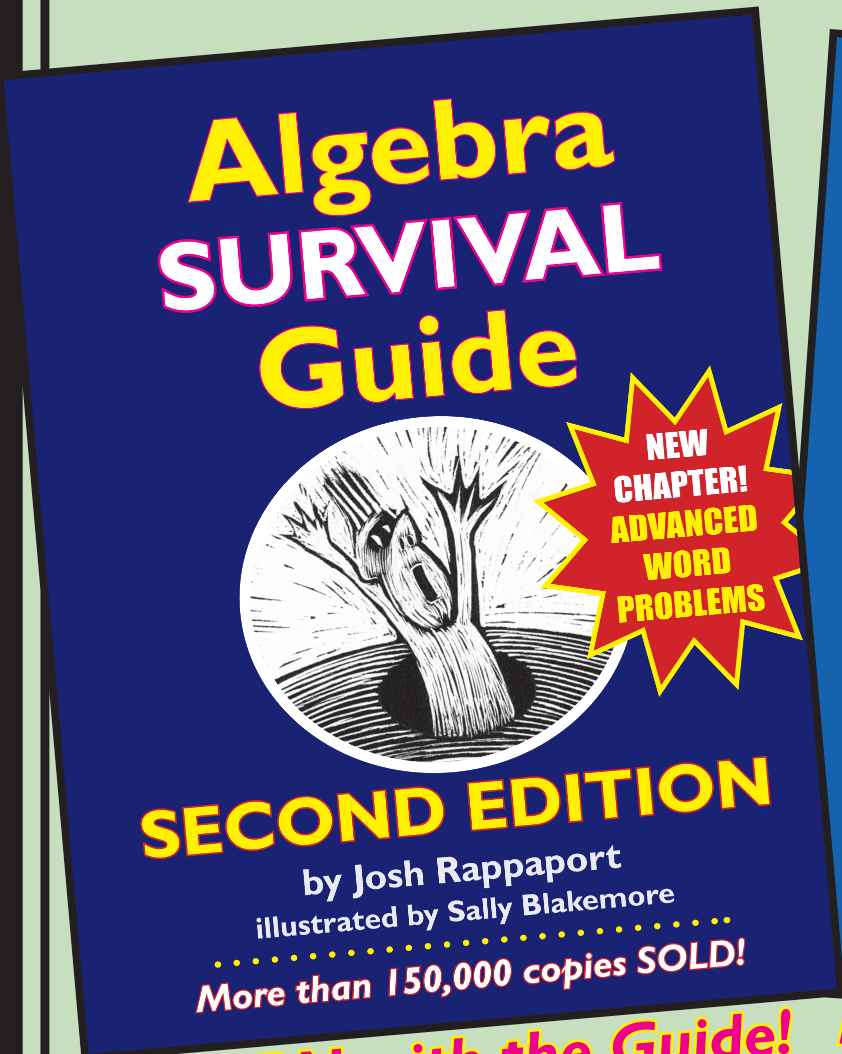
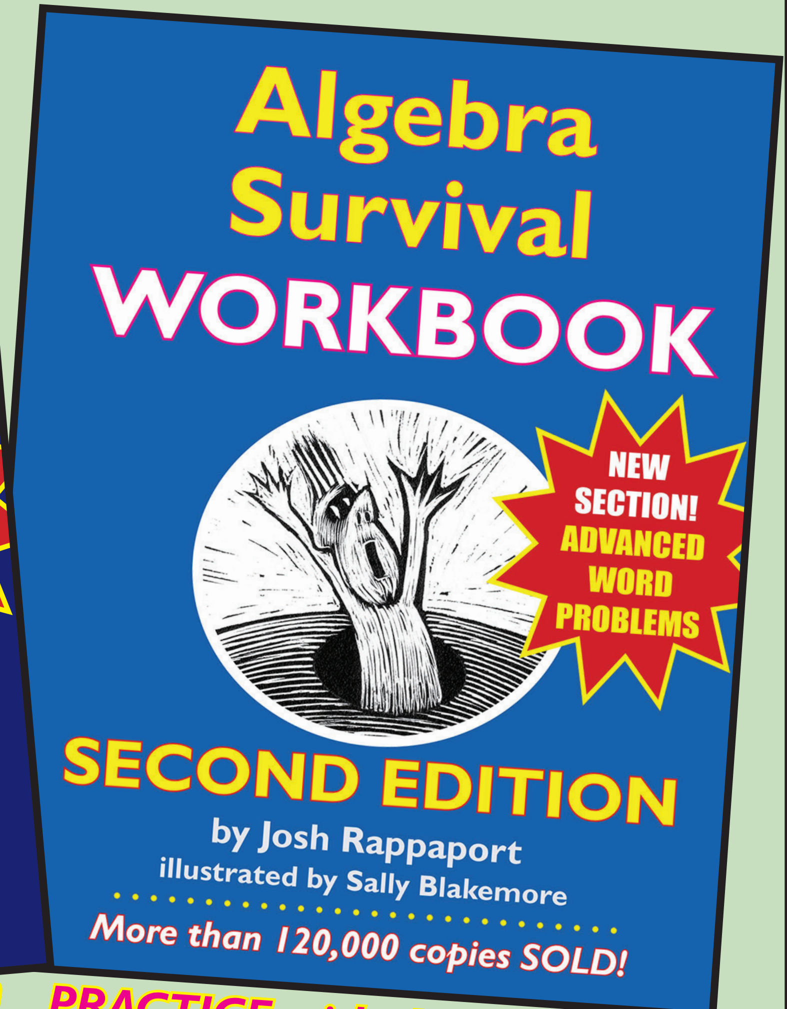
"Algebra Survival" Program – updated in a 2nd Edition





LEARN with the Guide! PRACTICE with the Workbook!

- ✓ FOR SCHOOL OR HOME USE
- ✓ PARENTS' CHOICE APPROVED
- ✓ USED IN TEACHER TRAININGS
- ✓ ALIGNED TO COMMON CORE
- ✓ CLEAR, FUN, COMPREHENSIVE!

PARENTS' CHOICE APPROVED
Parents' Choice Foundation

Algebra SURVIVAL Guide

NEW CHAPTER! ADVANCED WORD PROBLEMS

Algebra Survival Guide
may be purchased wherever
books are sold.

SRP: $19.95 US$

ISBN: 978-0-9846381-9-2

Publisher:
Singing Turtle Press
Santa Fe, New Mexico, USA
505.438.3418
info@SingingTurtle.com
www.SingingTurtle.com

SECOND EDITION

by Josh Rappaport
illustrated by Sally Blakemore

More than 150,000 copies SOLD!

CONTENTS

Welcome to the Second Edition!

It's been some time since the **Algebra Survival Guide** arrived on the scene, rescuing students lost in the **Algebra Wilderness**. And now, with the release of its 2nd edition, the **Guide** will provide even more aid to students. Here at Singing Turtle Press, we've packed this new edition with critical new 'survival' tools to make your algebra odyssey more successful than ever.

First and foremost, the 2nd edition features an all-new **62-page chapter** covering the particularly perilous **Advanced Algebra Word Problems**. This new chapter picks up where the **Guide's** previous word problem chapter left off — tackling word problems so challenging, they're known to strand students without a mental compass.

In the dank dark cave of our Algebra Survival Training Center, we spent many days huddled around our Sterno "campfire," pondering what makes these advanced word problems so maddeningly confusing. Reviewing our notes and re-hashing the memories from more than 10,000 hours of tutoring, we identified three key Challenge Zones and developed a technique for combatting each one. These techniques form the backbone of this edition's **Advanced Word Problems** chapter.

CHALLENGE ZONE #1, SETTING UP VARIABLE EXPRESISONS: Worried about the shadowy unknowns creeping about in word problems? No problem! The new chapter shows students how to set up variable expressions that capture the value of these unknowns, making them 100% manageable.

CHALLENGE ZONE #2, EXPRESSING KEY QUANTITIES: Unsure how to express the main quantities in word problems, such as the distance traveled, or the work performed? The new chapter's "Master Formula" tackles this problem, providing a surefire way to express such quantities.

CHALLENGE ZONE #3, ASSEMBLING THE EQUATION: Ever feel uncertain how to "put it all together?" We've got that covered too. The new chapter's "Master Equation" approach organizes the problem's info into a single equation that sets students on a direct path to the answer.

Like the rest of this book, the new chapter's pages are graced by the illustrations of award-winning artist Sally Blakemore. Ms. Blakemore's cartoons not only breathe life into the (ok ... dry) algebraic concepts, they also help students grasp how those concepts actually work.

But the 2nd edition delivers more that's new than just this huge, new word problems chapter. Thumbing through the new **Guide**, you'll notice several ways in which we've boosted the book's usability.

Glance at the bottom of the new edition's pages, and you'll spot an ever-changing line of white text. This line tells, **1st)** the name of chapter you're in, and **2nd)** the conceptual focus of each individual page. This navigation tool keeps you aware of where you are and mindful of where you're going.

The new edition also boasts an expanded Glossary. This mini-dictionary not only defines key terms, it also illuminates their meanings. For example, by reading the entry for the snake-like quadratic trinomial, you'll grasp this beastly concept so clearly, you'll spot and factor any trinomial before it can lunge to bite off your pencil point! The new Index, now also expanded, provides a great way to locate entries for any algebraic concept.

On a pedagogical level, the 2nd edition wrestles with an intriguing creature that wasn't even around when the **Guide** was first published: the Common Core (CC) standards, now spreading their influence through most U.S. public schools. To wrangle with this development, we meticulously surveyed the **Guide's** pages to see how its concepts and skills correlate with those of the Standards. Turns out, there's a huge amount of correlation! And so, to make things convenient for those who work with the Standards daily, we lay out a comprehensive **CC Standards Alignment Chart** on pp. 330 - 331.

Such are the highlights of the 2nd edition. We'd love to hear your comments on how the new chapter and new book work for you when you're trekking through the heart of the **Algebra Wilderness**. Feel free to shoot an email our way, aiming it to **info@SingingTurtle.com**

To your perseverance and success!

— Josh Rappaport

Hello and welcome!

You're trapped in a classroom. People are talking in what seems to be a foreign language.

Gibberish about exponents, variables, monomials, the Pythagorean theorem.

They expect you to "get it." And there's a test on all this stuff tomorrow! You are in danger of perishing at your very desk.

It's only a matter of time...

Thank goodness you just discovered the **Algebra Survival Guide.**

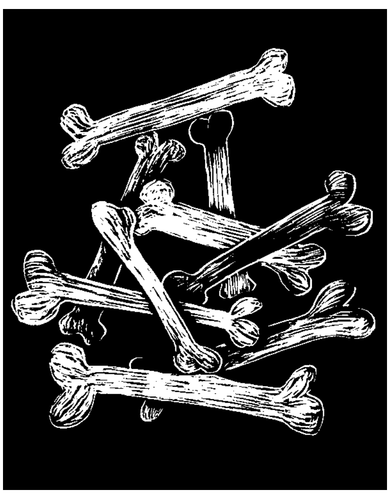
This guide, written by someone who, long ago, barely crawled out of the **Algebra Wilderness** alive, will help you find your way through this perilous territory.

But now that you have the **Guide**, how do you use it?

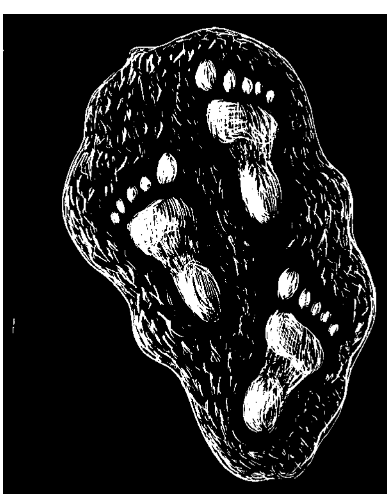
Just flip the page to find out!

A: The *Guide* contains five kinds of pages, along with regular QuikChek problems:

Mind Munchies pages give you "food for thought," to help you make sense of algebraic ideas.



Bare Bones pages present basic information you'll want to memorize cold.

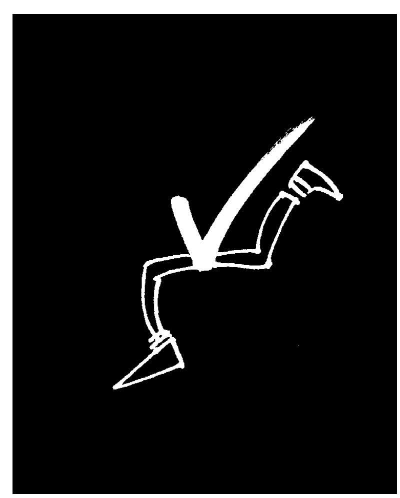


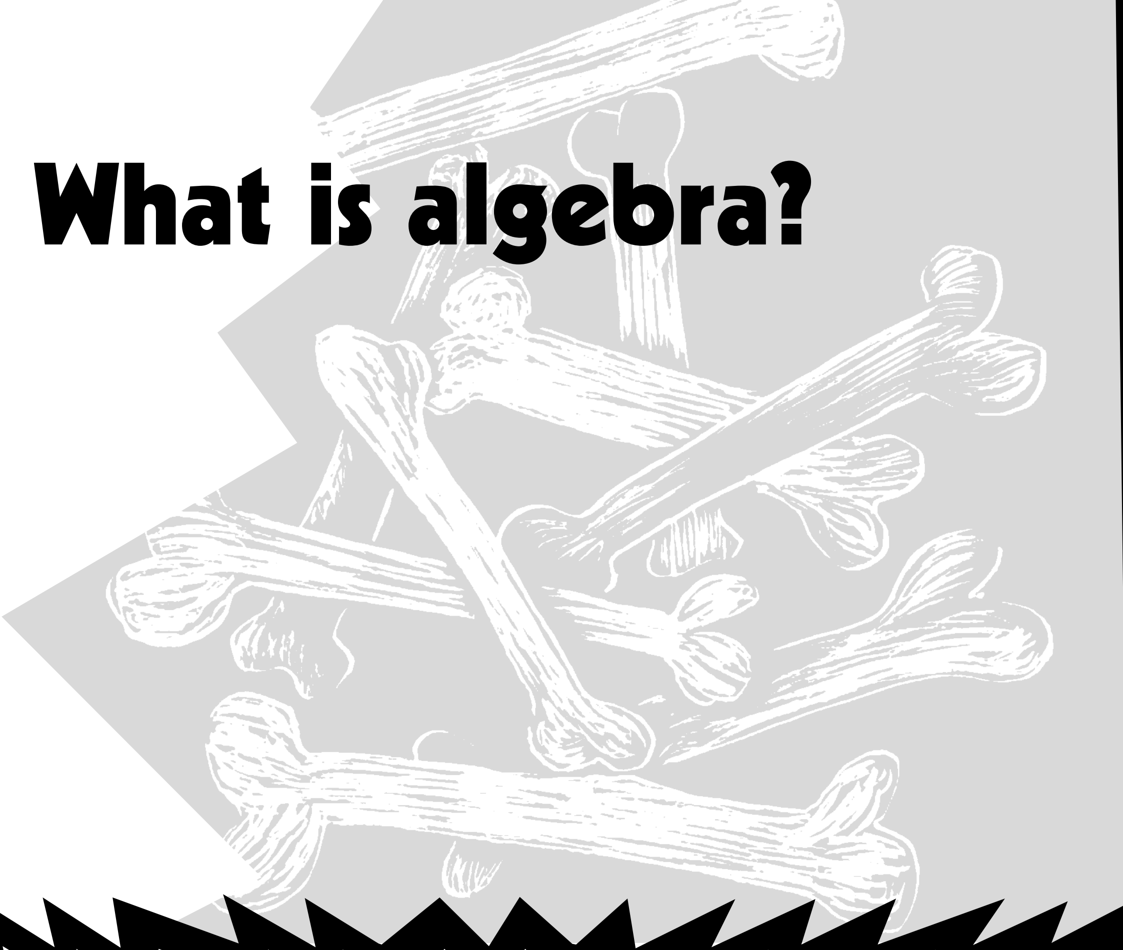
Step by Step pages show how to perform the steps for algebraic operations. These pages also illustrate those steps with an example.

Pitfall pages teach you misunderstandings and mistakes to avoid.

Target Practice pages let you test your understanding by working out practice problems.

QuikChek problems give you a chance to check your grasp of the concept just taught.



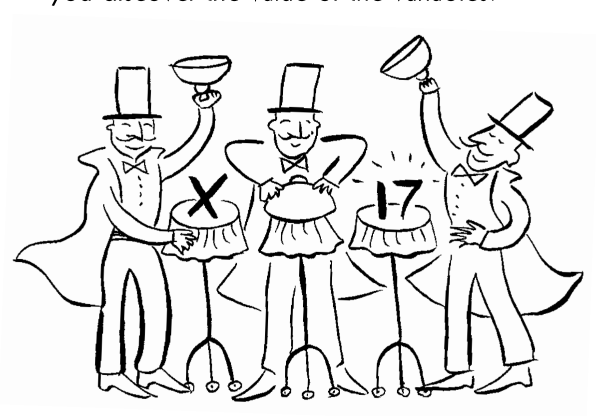


Q: What is algebra?

A: Algebra is a branch of math that performs a magic trick — it takes something that's **unknown** and - poof! - turns it into something **known**. Algebra does this by:

a) using letters (**variables**) to stand for **mystery numbers**, and

b) giving you a **process** to let you discover the value of the variables.



Simple example of an algebra problem

Joan has an unknown amount of money in her purse. If Joan had \$5 more, she would have \$100. How much money does Joan have?

Using algebra, you'd work out the solution like this:
Let the variable, **j**, stand for the amount of money **Joan** has.
Since Joan would have \$100 if she had five dollars more,

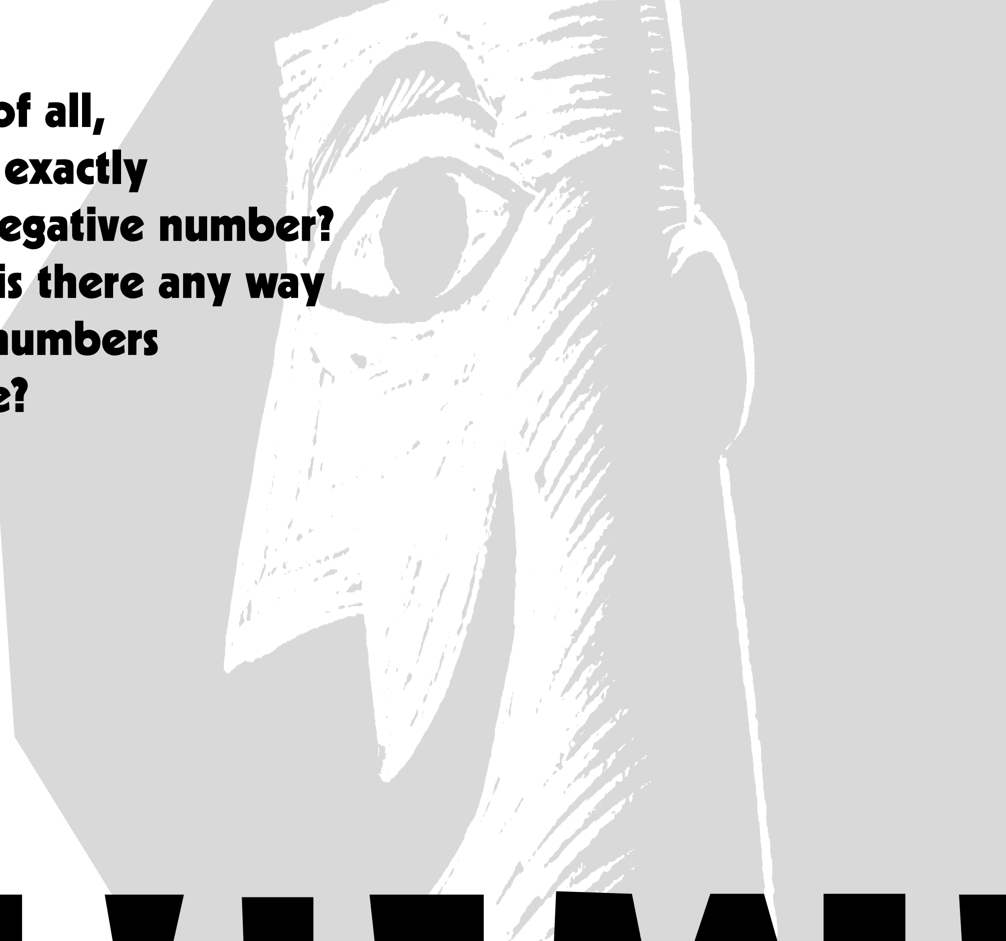
$$j + 5 = 100$$

Then, using rules for solving equations (**pp. 188-198**),

$$\begin{array}{rcr} j + 5 & = & 100 \\ -\ 5 & & -\ 5 \\ \hline j & = & 95 \end{array}$$

meaning: Joan has **\$95** in her purse

Seems simple? Don't worry ... in a little while, you'll be challenged by problems like this: **Two trains start heading toward Amityville at the same time. One's coming down from the north at 100 mph; the other is steaming up from the south at 150 mph. If it takes the trains three hours to reach Amityville, how far apart were they when they started?**



Q: First of all, what exactly is a negative number? And is there any way to relate negative numbers to my everyday life?

A: Negative numbers are numbers with negative signs, which means they have a value less than zero. "But wait," you say, "how can any number have a value less than zero? Isn't zero the lowest value possible?"

To get a grip on this idea, consider the meaning of a debt — an amount of money you owe someone. Suppose you have seven dollars in your pocket; it's as if your financial status is $+$ **7**. But now suppose you've spent your seven dollars. You have nothing left, but at least you don't owe anyone any money; now you can view your financial status as **0**. Finally imagine that you borrow seven dollars from someone; at this point, your financial status is $-$ **7**. In other words, negative seven is seven less (or here, worse) than **0**.

The same idea pops up with temperature readings. A temperature of positive **10** degrees means **10** degrees above **0**. But a temperature of negative **10** degrees means **10** degrees below **0**. In other words, freezing! Here too, you see that in real life you do have a concept of negative numbers, numbers with values less than zero.

Q:

Simplify using the order of operations:

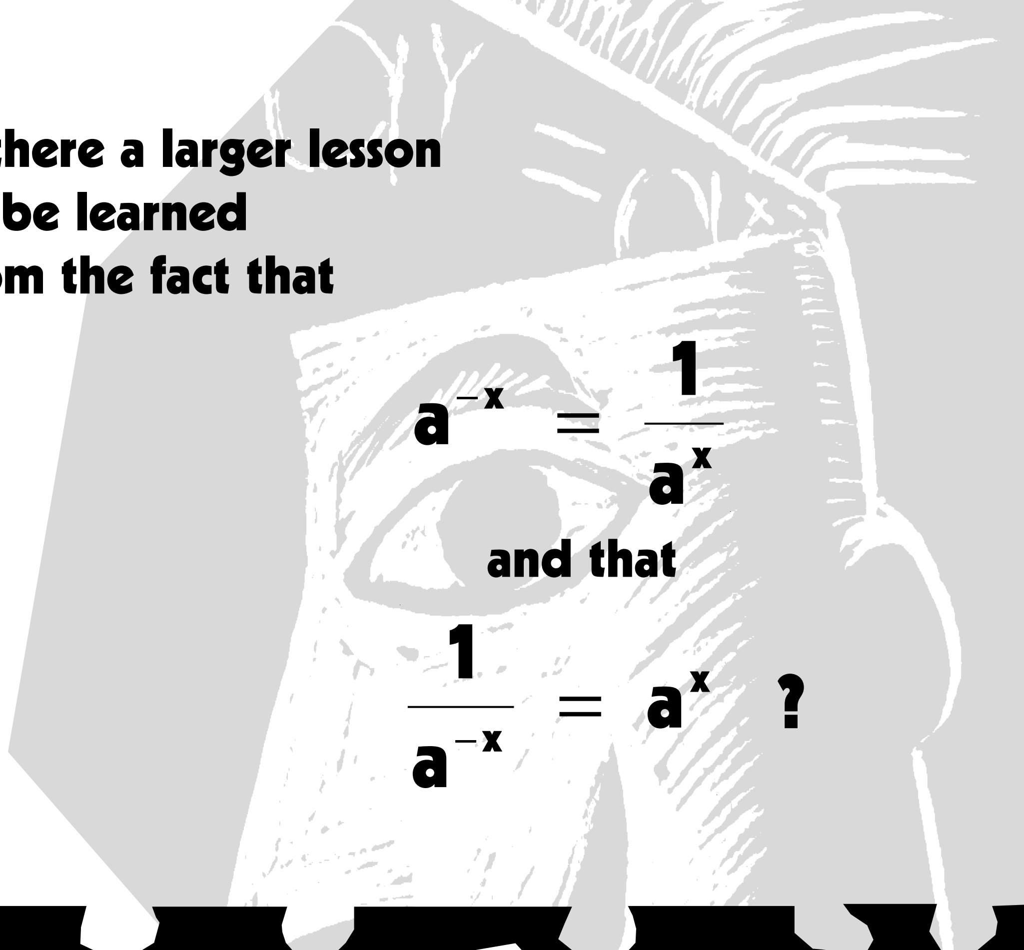
a) $5 \cdot 4^2$
b) $3xyz - -9xyz$
c) $2[6 + \{(4 + 2) \div (3 - 1)\}]$
d) $-3a + +4b - -12a + -6b$
e) $5(7 - 3) \cdot (8 - 6)$
f) $-(a - 3 - 6y + b)$
g) $-3x^2 - 7x^2 - 4x^2 - 2x^2$
h) $5^2 - 2^2 + (-3)^2$
j) $40 \div 8 \cdot 2$
k) $16 - 12 \div 4$
l) $-9pq + 12pq$
m) $+rs + rs + 2rs + 3rs$
n) $+6uv^2 - 11uv^2$
p) $(2 + 1) \cdot (2 + 5) + -4$
q) $-x + 4p - 7x - (+6p)$
r) $6 - (x - 2)$
s) $7\{(3 + 2) \cdot 4\}$
t) $3[2 + \{(18 \div 2) \div 3\} \div 3]$
u) $9vr - (-3vr) - (+5vr)$
v) $2^2 \div 2 + 6^2 \cdot 1 - (3 + 6)^2$
w) $6 \cdot 9 \div 27$

Answer true or false:

x) $4b + 2b = 6b$
y) $-(b - 3) = -b - 3$
z) $-5^2 = (-5)^2$
A) $4a^2b$ and $3a^2b$ are like terms.
B) $10x/2x = 5x$
C) $4 + 2 \cdot 3 = 18$
D) $3x^2 = (3x)^2$
E) a^2b and b^2a are like terms.
F) $4x \cdot 2x = 8x$
G) $4 + 2 \cdot 3 = 10$

A:

a) 80
b) 12xyz
c) 18
d) $9a - 2b$
e) 40
f) $-a + 3 + 6y - b$
g) $-16x^2$
h) 30
j) 10
k) 13
l) 3pq
m) 7rs
n) $-5uv^2$
p) 17
q) $-8x - 2p$
r) $8 - x$
s) 140
t) 9
u) 7vr
v) -43
w) 2
x) true
y) false
z) false
A) true
B) false
C) false
D) false
E) false
F) false
G) true



Q: Is there a larger lesson to be learned from the fact that

$$a^{-x} = \frac{1}{a^{x}}$$

and that

$$\frac{1}{a^{-x}} = a^{x} \quad ?$$

A: Actually there is a big lesson, and it is this:
Whenever you push an exponential term across the fraction bar, the exponent's sign changes. If the exponent's sign was positive, it becomes negative; if its sign was negative, it becomes positive. Below are illustrations of this idea.

exponent's sign changes from negative to positive

$$\frac{5a^{-3}}{7} = \frac{5}{7a^{3}}$$

$$\frac{1}{2c^{-4}} = \frac{c^{4}}{2}$$

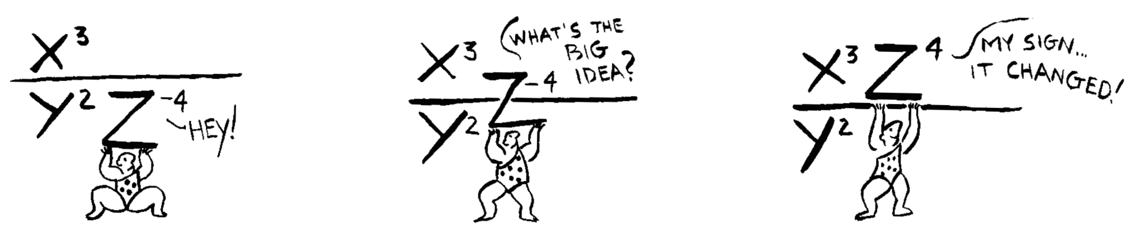
$$\frac{\text{popsicle}^{-2}}{\text{lollipop}^{-5}} = \frac{\text{lollipop}^{5}}{\text{popsicle}^{2}}$$

exponent's sign changes from positive to negative

$$\frac{8x^{4}}{11} = \frac{8}{11x^{-4}}$$

$$\frac{1}{6w^{3}} = \frac{w^{-3}}{6}$$

$$\frac{\text{popsicle}^{8}}{\text{lollipop}^{3}} = \frac{\text{lollipop}^{-3}}{\text{popsicle}^{-8}}$$

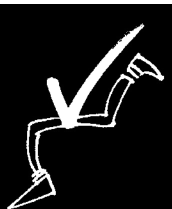


Q: Now I get the basic idea. But what about trinomials in which the first two terms are positive and the last term is negative. How do I factor a trinomial like this:

$$a^2 + 2a - 8$$

A: You use the same, basic technique, but there's one difference when the last term is negative — as it is here and on the next page. You must combine a positive and a negative number to get the coefficient of the middle term. Follow the steps below. **Factor:** $\mathbf{a^2 + 2a - 8}$

Steps	Example
1st) Using the first tip (**p. 155**), write the parentheses with the variable.	$a^2 + 2a - 8$ $(a \quad)(a \quad)$
2nd) Ask: what's the coefficient of the middle term? What's the value of the last term?	Coefficient of middle term is: $+2$ Last term is: -8
3rd) Then ask: what are the pairs of factors for the last term? Is there a pair of factors which add up to the coefficient of the middle term?	Since last term is negative, one of its factors is positive, the other negative (**p. 49**). Pairs of factors for -8 are: $(+1, -8), (+2, -4), (-1, +8), (-2, +4)$ Only pair adding to $+2$ is: $(-2, +4)$
4th) Now just drop those factors (sign and number together) into the two parentheses.	$-2 \quad +4$ $\downarrow \quad \downarrow$ $(a - 2)(a + 4)$



Now try factoring these trinomials:

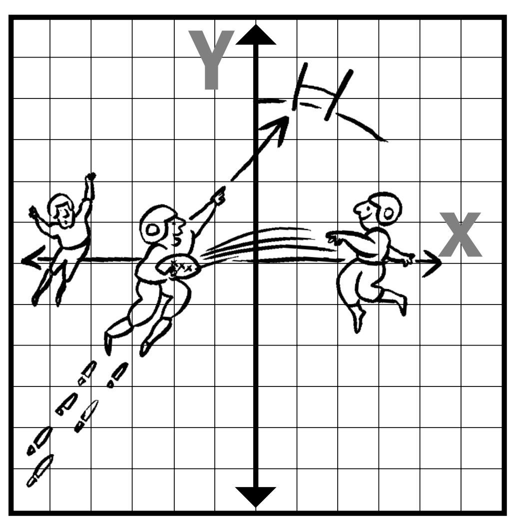
a) $n^2 + 3n - 10$
b) $t^2 + 7t - 18$
c) $w^2 + 4w - 45$
d) $u^2 + u - 2$

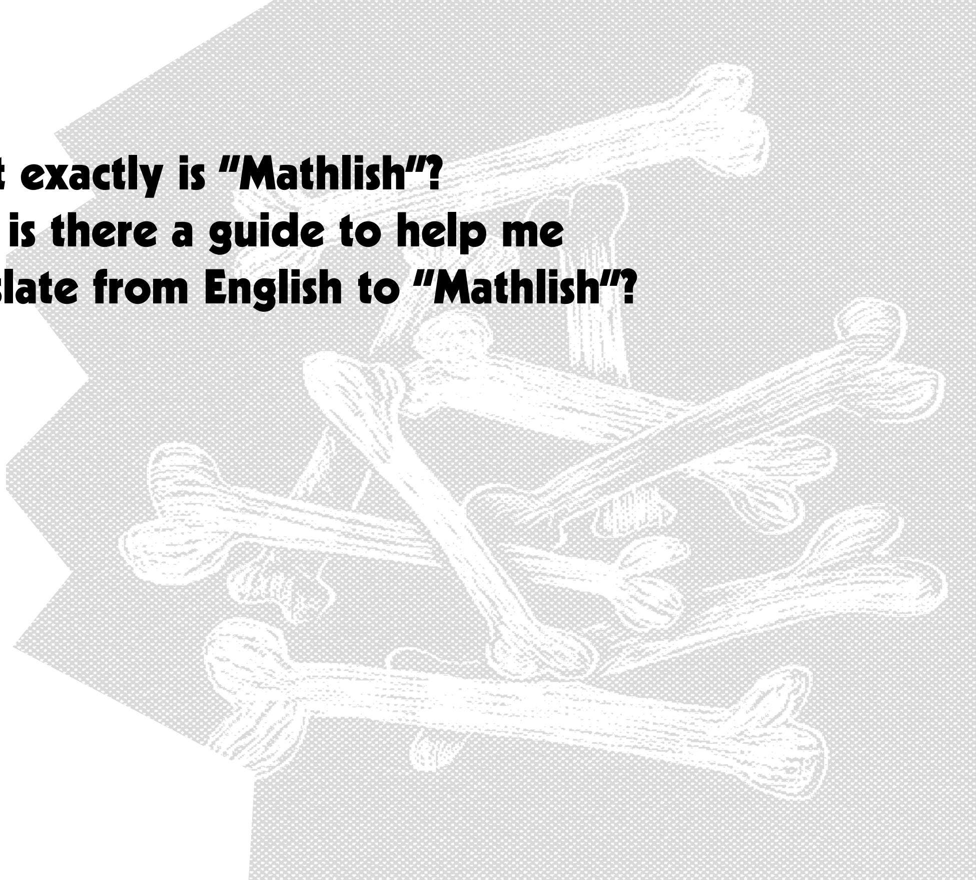
Answers:
a) $(n + 5)(n - 2)$
b) $(t + 9)(t - 2)$
c) $(w + 9)(w - 5)$
d) $(u - 1)(u + 2)$

Q: I hear about special points called x- intercepts and y-intercepts. What exactly are these? How do I indicate these points? And why in the world are they called "intercepts" in the first place?

A: The **x-intercept** is the **point where a line crosses the x-axis**; the **y-intercept**, that **point where a line crosses the y-axis**. For example, if a line crosses the x-axis at the point $(-2, 0)$, you'd say the **x-intercept** is $(-2, 0)$, or, in a shorthand way of talking, you can say the x-intercept is -2, since the line crosses the x-axis at -2. In the same way, if a line crosses the y-axis at $(0, 3)$, the **y-intercept** is $(0, 3)$, or just $+3$.

To see why these points are called **intercepts**, think about intercepted passes in football. Turning on your **imagination**, try to see the **x-axis** as the flight of a forward pass. Then go a step further. Imagine that a line crossing the **x-axis** is **the path of a defensive player running to intercept the pass**. The point where his/her path crosses the ball's flight is where the **intercept** is made, so it's the **x-intercept**. In the same way, if you view the **y-axis** as a forward pass, the point where a line crosses it is the **y-intercept**.



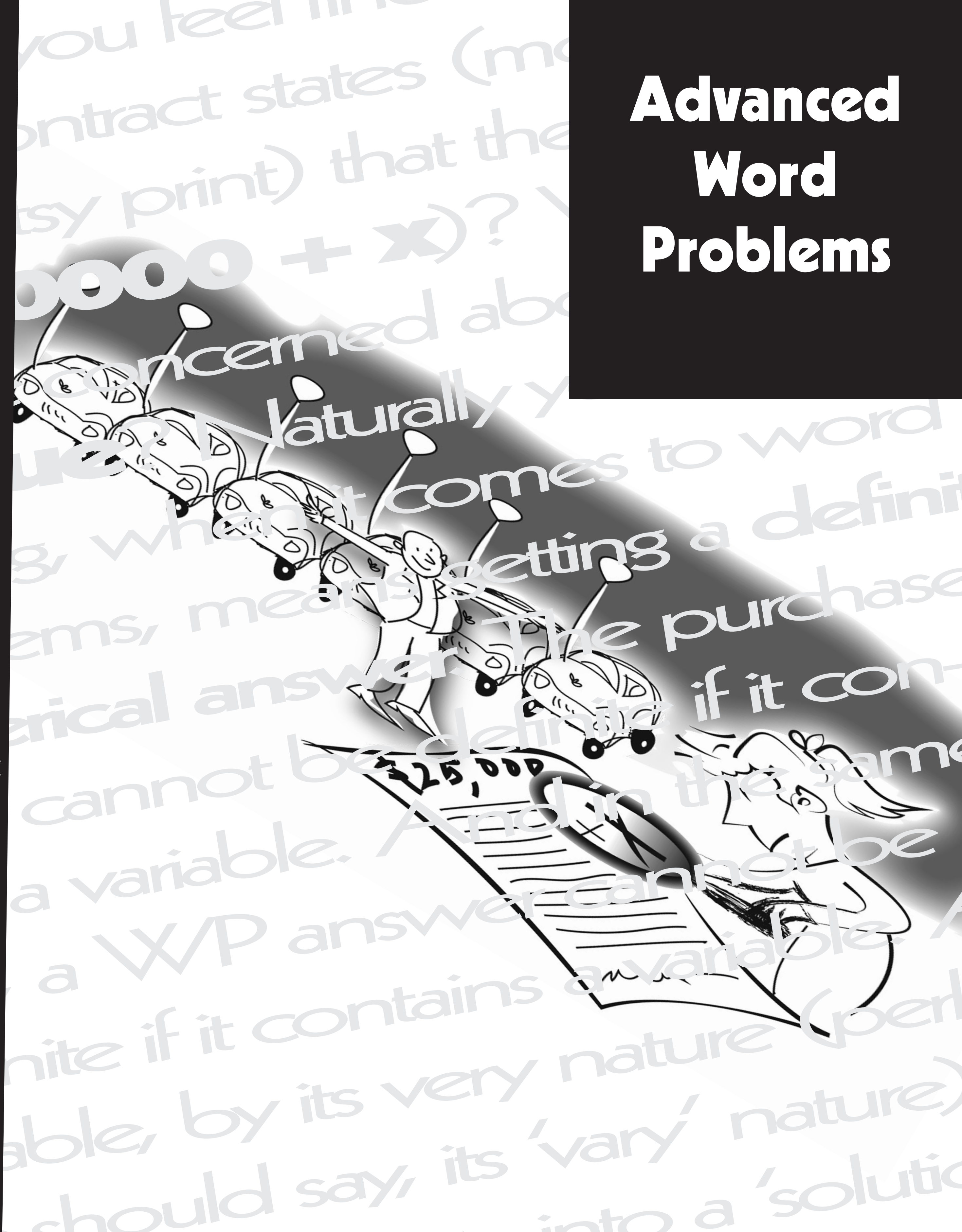


Q: What exactly is "Mathlish"? And is there a guide to help me translate from English to "Mathlish"?

A: Imagine that you're whisked away by helicopter and air-dropped into the backcountry of Kinnikanu. After parachuting down, you'd probably appreciate having a **mini-dictionary** so you could ask the locals survival questions like, "Hey, where can I grab a burger and fries around here?" The same holds for the **Algebra Wilderness**. You need a mini-dictionary so you can translate from **English** to **"Mathlish,"** that strange, seemingly foreign language that math is written in. Here's the mini-dictionary you need:

English	Mathlish
is/was/will be/equals/the result is	**=**
of	× **or** ·
a number	**n**
the opposite of a number	− **n**
three consecutive integers	**n, n + 1, n + 2**
three consecutive odd or even integers	**n, n + 2, n + 4**
sum/more than/ increased by/and	+
difference/less than/decreased by	−
product/times/multiplied by	× **or** ·
quotient/over/divided by	÷ **or fraction symbol:** /
what number/what fraction	**n**
what percent	**n/100**
quantity	( )

Advanced Word Problems



Q: One thing about these word problems ... they'd sure be simpler if I didn't have to do that substitution step. Is it really necessary? Why do I have to do it?

A: Good question! Understanding its answer will help you more fully grasp WP-solving strategy.

In the last two WPs, you took steps to reduce the equation's number of variables from two to one. You accomplished that by using substitution in the **3rd** or **4th** step. But now you're wondering why you're being asked (ok, told) to do this. In other words, why go to pains to make sure that the equation you solve has just one variable, rather than two? Why's this a big deal?

The answer, as it happens, stems from a fundamental truth about algebra. Drumroll, please ...

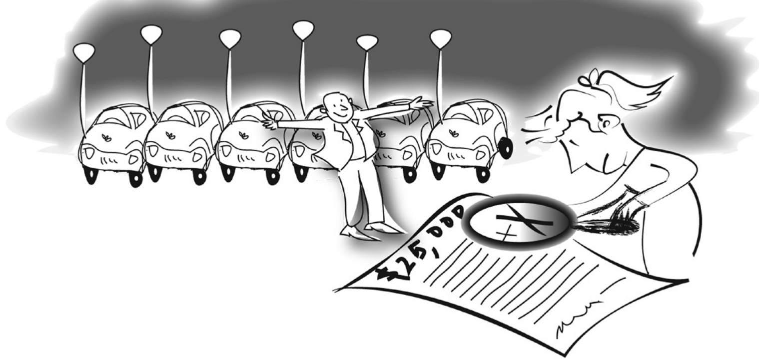
A SINGLE equation can't be solved if it contains TWO variables!

Think about this in simple terms. Say you have an equation with two variables and one number, like this:

$$x - y = 10$$

Solving this equation for **x** means stating the value of **x** with utter certainty. You might say: No problem! I'll just add **y** to both sides and get **x = 10 + y**. But someone else might respond: is that really 'solving'? Does a 'solution' that contains a variable provide certainty? To put this in perspective, let's relate this to the process of buying a car. Imagine you're buying your dream car. Would you feel fine if the purchase contract states (most likely in itsy-bitsy print) that the car costs **$(25,000 + x)**? Wouldn't you be concerned about that **x-value**? Naturally you would! Solving, when it comes to word problems, means getting a **definite numerical answer**. The car's purchase price can't be definite if it contains a variable. And in the same way, a WP's answer can't be definite if it contains a variable. A variable, by its very nature (perhaps we should say, its 'vary' nature), thrusts uncertainty into a 'solution.'

So to answer this page's question: you substitute when solving equations to decrease the number of variables from two down to one. That way, when you get your solution, the answer you've slaved to figure out will be a number and nothing but a number. So the next time you get annoyed because of this substitution step, remember that you're substituting so your answer gives you a definite amount, one with no squirrelly, variable quantities.



MidChapter Quiz

(see p. 325 for answers)

Problems about Pure Numbers

1. The sum of two numbers is 87, and their difference is 11. Find the two numbers.

2. The sum of two numbers is 120, and their difference is – 24. Find the two numbers.

3. The sum of two numbers is 446, and their difference is 68. Find the two numbers.

4. The sum of two numbers is – 30, and their difference is – 10. Find the two numbers.

5. The sum of two numbers is – 21, and their difference is – 97. Find the two numbers.

6. The sum of two numbers is – 142, and their difference is 44. Find the two numbers.

Coin Problems

7. Diego has 13 more dimes than nickels, and the total value of these coins is $3.85. How many dimes and nickels does Diego have?

8. Brianna has dimes and quarters with a total value of $10.90. She has 17 fewer dimes than quarters. How many dimes and quarters does Brianna have?

9. Carol has nickels, dimes and quarters with a total value of $17.70. She has 4 times as many dimes as nickels, and she has 10 times as many quarters as nickels. How many nickels, dimes, and quarters does Carol have?

10. Zara has $6.00 in half-dollars and dimes. The number of her dimes is seven times greater than the number of her half-dollars. How many dimes and half-dollars does Zara have?

11. Quinn has quarters and nickels with a total value of $13.90. If he has 90 of these coins in all, how many quarters and how many nickels does Quinn have?

Value Problems

12. Clairmont High School needs to purchase trophies for individual students and teams that have participated in sports and academic competitions during the year. Trophies for individual students cost $8 each, while team trophies cost $14 each. If the school spends $660 on both kinds of trophies, and if it orders 12 times as many individual student trophies as team trophies, how many trophies of each kind does the school purchase?

13. Grand Vista Adventures needs to purchase backpacks and tents for its Fall Patagonia Expedition. The company will purchase a total of 96 items in all. If the cost of each backpack is $80, the cost of each tent is $200, and if Grand Vista spends $9,600 in all, how many backpacks and how many tents does the company buy?

RTD Problems

14. After school, Calvin jogs from his home to his girlfriend's house at 6 mph. They have a big argument, and Calvin leaves abruptly. Feeling upset, Calvin takes considerably more time going home, traveling just 1 mph. If Calvin's total time traveling is 3.5 hours, how long (in hours) is his trip to his girlfriend's house, and how long (in hours) is his trip returning home?

15. The EuroStar high-speed train travels from London to Paris (beneath the English Channel!) at 220 kilometers per hour (kph). Continuing on, from Paris to Lyon, it travels at a slightly faster 232 kph. If the entire trip from London to Lyon takes 4.25 hours and covers 960 km, how long does the EuroStar take (in hours) for each leg of its trip?

Bonus: Express the speed of each leg of the trip in miles per hour, using the fact that 1 mile = 1.609 km.

16. Jack and Mack have set up an extreme Hot Wheels® collision. Jack's 'Blue Bomber' travels 24 inches per second, while Mack's 'Ruby Racer' zips along at 30 inches per second. The two cars travel a total distance of 246 inches before they crash. If the 'Ruby Racer' starts traveling first, and the 'Blue Bomber' starts moving 1 second later, for how many seconds does each car travel until they meet in their glorious collision?

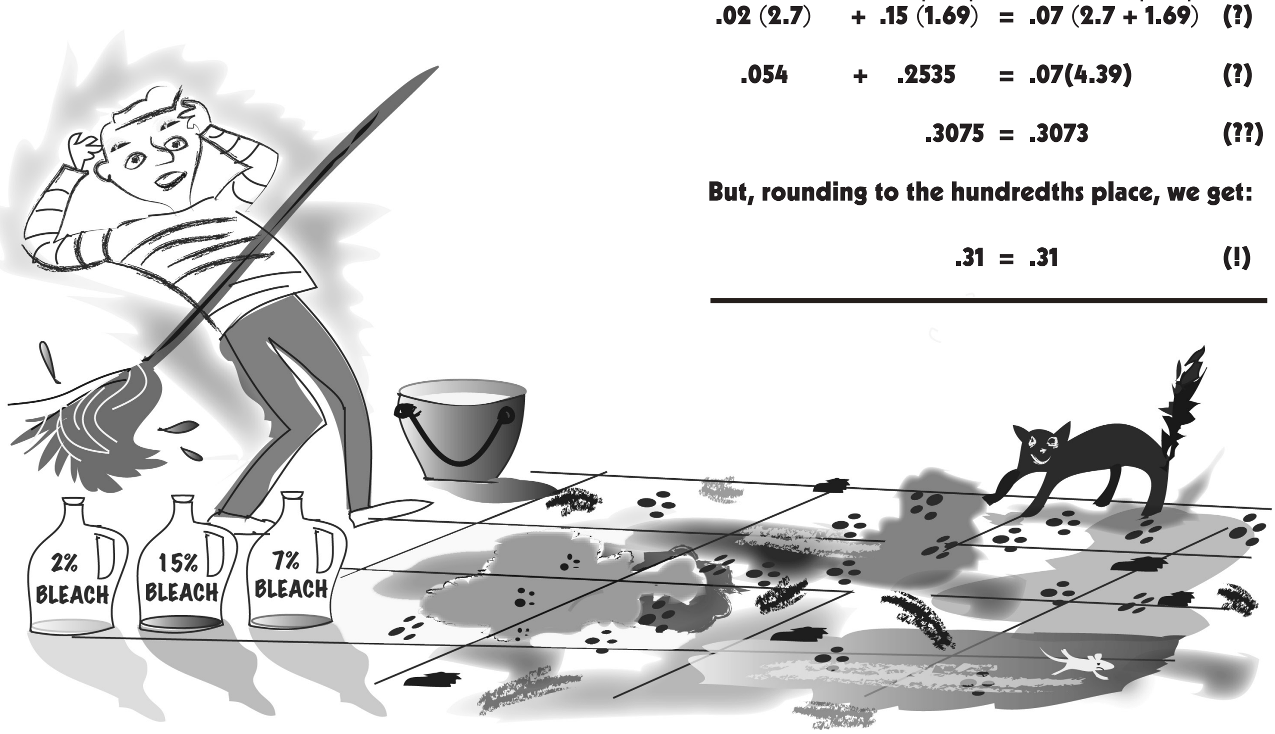
Q: OK, I get the Master Formula and Master Equation for mixture problems. But now I need to see all of the steps for a mixture problem put together. What exactly does that look like?

A: Here's a problem for which you can see all of the steps:

PROBLEM: Sid needs a solution that's 7% bleach to scour a dirty kitchen floor. He has 2.7 quarts of a 2% bleach solution, and he can add any volume of a 15% bleach solution to it. How many quarts of the 15% solution should Sid add to end up with a solution that's 7% bleach? Round answer to the hundredths place.

Steps	Example
1st) Name the **Q**uantity whose value you seek.	The volume (in quarts) of the 15% solution.
2nd) Set up a **V**ariable to stand for this quantity.	Let **q** stand for the number of quarts of the 15% solution that Sid will add.
3rd) Using the Master Formula, **TR**anslate the problem's three quantities from English to Mathlish	2% solution: **.02** (**2.7**) qts. of bleach 15% solution: **.15** (**q**) qts. of bleach 7% solution: **.07** (**2.7 + q**) qts. of bleach
4th) Write the ME/E in an abbreviated form.	Bleach in 2% solution + Bleach in 15% solution = Bleach in 7% solution.
5th) **TR**anslate the Master Equation from English to Mathlish by injecting the Master Formula quantities found in the **3rd** step.	2%-Sol. Bleach + 15%-Sol. Bleach = 7%-Sol. Bleach ↓ ↓ ↓ **.02 (2.7)** + **.15 (q)** = **.07 (2.7 + q)**

Steps	Example
6th) Solve the equation, following the steps in the Equations chapter.	$.054 + .15(q) = .189 + .07q$ $.08(q) = .135$ $q = 1.6875$ $q \approx 1.69$
7th) Say what the answer **M**eans.	This means that Sid needs to add approximately **1.69 quarts** of the **15%** solution to his **2%** solution to create the **7%** bleach solution.
8th) CHeck your answer by plugging the value you got for **q** back in, starting with the ME/E.	2%-Sol. Bleach + 15%-Sol. Bleach = 7%-Sol. Bleach $.02(2.7) + .15(q) = .07(2.7 + q)$ $.02(2.7) + .15(1.69) = .07(2.7 + 1.69)$ (?) $.054 + .2535 = .07(4.39)$ (?) $.3075 = .3073$ (??) **But, rounding to the hundredths place, we get:** $.31 = .31$ (!)



Solve the following mixture problem, using the steps outlined in the last four pages.

a) April has 2 liters of a 5% ammonia solution, but she needs to boost it to an 8% strength for some heavy-duty kitchen cleaning. How many liters of 23% ammonia concentrate should April add to make her solution reach the desired 8% strength?

Answers:

a) April should add 0.4 liters = 40 centiliters of the 23% solution.

Q: Now that I'm done, what are the main things I should be taking away from this chapter?

A: Hopefully there are two main things you should have learned: **1)** the overall process for solving word problems, and **2)** the steps for solving several specific algebraic word problems.

In terms of the overall process, you learned that in any WP you must carefully analyze the unknowns so you can set up variables and variable expressions to stand for the unknowns. You also learned that if you know both the Master Formula and the Master Equation for word problems, you'll be able to set up the quantities and the equation that you need to solve the word problem. In this respect, the Master Formulas and Master Equations are critical keys for WP success. To help you learn and memorize the Master Formulas and Master Equations for the WPs in this section, here's a table summarizing the key info.

Mathematical Expression or Equation

Type of Word problem	Master Formula	Master Equation	Master Equation Abbreviated
Coin Problem	Value of Several Coins of the Same Kind = (Value per Coin) x (# of Coins)	(Value of Coin 1) + (Value of Coin 2) = Value Total	$V_1 + V_2 = V_T$
Value Problem	Value of Each Kind of Item = (Value per Item) x (Number of Items)	(Value of Item 1) + (Value of Item 2) = Value Total	$V_1 + V_2 = V_T$
RTD Problem	Distance = (Rate) x (Time)	Distance 1 = Distance 2 or Dist. 1 + Dist. 2 = Dist. Total	$D_1 = D_2$ or $D_1 + D_2 = D_T$
RTD Problem w/ Wind Speed or Current Speed	Plane w/ wind: $r = (p + w)$ Plane vs. wind: $r = (p - w)$ Boat w/ current: $r = (b + c)$ Boat vs. current: $r = (b - c)$	Plane w/ wind: $D = (p + w) \cdot t$ Plane vs. wind: $D = (p - w) \cdot t$ Boat w/ current: $D = (b + c) \cdot t$ Boat vs. current: $D = (b - c) \cdot t$	$D = (p + w) \cdot t$ $D = (p - w) \cdot t$ $D = (b + c) \cdot t$ $D = (b - c) \cdot t$
Work Problem	Amount of Work Done = (Rate of Worker) x (Time Working)	(Fractional Work of Person 1) + (Fractional Work of Person 2) = 1 JOB	$FW_1 + FW_2 = 1$
Mixture Problem	Amount of Substance = (Percent Concentration) x (Volume of Substance)	Substance at Start + Substance Added = Substance at End	$S_{(Start)} + S_{(Added)} = S_{(Final)}$

CHAPTER TEST
Solve the word problems using the methods presented in this chapter.

PROBLEMS from FIRST HALF OF THE CHAPTER

1. The sum of two numbers is 97, and their difference is – 19. Find the two numbers.

2. Quianna has nickels, dimes, and quarters with a total value of $9.25. She has 8 more quarters than dimes, and she has 7 fewer nickels than dimes. Find out how many coins Quianna has of each kind.

3. Harry's Soup Kitchen needs to purchase tables, chairs and tablecloths for an outdoor addition that will be used in the summer months. Harry's needs to buy 8 times as many chairs as tables, and the number of tablecloths needed is four more than the number of tables. If the per-unit costs are $35 for tables, $18 for chairs, and $5 for tablecloths, and if Harry's spends $1,492 in all, how many of each item does Harry's purchase?

4. Dana and Raina are setting up their camp on a high desert plain. While they're setting up their tent, a curious skunk strolls through their campsite and startles the girls, who unfortunately, shriek. At that, the skunk sprays the campsite, and the girls dash off, Dana heading west and Raina heading east. If Raina runs 2 yards per second faster than Dana, and the girls are 84 yards apart after 6 seconds, how fast do Dana and Raina run?

PROBLEMS from SECOND HALF OF THE CHAPTER

5. College students are racing their rowboats along the Charles River in Massachusetts. Each team first rows upstream, against the current, and then turns around and races downstream, with the current. The course is 2 miles each way, for a total distance of 4 miles both ways. The Starched-Collar Team takes 1/2 hour to go upstream and 1/4 hour to go downstream. Given these times, what is the Starched-Collar Team's rowing speed in still water? And what is the speed of the current?

6. Solve each of the following problems:

a) $1/8\ a + 1/6\ a = 1$

b) $7/10\ v - 4/15\ v = 1$

7. Kelly can design an app in just 3 days, while her friend, Nelly, needs 4 days to design an app. If Nelly gets a two-day headstart on the process, and then she and Nelly finish the job working together, how long will it take the two young ladies to finish designing the app?

Supplies

Alignment to Common Core State Standards for Math

The tables on this and the following page show how the chapters and pages of the Algebra Survival Guide (ASG) align with the **Common Core State Standards for Math**. Here are the abbreviations used to identify the ASG chapters:

WIA:....What is Algebra?
P:.........Properties of Numbers
S: ....Sets of Numbers
P/N:.....Positive and Negative Numbers
O/LT:...Order of Operations & Like Terms
AV:......Absolute Value
EX:.......Exponents
R:.........Radicals
F: ....Factoring
C:.........Cancelling
EQ:......Solving Equations
CP:.......Coordinate Plane
WP:......Word Problems
AWP:...Advanced Word Problems

Grade	CC Math Standard	Chapter: .... Pages of ASG
4	CONTENT.**4.OA.B.4**	F: **148-149**
5	CONTENT.**5.OA.A.1**	O/LT:..... **57-62**
6	CONTENT.**6.NS.B.4**	F: **150-153**
6	CONTENT.**6.NS.C.5**	P/N: ... **34-48**
6	CONTENT.**6.NS.C.6**	S: **26-29**
6	CONTENT.**6.NS.C.6.B**	CP: **215-218**
6	CONTENT.**6.NS.C.6.C**	CP: **215-218**
6	CONTENT.**6.NS.C.7.C**	AV: **78**
6	CONTENT.**6.NS.C.8**	CP: **234**
6	CONTENT.**6.EE.A.1**	EX: **86-111**
6	CONTENT.**6.EE.A.2**	WP: ... **247-263** AWP: .. **269-328**
6	CONTENT.**6.EE.A.2.A**	WP: ... **247-263** & AWP: .. **269-328**
6	CONTENT.**6.EE.A.2.B**	EX: .... **86** R: .... **116, 118** F: .... **143, 147, 154, 162, 164** AWP: **269-328**
6	CONTENT.**6.EE.A.2.C**	O/LT: .. **59, 63, 65**
6	CONTENT.**6.EE.A.3**	P: .... **15, 16** EX: .... **86** R: **119, 120, 131**

Grade	CC Math Standard	Chapter: .... **Pages of ASG**
6	CONTENT.**6.EE.A.4**	P: .... **15-16** EX: .... **86** R: **119, 120, 131**
6	CONTENT.**6.EE.B.5**	EQ: ... **188-211**
6	CONTENT.**6.EE.B.6**	WP: ... **246-265** AWP: .. **269-328**
6	CONTENT.**6.EE.B.7**	EQ: ... **194-195**
7	CONTENT.**7.NS.A.2.A**	PN: **49-53**
7	CONTENT.**7.NS.A.2.B**	PN: **51-52**
7	CONTENT.**7.NS.A.2.D**	S: **25-28**
7	CONTENT.**7.NS.A.3**	PASSIM: P/N, EQ, WP, AWP
7	CONTENT.**7.EE.A.1**	O/LT: .. **66-76** F: .... **142-166** C: **168-185**
7	CONTENT.**7.EE.A.2**	WP: ..... **252-253** AWP: .. **270-328**
7	CONTENT.**7.EE.B.3**	WP: **270-274**
7	CONTENT.**7.EE.B.4**	WP: ..... **246-265** AWP: .. **270-328**
7	CONTENT.**7.EE.B.4.A**	WP: **250-265**
8	CONTENT.**8.NS.A.1**	S: **26-28**
8	CONTENT.**8.EE.A.1**	E: **86-111**
8	CONTENT.**8.EE.A.2**	R: **116-140**
8	CONTENT.**8.EE.C.7**	EQ: **188-211**
8	CONTENT.**8.EE.C.7.B**	EQ: **190-199**
8	CONTENT.**8.EE.C.8.A**	EQ: **240**
8	CONTENT.**8.EE.C.8.B**	EQ: **237-240**
8	CONTENT.**8.EE.C.8.C**	AWP: .. **270-274**
HS	CONTENT.**HSA.SSE.A.1**	WP: **246-256**
HS	CONTENT.**HSA.SSE.A.1.A**	PASSIM: AV, EX, R, F, C, EQ, CP, WP, AWP
HS	CONTENT.**HSA.SSE.A.1.B**	AWP: .. **277-328**
HS	CONTENT.**HSA.SSE.A.2**	F: **154-166**
HS	CONTENT.**HSA.SSE.B.3.A**	CP: **204-205**
HS	CONTENT.**HSA.CED.A.1**	WP: **250-265**
HS	CONTENT.**HSA.CED.A.2**	AWP: .. **269-328**
HS	CONTENT.**HSA.REI.A.1**	EQ: **188-199**
HS	CONTENT.**HSA.REI.B.4**	EQ: **204-205**

Glossary

Note: Any term bolded in the definition has its own glossary entry.

absolute value: the distance between a number and zero. Absolute value is always positive because **distance** is always positive. For example, the absolute value of **3** is **3**, and the absolute value of – **3** is also **3**. The absolute value of a quantity, **x**, is represented with two vertical lines, thus: $|x|$

addends: the individual numbers or terms that are combined in an addition problem. Example: in the problem, $7 + 5 + 9 = 21$, the addends are **7**, **5**, and **9**.

additive identity property: this property says that when you add zero to any **number** or term, you get back the number or term you started with. In other words, $a + 0 = a$; $-2 + 0 = -2$, etc.

associative property: property that says that in addition and multiplication, the way the terms are grouped makes no difference. In other words, $a + (b + c) = (a + b) + c$, and $a\cdot(b\cdot c) = (a\cdot b)\cdot c$

base: the larger, bottom number in an **exponential term**. Example: in the term, x^7, **x** is the base, and **7** is the **exponent**.

binomial: a **polynomial** composed of two **monomials**. For example, each of the following three expressions is a binomial: $x + 3$; $a^7 - 9$; $-6 + 7v$.

cancelling: the act of tidying up mathematical expressions.

coefficient: the number that multiplies the **variable** or **variable string** in a **monomial**. A coefficient may be positive or negative. Example: in the monomial $5x^2y$, the coefficient is **5**; in the monomial $-5x^2y$, the coefficient is -5.

commutative property: property that says that in addition and multiplication, the order of the terms in an expression does not affect the expression's value. In other words, $a + b$ has the same value as $b + a$; similarly, $a\cdot b$ has the same value as $b\cdot a$.

consecutive integers: integers that are one apart from one another. Example: **4**, **5** and **6** are consecutive integers; similarly, -6, -5, -4 are also consecutive integers.

coordinate: a number which, by acting as a directional tool, helps you locate a point on the **coordinate plane**. Each point on the coordinate plane has both an **x-coordinate** and a **y-coordinate**.

coordinate plane: the x-y plane, used for graphing **points**, **lines**, and more.

denominator: the quantity below a fraction bar is the denominator. (Compare with numerator.)

descending order: a way of writing a **polynomial** so that the **exponents** of its leading terms

Index

Algebra SURVIVAL Workbook

Alg. Survival Workbook
may be purchased
wherever books are sold.
104 pp.
SRP: $9.95 US$
ISBN: 0-978-9846381-78

NEW SECTION! ADVANCED WORD PROBLEMS

Publisher:
Singing Turtle Press
Santa Fe, New Mexico
info@SingingTurtle.com
V: 505.438.3418
F: 512.682.0500

SECOND EDITION

by Josh Rappaport

illustrated by Sally Blakemore

More than 120,000 copies SOLD!

Contents

NAME ____________________ DATE ____________

Use the order of operations to simplify the following problems. See ASG, p. 62

1) $4^2 + 8(3 \cdot 2)$ ________
2) $3 + [8 - (4 + 3)^2]$ ________
3) $2(4 + 3) + (-16)(4 - 6)$ ________
4) $\{15 - (3 \cdot 2)\} \div 3$ ________
5) $3^2 - (-1) + (-30 \div 2)$ ________
6) $7 + ([3 - 7] + 4^2) \div 2$ ________
7) $(-6) - (4 \cdot 3)(3 - 1) - 2^2$ ________
8) $(3 + 4)^2$ ________
9) $(3^2 + 4^2)$ ________
10) $5 - [(4 \cdot 5) \div 2]$ ________
11) $\{[(3 + 5) \div 2]^2 - (3 \cdot 2)\} \cdot (-2)$ ________
12) $[(4 \cdot 6) - (3 \cdot 2)] \div 2$ ________
13) $[3^2 - (2^2 \cdot 4)] + 7$ ________
14) $3 + \{(4 + 3) \cdot 6 - 2\}$ ________
15) $\{(8 - 3) \cdot 4 - [6(2 + 3) - 10]\} + 4$ ________
16) $(2)(3) + (3)(4) - (4)(5)$ ________
17) $[8 + (4)(5)] \div (2 - 6)$ ________
18) $(40 \cdot 2) \div [(12 \cdot 2) - 4]$ ________
19) $7 \cdot 8 \div 4 - 20$ ________
20) $15 \cdot 3 \div 5 + 12 \div 2$ ________

____ %

Multiply and divide. See ASG, p. 63

1) $50 \div 5 \times 2$ ________
2) $50 \times 2 \div 5$ ________
3) $50 \div 5 \div 2$ ________
4) $50 \div (5 \times 2)$ ________
5) $50 \div 2 \times 5$ ________
6) $50 \times 5 \div 2$ ________
7) $50 \times (5 \div 2)$ ________
8) $6 \times 3 \div 2$ ________
9) $3 \div 2 \times 6$ ________
10) $2 \div 3 \times 6$ ________
11) $3 \times 2 \div 6$ ________
12) $4 \times 7 \div 2 \times 3$ ________
13) $4 \times 7 \times 3 \div 2$ ________
14) $3 \div 2 \times 4 \times 7$ ________
15) $4 \times 3 \div 2 \div 6$ ________
16) $4 \div 3 \times 2 \times 6$ ________
17) $4 \times 3 \div (2 \times 6)$ ________
18) $4 \div 2 \times 3 \div 6$ ________
19) $2 \times 3 \div 4 \times 6$ ________
20) $2 \times 3 \div (4 \times 6)$ ________

____ %

NAME ____________________ DATE ____________

Use the exponent-to-exponent rule to simplify these terms.

See ASG, p. 106

1) $(3^2)^4$ ____________
2) $(a^3)^5$ ____________
3) $(c^x)^y$ ____________
4) $(4^{-3})^{-2}$ ____________
5) $(\text{llama}^{-4})^{-4}$ ____________
6) $(k^4)^{-2}$ ____________
7) $(\odot^6)^5$ ____________
8) $(p^x)^{-z}$ ____________
9) $(\text{gum}^6)^6$ ____________
10) $(n^{-4})^{-6}$ ____________
11) $(6^{-2})^{-5}$ ____________
12) $(12^6)^{-3}$ ____________
13) $(\diamond^c)^f$ ____________
14) $(3^3)^9$ ____________
15) $(p^r)^4$ ____________
16) $(8^{-8})^6$ ____________
17) $(v^{10})^2$ ____________
18) $(☆^v)^{-w}$ ____________
19) $(e^4)^{-7}$ ____________
20) $(\text{bug}^{-3})^d$ ____________

____ %

Simplify these expressions. Use only positive exponents.

See ASG, p. 108

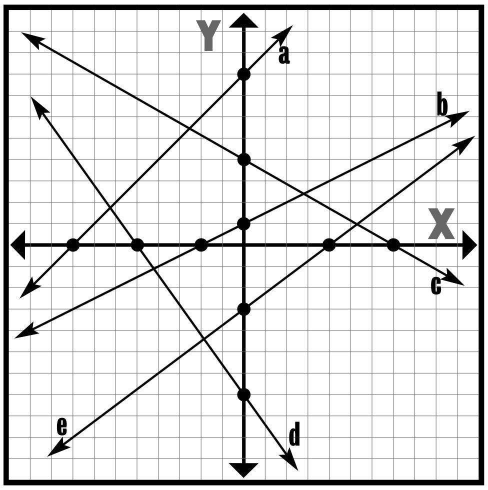
1) $e^3(e^4)^2e^{-2}$ ____________
2) $2^3p^0(p^3)^3$ ____________
3) $\dfrac{x^{-3}(x^3)^2}{(x^4)^2x^{-10}}$ ____________
4) $(r^3)^4(r^{-2})^3(-2)^2$ ____________
5) $\dfrac{(b^{-2})^{-5}b^0b^6}{b^7b^{-2}(b^{-4})^{-4}}$ ____________
6) $(4^{-2})^{-1}(z^2)^{-4}(z^{-5})^2$ ____________
7) $(5^1)^{-1}t^{-3}(t^3)^4$ ____________
8) $\dfrac{(k^{-6})^3k^5(k^3)^{-2}}{k^7(k^4)^6k^{-12}}$ ____________
9) $\dfrac{v^9v^6(v^{-3})^3}{v^3(v^2)^{-4}v}$ ____________
10) $\dfrac{(3^4)^2r^{-3}}{(3^2)^3(r^2)^6(r^3)^0}$ ____________
11) $(w^{-5})^{-3}w^{-10}(w^{-2})^2$ ____________
12) $\dfrac{c^4c^{17}(c^{-4})^4}{(c^5)^{-6}c^{14}}$ ____________
13) $\dfrac{(4^{-3})^5n^4}{n^3(n^4)^{-2}(4^2)^{-6}}$ ____________
14) $(3^{-2})^{-1}(y^{-3})^{-6}y^{-13}$ ____________
15) $(d^{-3})^2d^8(d^4)^{-2}d^6$ ____________
16) $a^4(a^2)^{-2}(5^{-1})^3$ ____________
17) $\dfrac{(6^{-3})^2f^5}{(6^{-2})^2(f^{-3})^4}$ ____________
18) $(s^2)^6(s^4)^{-4}s^{-3}$ ____________
19) $\dfrac{(8^3)^7q^6(q^{-2})^8}{(q^2)^{-4}(8^{-4})^{-5}}$ ____________
20) $(u^{13})^2(4^2)^{-1}(u^{-2})^{10}$ ____________

____ %

NAME ____________________ **DATE** ____________

Name the x- and y-intercepts for each of these lines. See ASG, p. 229

____ %



COORDINATE PLANE A

a) ____________

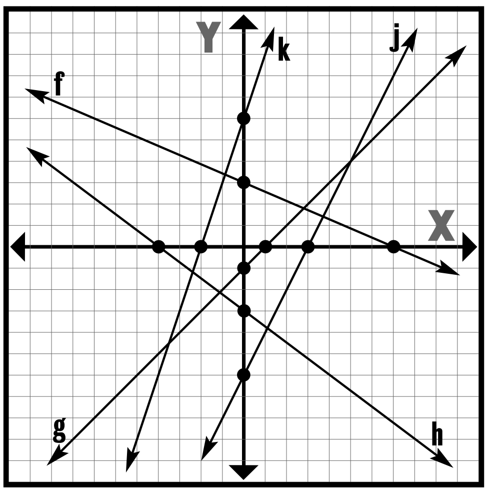
b) ____________

c) ____________

d) ____________

e) ____________

____ %



COORDINATE PLANE B

f) ____________

g) ____________

h) ____________

j) ____________

k) ____________

Name the slopes and y-intercepts of these lines. See ASG, p. 230

1) $y = 3x + 8$ ____________

2) $y = -4x + 2$ ____________

3) $y = \frac{1}{2}x - 4$ ____________

4) $y = 2x + \frac{1}{2}$ ____________

5) $y = -\frac{3}{5}x + 3$ ____________

6) $y = 6x + 1$ ____________

7) $y = -8x - \frac{4}{5}$ ____________

8) $y = x - 2$ ____________

9) $y = -\frac{9}{10}x + \frac{3}{2}$ ____________

10) $y = \frac{1}{4}x$ ____________

11) $y = 7x + 2$ ____________

12) $y = -2x - \frac{1}{5}$ ____________

13) $y = \frac{1}{8}x - 6$ ____________

14) $y = -\frac{5}{8}x + \frac{2}{3}$ ____________

15) $y = -x - 3$ ____________

16) $y = 5$ ____________

17) $y = -2x + \frac{1}{2}$ ____________

18) $y = \frac{1}{4}x + 10$ ____________

19) $y = \frac{1}{6}x - 4$ ____________

20) $y = -8x - 1$ ____________

____ %

NAME ______________________ DATE ______________

For each situation, let a variable stand for the smaller unknown. Then create an expression that stands for the larger unknown.

See ASG, p. 275

____ %

1) Paul has 50 times as many apples as Sam.
2) Kyle travels 30 miles farther than Zane travels.
3) Abigail has 80 more coins than Ethan.
4) Ned scores 3 more goals than Ted.
5) Daniel eats 3 times faster than Jacob.
6) Avril gains 30 points more than Mason.
7) Noah solves a problem 5 times faster than Liam solves it.
8) Shyan consumes 1,000 more calories than Jack.
9) Karyn gains her energy 8 times faster than Alexander gains his energy.
10) Jayden speaks twice as fast as Sophia.

For each situation, let a variable stand for the smaller unknown. Then create an expression that stands for the larger unknown.

See ASG, p. 276

____ %

1) Ben is five times shorter than Ned.
2) Paul's savings account has a balance that's 2 times smaller than Ted's savings account balance.
3) Samuel's speed is 3 times less than Jack's speed.
4) Javier loses 3 times less weight than Alexander loses.
5) Madison drinks 5 times less fruit juice than William drinks.
6) Sam drives 13 mph slower than Avril drives.
7) Zombies eat 7 times fewer "things" than aliens eat.
8) In a game of "Candy Crash," Sophia scores 5,000 fewer points than Isabella.
9) Juan's has 300 fewer Facebook friends than Emily.
10) As a daily average, Ava drinks 2 fewer cups of coffee than Mia.

Write an algebraic expression to express the value of each set of coins, in cents:

See ASG, p. 277

____ %

1) An unknown number of nickels.
2) An unknown number of nickels added to an unstated number of dimes.
3) An unstated number of nickels added to an unknown number of quarters.
4) The difference of an unknown number of half-dollars minus an unspecified number of dimes.
5) The difference of an unknown number of quarters minus an unstated number of dimes.
6) An unknown number of half-dollars added to an unspecified number of nickels.
7) The difference of an unstated number of nickels minus an unspecified number of half-dollars.
8) The difference of an unstated number of dimes minus an unspecified number of quarters.
9) The difference of an unknown number of nickels minus an unspecified number of dimes.
10) The difference of an unstated number of dimes minus an unspecified number of nickels.

NAME ____________________ DATE ____________

Solve, using the technique on pp. 306 - 307. See ASG, pp. 306-307

____ %

1) Flying into a headwind, a passenger plane travels 2,200 miles in 5 hours. Aided by a tailwind, the same plane makes the return trip in 4 hours. What is the speed of the plane in still air, and what is the speed of the wind?

2) Traveling against the current, a boat makes the 450-mile trip from Charleston to Miami in 18 hours. Traveling with the current, the same boat makes the return trip in 15 hours. What's the speed of the boat in still water, and what's the speed of the current?

Express the amount of work completed in each situation. See ASG, p. 308

____ %

1) Kathy can build a treehouse in 6 weeks, and she works on one for 2 weeks.

2) Josie can animate a cartoon in 2 weeks, and she works on one for 1 week.

3) Ari can cook dinner in 3 hours, and he works on it for 2 hours.

4) Steve can clean his room in 60 minutes, and he works on it for 15 minutes.

5) Ella can write a song in 5 hours, and she works on one for 4 hours.

Write the ME/E and the ME/M for each situation. See ASG, p. 309

____ %

1) Ashlynn takes 7 hours to paint a 10′ x 10′ room, while Nadia needs 9 hours to complete the same task. How long will it take the two of them to paint this same size room if they work together?

2) Candace can prepare breakfast for six people in 45 minutes, but it takes Sarah 1 hour to prepare the same meal. How long will it take them to make this same breakfast if they work together?

3) Two birds are building a nest. Working alone, the first bird takes 4 days to build a nest. The second bird needs only 2 days to build her nest. How long will it take the birds to build a nest if they work together?

4) A man completes The New York Times crossword puzzle in 9 minutes, but his daughter can complete the same puzzle in just 3 minutes. Assuming seamless cooperation, how long would it take father and daughter to solve the puzzle if they work on it together?

5) Noah requires 3 days to paint the fence that surrounds his house, while Adam needs only 2 days to do the same task. How long would it take the two of them to complete this task if they work together?

Answers

page 43

1) m
2) 1/p
3) 1/xy
4) a
5) r
6) ce
7) 1/k
8) $1/p^2$

1) a
2) 3 and y
3) (m + n)
4) x
5) x and y
6) m
7) e
8) (s + t)
9) c
10) v and n

1) b
2) 5
3) 3
4) $\frac{p}{q} + 1$
5) 9 − d
6) y
7) $\frac{b + c}{3}$
8) $\frac{u}{v} + 1$
9) 7x − 1
10) rm

page 44

1) x + 2y
2) b + c
3) $\frac{3m + 5n}{2}$
4) $\frac{2}{u - 3v}$
5) 2s − 5t
6) $\frac{1}{e + v}$
7) $\frac{2w}{x + 3y}$
8) 3d − 2e + 5f
9) $\frac{p - 3q}{2}$
10) $\frac{5n + 2r - 6k}{3}$

1) $\frac{m + n}{2(b + c)}$
2) $\frac{1 - 2y}{2 - 3y}$
3) $\frac{d + 3f}{2d - 3f}$
4) $\frac{2(3n - r)}{3n + 2r}$
5) $\frac{4 + 5e}{3(2 + 3e)}$
6) $\frac{2 - 3m}{2(m + 4)}$
7) $\frac{2(a - 2c)}{2a - 3c}$
8) $\frac{rv - 2sq}{3xy + 4wz}$
9) $\frac{2(nr + 2st)}{3ns + 5rt}$
10) $\frac{2x + 3z}{3z - 4x}$

page 45

1) $\frac{3(g^2 - 2)}{g(g + 1)}$
2) $\frac{3y - 2}{y(2y + 5)}$
3) $\frac{2c(1 + 2c^2)}{4c^2 - 1}$
4) $\frac{2n + 3}{2n(n^2 + 1)}$
5) $\frac{2(3 - 4r)}{5(1 + 3r^2)}$
6) 2a + 6
7) $t^2 - 3t$
8) $3u - 4u^2$
9) 2z − 3
10) $2c^2 - 3d$

1) Yes
2) No
3) No
4) Yes
5) No
6) No
7) Yes
8) Yes
9) No
10) Yes

1) num.: 5, (d + g)
denom.: 3, 5, 15, (d + g)
2) num.: n, (r + t)
denom.: (r + t)
3) num.: 3, 9, (e + f)
denom.: 2, 3, 4, 6, 12, e
4) num.: (n + p − r)
denom.: r, (n + p)
5) num.: (s − t + v)
denom.: (t + v)
6) num.: (x − y)
denom.: w, (x − y)
7) num.: 2, 3, 6, m, m^2
denom.: (u + m)
8) num.: 2, 4, (p − q)
denom.: 2, 3, 6, (p + q)
9) num.: 3, (b + c)
denom.: (b + c), $(b + c)^2$
10) num.: x, x^2, (y − z)
denom.: (y − z), (y + z), $(y^2 - z^2)$

page 46

1) 1/2
2) 3/5
3) 1
4) 1/3
5) 3u/2w
6) 9
7) 1/6
8) x/y
9) 3/7u
10) $2c/d^2$

1) $\frac{x}{z} + \frac{y}{z}$
2) $\frac{a}{c} + \frac{b}{c} - \frac{3}{c}$
3) $\frac{n^2}{r} - \frac{r}{r}$
4) $\frac{\text{ant}}{\text{spider}} - \frac{\text{mouse}}{\text{spider}}$
5) $\frac{11}{21} - \frac{t}{21}$
6) $\frac{p}{z} + \frac{2}{z}$
7) $\frac{\bullet}{\star} + \frac{\odot}{\star}$
8) $\frac{c}{2} + \frac{d}{2}$
9) $\frac{3v}{2x} + \frac{2u}{2x} - \frac{4x}{2x}$
10) $\frac{k^2}{4} - \frac{4k}{4}$

1) $\frac{4}{d} + 1$
2) $1 + \frac{e}{c}$
3) $\frac{1}{x} - \frac{y}{x^2}$
4) $\frac{p^2}{q} - 1$
5) $\frac{a}{b^2} + 1$
6) $\frac{n}{r} - r$
7) $1 + \frac{k}{v} + \frac{w}{v}$
8) $\frac{u}{s} + \frac{t}{s} + 1$
9) $1 - \frac{y^2}{x^2}$
10) $1 + \frac{b}{a} - \frac{c}{a}$

page 70

1) First friend runs for 5 seconds; second friend runs for 3 seconds.
2) Ken's speed is 2 yps; Ben's speed is 4 yps.
3) Graham drives for 5 hours; Janet drives for 3 hours.
4) Sandy drives 20 mph; her mom drives 80 mph.

1) Train 'A' travels 50 mph; Train 'B' travels 70 mph.
2) Sara's speed is 80 mph; Emma's speed is 65 mph.
3) The Yellow Lambo travels 3 fps; the Purple Ferrari travels 5 fps.
4) Ned's speed is 6 fps; Ted's speed is 10 fps.

page 71

1) Speed w/ tailwind = 776 mph; speed vs. headwind = 704 mph.
2) Speed w/ tailwind = 932 kph; speed vs. headwind = 838 kph.
3) Speed w/ tailwind = 637 mph; speed vs. headwind = 579 mph.
4) Speed w/ tailwind = 843 kph; speed vs. headwind = 735 kph.

1) (– 2, – 1)
2) (– 3, – 6)
3) (5, – 2)
4) (– 7, – 3)

1) 300 = 1 x (b + c)
   300 = 1.5 x (b – c)
2) 1,700 = 3 x (p + w)
   1,700 = 4 x (p – w)

page 72

1) Speed of the plane in still air = 495 mph; wind speed = 55 mph.
2) Speed of the boat in still water = 27.5 mph; current speed = 2.5 mph.

1) Amount of treehouse built = (1/6) x (2) = 1/3
2) Amount of cartoon animated = (1/2) x (1) = 1/2
3) Amount of dinner cooked = (1/3) x (2) = 2/3
4) Amount of room cleaned = (1/60) x (15) = 15/60 = 1/4
5) Amount of song written = (1/5) x (4) = 4/5

---

1) ME/E: Ashlynn's Fractional Work + Nadia's Fractional Work = 1
   ME/M: $(r_a \times t_a) + (r_n \times t_n) = 1$
2) ME/E: Candace's Fractional Work + Sarah's Fractional Work = 1
   ME/M: $(r_c \times t_c) + (r_s \times t_s) = 1$
3) ME/E: First Bird's Fractional Work + Second Bird's Fractional Work = 1
   ME/M: $(r_1 \times t_1) + (r_2 \times t_2) = 1$
4) ME/E: Man's Fractional Work + Daughter's Fractional Work = 1
   ME/M: $(r_m \times t_m) + (r_d \times t_d) = 1$
5) ME/E: Noah's Fractional Work + Adam's Fractional Work = 1
   ME/M: $(r_n \times t_n) + (r_a \times t_a) = 1$