

Algebra 2 · Structure of Expressions and Modeling with Equations · Worksheet

Common Core A-SSE.A.1, A-SSE.A.2, A-CED.A.1, A-CED.A.2, A-CED.A.3, A-CED.A.4, A-REI.D.11, A-APR.C.5, N-CN.C.8, N-CN.C.9 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

These 22 problems practice the structure of expressions and the modeling standards A-SSE.A.1, A-SSE.A.2, A-CED.A.1 through A-CED.A.4, A-REI.D.11, A-APR.C.5, N-CN.C.8 and N-CN.C.9. Early problems interpret and factor expressions, the middle ones expand binomials and rearrange formulas, and the last six turn real situations into equations and inequalities.

Show every step, check each answer in the original situation, and reject solutions that break a constraint.

Algebra 2 Common Core: A-SSE.A.1 · A-SSE.A.2 · A-CED.A.1 · A-CED.A.2 · A-CED.A.3 · A-CED.A.4 · A-REI.D.11 · A-APR.C.5 · N-CN.C.8 · N-CN.C.9

Problem 1: Parts of an exponential model

The value of Priya's savings account is $B = 800(1.03)^t$ dollars, where t is the number of years since she opened it.

- Identify the starting amount.
- Identify the growth factor and the yearly percent increase.
- Explain what $t = 0$ tells you about B .

Problem 2: Terms and coefficients

Consider the expression $5x^3 - 2x^2 + 7x - 9$.

- List the terms.
- Name the coefficient of each term that contains x .
- Name the constant term.
- List the factors of $3(x+1)(x-4)$.

Problem 3: Meaning of a factor

A school store sells spirit T-shirts at p dollars each. The number sold is $500 - 20p$, so revenue is $R = p(500 - 20p)$ dollars.

- Identify the two factors in R and say what each one represents.
- Find R when the price is \$5.
- Find R when the price is \$10.
- Which of the two prices earns more revenue?

Problem 4: Write and interpret a cost expression

Ethan buys n notebooks at \$2.50 each and one backpack for \$18. Sales tax is 8% of the whole purchase.

- Write an expression for the total cost in dollars.
- Explain what the factor 1.08 means.
- Evaluate the expression for $n=6$.
- Rewrite the expression in the form $an+b$.

Problem 5: Fourth-power differences

Factor each expression completely over the real numbers.

- x^4-16
- x^4-81
- $16x^4-1$
- m^4-n^4

Problem 6: Hidden squares

Factor each expression completely.

- $(x+3)^2-16$
- $(2x-1)^2-25$
- x^4-5x^2+4
- x^4-13x^2+36

Problem 7: Simplify with structure

Rewrite each rational expression in simplest form and state any excluded values.

- $\frac{x^4-16}{x^2+4}$
- $\frac{x^2-49}{x^2+14x+49}$
- $\frac{x^4-1}{x^2-1}$

Problem 8: Factor over the complex numbers

Factor each expression completely over the complex numbers.

- a. x^2+9
- b. x^2+25
- c. $4x^2+1$
- d. x^4-16

Problem 9: Quadratic zeros and the Fundamental Theorem

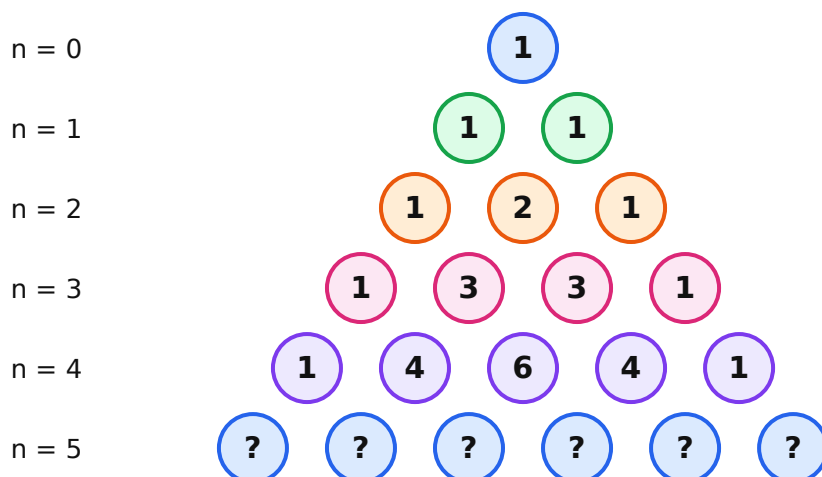
Solve each equation with the quadratic formula and write the quadratic in factored form over the complex numbers.

- a. $x^2-6x+13=0$
- b. $x^2+2x+10=0$

How many complex zeros does every quadratic have?

Problem 10: Pascal's triangle rows

Use the part of Pascal's triangle shown to answer each question.



Rows 0 to 4 are filled in; row 5 is blank.

- a. Fill in row 5 and then write row 6.
- b. What is the coefficient of a^3b^2 in $(a+b)^5$?
- c. Find the sum of the numbers in row 6. What pattern do you see?

Problem 11: Expand binomials

Use Pascal's triangle to expand each power.

- a. $(x+2)^4$
- b. $(x-3)^3$
- c. $(2x-1)^5$

Problem 12: Rearrange common formulas

Solve each formula for the variable shown.

- a. $A = \frac{1}{2}bh$ for b
- b. $P = 2l + 2w$ for w
- c. $V = \pi r^2 h$ for h
- d. $F = \frac{9}{5}C + 32$ for C

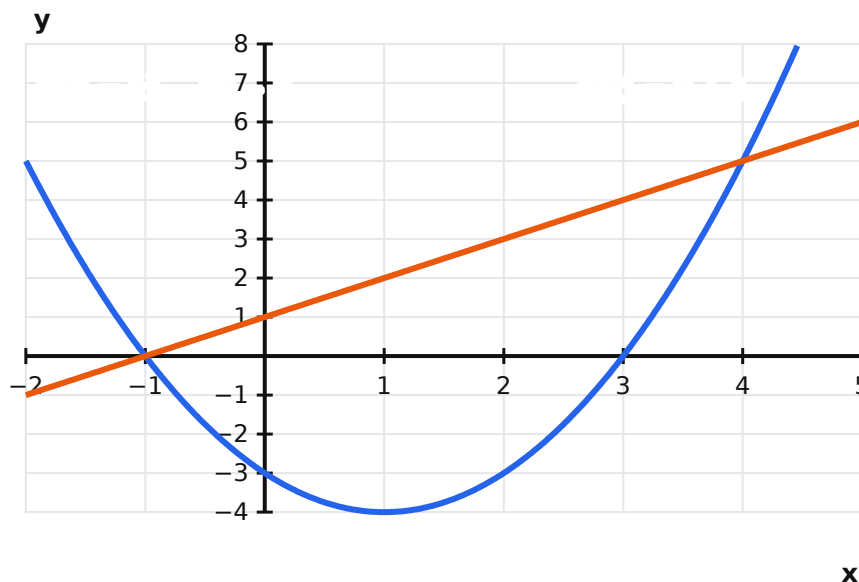
Problem 13: Rearrange formulas with fractions

Solve each equation for the variable shown.

- a. $\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$ for q
- b. $S = \frac{a}{1-r}$ for r
- c. $A = P(1+r)^t$ for P
- d. $y = \frac{2x+1}{x-3}$ for x

Problem 14: Solve $f(x) = g(x)$ from a graph

The graph shows $f(x) = x^2 - 2x - 3$ and $g(x) = x + 1$.



Graphs of f and g .

- a. Estimate the solutions of $f(x) = g(x)$ from the graph.
- b. Verify them algebraically.

Problem 15: Solve $f(x) = g(x)$ from a table

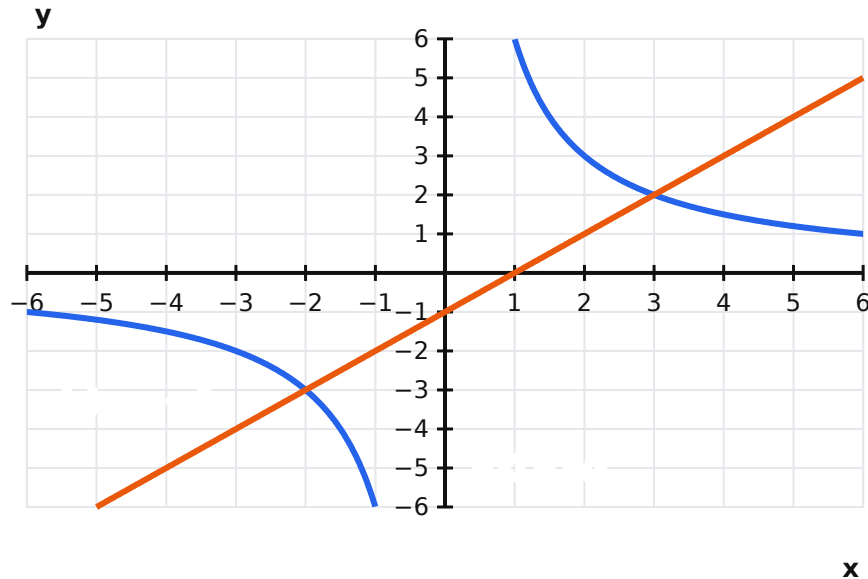
Let $f(x) = 2^x$ and $g(x) = 11 - x$. Complete the table, then solve $f(x) = g(x)$.

x	1	2	3	4	5
f(x)	?	?	?	?	?
g(x)	?	?	?	?	?

Explain why there is only one solution.

Problem 16: Solve a rational equation by graphing

The graph shows $f(x) = \frac{6}{x}$ and $g(x) = x - 1$.

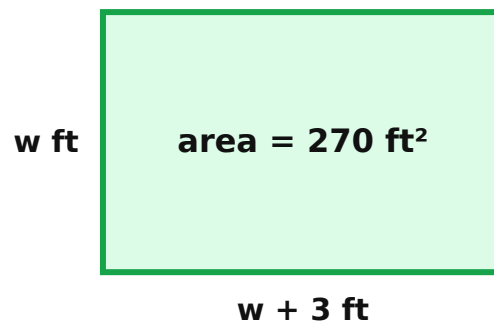


A hyperbola and a line.

- Use the graph to estimate the solutions of $f(x) = g(x)$.
- Write an equation without fractions and solve it to confirm.

Problem 17: Garden area model

Mei plans a rectangular garden whose length is 3 feet more than its width. The area must be 270 square feet.



A rectangular garden with an area of 270 square feet.

- Write an equation for the width w .
- Solve it and state the dimensions. Explain which solution you reject.
- Fencing costs \$4.50 per foot. Find the cost to fence the whole garden.

Problem 18: Speed and time model

Liam drives 60 miles on a country road at r miles per hour, then 60 miles on an interstate at $r+20$ miles per hour. The trip takes 2.5 hours in all.

- Write an equation for the total time.
- Solve it for r and reject any solution that does not fit.
- State both speeds.

Problem 19: Bacteria growth model

A lab culture starts with 500 bacteria, and the number doubles every 3 hours.

- Write a function $N(t)$ for the number of bacteria after t hours.
- Find $N(6)$.
- Write and solve an equation to find when the culture reaches 16,000 bacteria.

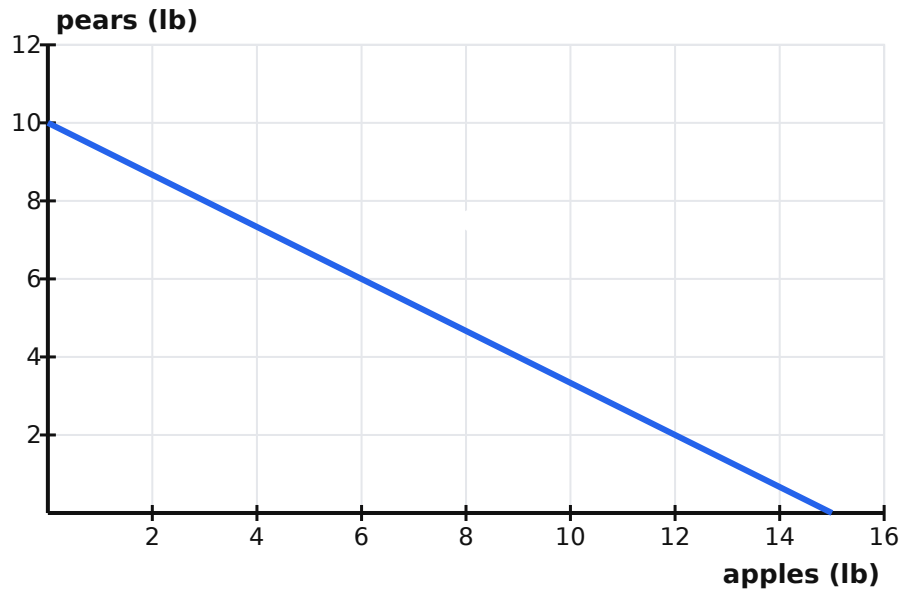
Problem 20: Budget inequality

Aisha has \$120 for team shirts. The printer charges a \$30 setup fee plus \$6.50 per shirt.

- Write an inequality for the number of shirts n she can order.
- Solve it.
- State the constraint that applies to n and give the greatest number of shirts.

Problem 21: Farmers market equation

Maya spends exactly \$30 at the farmers market on apples at \$2 per pound and pears at \$3 per pound.

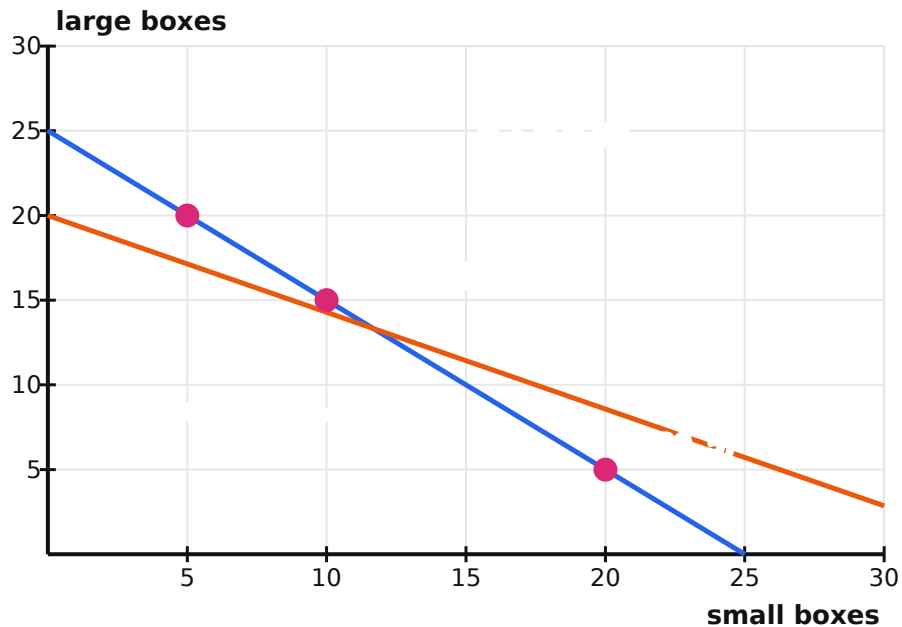


Every solution lies on this line.

- Write an equation relating apples a and pears p (in pounds).
- The stand sells whole pounds only. List every possible pair (a, p) .
- Which constraint on a and p rules out points of the line with negative coordinates?

Problem 22: Cookie box constraints

Ethan sells small cookie boxes (x of them) for \$4 and large boxes (y of them) for \$7 at a bake sale. He packed at most 25 boxes and wants to earn at least \$140.



Two boundary lines and three possible sales plans.

- Write a system of inequalities for the situation.
- Decide which of A, B and C are possible plans.

c. If Ethan sells exactly 25 boxes, what is the least number of large boxes he must sell?