides one of the angles into parts which are in the ratio 3 : 2. Express the width of the rectangle as a percentage of its length.
5. The longer base of a trapezoid is 210 feet long, and the other three sides are each 120 feet long. Find the angles of the trapezoid.
6. Use a diagram of an isosceles right triangle and of a  $30^\circ-60^\circ-90^\circ$  triangle to find  $X$  if
  - A.  $\sin X = \frac{1}{2}\sqrt{3}$
  - B.  $\sin X = \frac{1}{2}\sqrt{2}$
  - C.  $\cos X = \frac{1}{2}\sqrt{3}$
  - D.  $\tan X = \frac{1}{2}\sqrt{3}$
7. The sides of a rectangle are 12.75 in. and 27.50 in. Find the acute angle formed by the diagonals.
8. A staircase is to rise 15 ft. 2 in. in a horizontal distance of 18 ft. 4 in.
  - A. Find the inclination of the handrail to the horizontal.
  - B. Find also the vertical rise of each stair if it has a horizontal run of 10 in.
9. A regular polygon of 90 sides is inscribed in a circle of radius 10.00 in.
  - A. Find the perimeter of the polygon to three significant figures.
  - B. Find the circumference of the circle to three significant figures. (Use  $C = 3.14d$ )
10. A diagonal of a rectangle divides one of the angles into parts which are in the ratio 3:2. Express the width of the rectangle as a percentage of its length.

# 8 PARABOLIC FUNCTIONS/RELATIONS

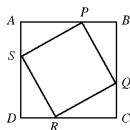
# Level B

- A gardener makes a rectangular enclosure using a wall for one side and 80 feet of fence for the other three sides. If one of the equal sides formed by the fence is  $x$  feet, express the area of the enclosure in terms of  $x$ . Find:

  - the value of  $x$  when the area is 600 square feet,
  - the largest possible area for the enclosure.

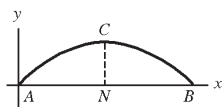
- A square  $ABCD$  of side 10 inches has a square  $PQRS$  inscribed in it, as shown in the diagram. If  $PB = x$  inches, express the area  $PQRS$  in terms of  $x$ . Find:

  - the value of  $x$  for which the area is 60 square inches,
  - the minimum value of the area.



- A parabolic arch  $ACB$  is to have a span  $AB$  of 60 feet, and a maximum height  $CN$  of 20 feet. Find:

  - the equation of the curve  $ACB$  referred to the indicated axes, taking 1 foot as a unit,
  - the width of the arch at a height of 10 feet above  $AB$ .

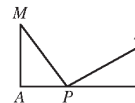


- There are 20 members of a club for which the dues are \$4.00 per member. To encourage the recruiting of new members the executive committee makes a rule that for every member above 20 in the club the dues for all members shall be reduced 10 cents.

  - Show that when there are  $x$  members in addition to the 20, the total received in dues is a quadratic expression in  $x$ .
  - Is there a value of  $x$  for which the club receipts reach \$100?
  - Up to what value of  $x$  does the total received in dues increase when a new member is added?

- In the diagram,  $AB = 12$  feet,  $AM = 6$  feet,  $BN = 4$  feet, and  $AB$  is perpendicular to both  $AM$  and  $BN$ .  $P$  is a point on  $AB$ , and the length  $AP$  is  $x$  feet.

  - Express  $(MP)^2 + (NP)^2$  in terms of  $x$ .
  - Find the position of  $P$  on  $AB$  for which  $(MP)^2 + (NP)^2$  is least.



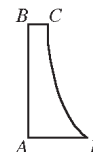
- A workman is to form a trough to carry water by bending a sheet of metal 24 inches wide so that it has a cross-section  $ABCD$  which is rectangular but open at the top. Find the length of the vertical segment  $AB$  when the capacity of the trough is as large as possible.



- A workman is to form a trough to carry water by bending a sheet of metal 24 inches wide. If the trough has a cross-section  $ABCD$  which is rectangular but open at the top, the capacity is maximized with dimensions  $AB = 6$  in. and  $BC = 12$  in. Show that the capacity of the trough can be increased if the cross-section is an isosceles trapezoid with the sides inclined at  $60^\circ$  to the horizontal.

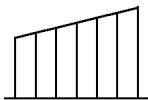


- $ABCD$  is a cross-section of a retaining wall in which  $CD$  is an arc of a parabola having its vertex at  $D$ . If  $AD = 6$  feet,  $AB = 16$  feet, and  $BC = 2$  feet, find the thickness of the wall at a height of 9 feet above the level of  $AD$ .



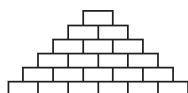
## 12 SEQUENCES AND SERIES

1. The side of a shed is 9 feet high at the front, 6 feet high at the back, and 12 feet from back to front. If supporting poles are placed at 2-foot intervals from front to back, find the total length of these supports.

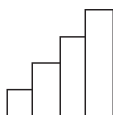


2. A boy was given an allowance of 25 cents a week beginning on his sixth birthday. On each birthday following this the weekly allowance was increased 15 cents.
- What is the weekly allowance for the year beginning on his 15th birthday?
  - Taking 52 weeks in each year find the total amount of his allowance between his sixth and sixteenth birthdays.

3. A gable end is built with 24 bricks in the lowest row, and one less brick in each row than in the row beneath. Find the total number of bricks required.



4. The lowest step of a staircase is 8 inches high, and the others each rise 6 inches above the one below. If there are 15 steps, find the total length of board required to enclose the two sides of the staircase.



5. A ball rolling down an inclined plane travels, in successive seconds,  $k$  feet,  $2.5k$  feet,  $4k$  feet, ... . Find the distance traveled by the ball in the:
- ninth second,
  - first 15 seconds.

6. A machine for cutting lengths of metal rod is such that when the pointer on a dial is set at  $x$ , each piece cut is  $x$  inches longer than the one before. A mechanic needs 36 such pieces ranging from 24 inches to 38 inches. Find the required setting on the dial, and the total length of the 36 pieces.

7. If the sum of  $\$P$  is invested at  $x\%$  compound interest, the amount or value of the investment at the end of  $k$  years is given by  $A = P(1 + \frac{x}{100})^k$ . The sum of  $\$1000$  is invested at  $4\%$  compound interest. Use the formula to write the amount of the investment at the end of 1, 2, 3,  $n$  years.

8. Find to the nearest 1% the single percentage increase in the price of an article which is equivalent to 5 successive increases of 10%.

9.
  - If  $\$1000$  is invested at  $5\%$  simple interest for 10 years, how much does it earn in that time?
  - If  $\$1000$  is invested at  $5\%$  compound interest for 10 years, how much does it earn in that time?

10. If in nuclear fission one neutron splits an atom causing the release of two others, each of which splits an atom and produces the release of two more neutrons, and so on, write the first few terms of the sequence showing the number of atoms being split at each stage. If the interval from one stage to the next is one-millionth of a second, write an expression for the number of atoms being split at the end of 1 second. If this number were written in the normal manner, approximately how many digits would it have?