BEAM – BUFFALO ENGINEERING AWARENESS FOR MINORITIES

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TO THE STUDENT:

This book contains about nine dozen problems stated in English sentences. We have written this set of practice problems to give you practice in skills that you will need in your study of enginering.

Every engineering problem has two parts: a translation part and a solution part. Both are important, but it is likely that you will be better at solution than at translation. Don't be surprised, then, if we spend about twice as much class time on translation we spend on solution.

What has this got to do with engineering? We have found that successful engineers and engineering students are good at doing problems like those in this book. Further, they actually enjoy doing them! Two of the leading engineering magazines, "The Bent" (the magazine of Tau Beta Pi, the leading engineering honorary society) and "Technology Review" (the M.I.T. alumni magazine) publish Puzzle Corner columns every month containg problems similar in spirit to those in this book. We must conclude, then, that engineers enjoy doing word problems and are good at it.

We hope that you will practice and work hard on these problems, get good (or better), and that the skills you learn will help you a lot in engineering school and beyond.

Acknowledgement: We thank Jim Legge, Executive Director of BEAM, for his encouragement and support.

This set of problems concerns the translating of problems explained in english, to the mathematical descriptions that are neccesary for solution. Note that this is how a vast majority of real engineering problems are presented.

Problem TRANS- 1

Alice is 7 years younger than Trixie. If X represents Trixie's age now, express Alice's age 4 years ago in terms of X.

Problem TRANS- 2

A ship whose rate in still water is r mph is carrying a cargo of integrated circuits on a river in the same direction as the current of c mph.
What is the distance with respect to the shore that the boat will travel in h hours ?

(A) $h(r - c)$ (C) $d/(r + c)$

(B) $d/(r - c)$ (D) $h(r + c)$

Problem TRANS- 3

If a two digit number is divided by the sum of the digits, the quotient is 2. Express the units digit u in terms of the tens digit t.

Problem TRANS- 4

Trixie is 2 years younger than Alice. If Z represents Alice's age now, express Trixie's age 7 years ago in terms of Z.

Problem TRANS- 5

Ralph is in a car parked next to a truck from the Off & On Transistor company. They begin driving in opposite directions, Ralph at a rate of V mph, and the truck at a rate of S mph.
What will be the distance D between the two vehicles at the end of H hours ?

(A) $(V + S)/2$

(B) $VH + SH$

(C) $D/(V + S)$

(D) $(V + S)/H$

Problem TRANS- 6

If a two digit number is divided by the sum of the digits, the quotient is 3. Express the units digit u in terms of the tens digit t.

Problem TRANS- 7

Ralph is 8 years younger than Alice. If V represents Alice's age now, express Ralph's age 2 years ago in terms of V.

Problem TRANS- 8

Ralph is in a car parked next to a truck from the Al's Used Computer company. They begin driving in opposite directions, Ralph at a rate of V mph, and the truck at a rate of S mph.
How many hours H must pass before the two vehicles are D miles apart ?

(A) (V + S)/2 (C) D/(V + S)

(B) VH + SH (D) (V + S)/H

Problem TRANS- 9

Ralph is in a car parked next to a truck from the Buffalo Micro-Chip company. They begin driving in opposite directions, Ralph at a rate of V mph, and the truck at a rate of S mph.
What is the average rate of the two vehicles ?

(A) (V + S)/2 (C) D/(V + S)

(B) VH + SH (D) (V + S)/H

Problem TRANS- 10

It took an engineer 3 hours and 45 minutes to drive 555 kilometers to the Silicon Valley with a prototype satellite. What was her average rate in kilometers per hour ?

Problem TRANS- 11

If a two digit number is divided by the sum of the digits, the quotient is 5. Express the units digit u in terms of the tens digit t.

Problem TRANS- 12

It took an engineer 3 hours and 15 minutes to drive 558 kilometers to the Silicon Valley with a prototype disk drive. What was her average rate in kilometers per hour ?

Problem TRANS- 13

It took an engineer 3 hours and 45 minutes to drive 518 kilometers to the Silicon Valley with a prototype power amplifier. What was her average rate in kilometers per hour ?

Problem TRANS- 14

A ship whose rate in still water is r mph is carrying a cargo of radar antennas on a river in the same direction as the current of c mph.
How many hours will it take for the boat to travel d miles with respect to the shore ?

(A) $h(r - c)$ (C) $d/(r + c)$

(B) $d/(r - c)$ (D) $h(r + c)$

Problem TRANS- 15

It took an engineer 3 hours and 30 minutes to drive 500 kilometers to the Silicon Valley with a prototype disk drive. What was her average rate in kilometers per hour ?

Problem TRANS- 16

Spike is in a car parked next to a truck from the BEAM Laser company. They begin driving in opposite directions, Spike at a rate of V mph, and the truck at a rate of S mph.
What will be the distance D between the two vehicles at the end of H hours ?

(A) (V + S)/2

(B) VH + SH

(C) D/(V + S)

(D) (V + S)/H

Problem TRANS- 17

Alice is 7 years younger than Trixie. If X represents Trixie's age now, express Alice's age 5 years ago in terms of X.

Problem TRANS- 18

It took an engineer 5 hours and 15 minutes to drive 480 kilometers to the Silicon Valley with a prototype satellite. What was her average rate in kilometers per hour ?

Problem TRANS- 19

Spike is in a car parked next to a truck from the Al's Used Computer company. They begin driving in opposite directions, Spike at a rate of V mph, and the truck at a rate of S mph.
How many hours H must pass before the two vehicles are D miles apart ?

(A) (V + S)/2

(B) VH + SH

(C) D/(V + S)

(D) (V + S)/H

Problem TRANS- 20

Alice is 5 years younger than Trixie. If C represents Trixie's age now, express Alice's age 2 years ago in terms of C.

Problem TRANS- 21

If a two digit number is divided by the sum of the digits, the quotient is 4. Express the units digit u in terms of the tens digit t.

Problem TRANS- 22

It took an engineer 6 hours and 30 minutes to drive 457 kilometers to the Silicon Valley with a prototype integrated circuit. What was her average rate in kilometers per hour ?

Problem TRANS- 23

It took an engineer 4 hours and 30 minutes to drive 566 kilometers to the Silicon Valley with a prototype integrated circuit. What was her average rate in kilometers per hour ?

Problem TRANS- 24

It took an engineer 4 hours and 30 minutes to drive 479 kilometers to the Silicon Valley with a prototype power amplifier. What was her average rate in kilometers per hour ?

Problem TRANS- 25

Alice is in a car parked next to a truck from the Al's Used Computer company. They begin driving in opposite directions, Alice at a rate of V mph, and the truck at a rate of S mph.

What is the average rate of the two vehicles ?

(A) $(V + S)/2$

(B) $VH + SH$

(C) $D/(V + S)$

(D) $(V + S)/H$

Problem TRANS- 26

If a two digit number is divided by the sum of the digits, the quotient is 6. Express the units digit u in terms of the tens digit t.

Problem TRANS- 27

Ralph is 9 years younger than Alice. If L represents Alice's age now, express Ralph's age 3 years ago in terms of L.

Problem TRANS- 28

If a two digit number is divided by the sum of the digits, the quotient is 7. Express the units digit u in terms of the tens digit t.

Problem TRANS- 29

Spike is in a car parked next to a truck from the BEAM Laser company. They begin driving in opposite directions, Spike at a rate of V mph, and the truck at a rate of S mph.
What will be the distance D between the two vehicles at the end of H hours ?

(A) $(V + S)/2$

(B) $VH + SH$

(C) $D/(V + S)$

(D) $(V + S)/H$

Problem TRANS- 30

A ship whose rate in still water is r mph is carrying a cargo of radar antennas on a river in the opposite direction as the current of c mph.
What is the distance with respect to the shore that the boat will travel in h hours ?

(A) $h(r - c)$

(B) $d/(r - c)$

(C) $d/(r + c)$

(D) $h(r + c)$

This set of problems concerns mixtures. Each problem leads to one equation in one unknown. All answers have units, so be sure to express your answers completely. You will find that proficiency in solving problems of this type will help you in your chemistry courses.

Problem MIX- 1

How many kilograms of water must be evaporated from 48 kilograms of a 30% salt solution to raise it to a 40% salt solution?

Problem MIX- 2

In a tank, there are 50 kilograms of water and 20 kilograms of acid. How many kilograms of water must be evaporated to create a solution which is 40% acid?

Probem MIX- 3

How many grams of pure acid must be added to 30 grams of a 20% solution to make it a 50% solution?

Problem MIX- 4

How many kilograms of water must be evaporated from 84 kilograms of a 20% salt solution to raise it to a 35% salt solution?

Problem MIX- 5

In a tank, there are 48 kilograms of water and 36 kilograms of acid. How many kilograms of water must be evaporated to concentrate the solution so it is 60% acid?

Probem MIX- 6

How many grams of pure acid must be added to 24 grams of a 30% solution to make it a 60% solution?

Problem MIX- 7

How many kilograms of water must be evaporated from 96 kilograms of a 60% salt solution to raise it to a 80% salt solution?

Problem MIX- 8

In a tank, there are 24 metric tons of water and 32 metric tons of acid. How many tons of water must be evaporated to create a more concentrated solution which is 80% acid? Watch your units!

Probem MIX- 9

How many grams of pure acid must be added to 100 grams of a 25% solution to make it a 50% solution?

Problem MIX-10

How many kilograms of water must be evaporated from 72 kilograms of a 25% salt solution to raise it to a 50% salt solution? (if you like this problem, see also problem XTRA-3)

Problem MIX-11

In a tank, there are 56 kilograms of water and 42 kilograms of acid. How many kilograms of water must be evaporated to create a solution which is 50% acid?

Probem MIX-12

How many grams of pure acid must be added to 80 grams of a 10% solution to make it a 60% solution? Note the large increase in percent concentration.

Problem MIX-13

In a tank, there are 64 kilograms of water and 48 kilograms of acid. How many kilograms of water must be evaporated to create a solution which is 75% acid? After evaporation, is the solution more or less concentrated than originally?

Probem MIX-14

How many kilograms of pure antifreeze must be added to 100 kilograms of a 40% solution to make it a 80% solution? (A practical problem for Buffalo drivers)

Problem MIX-15

How many kilograms of water must be evaporated from 108 kilograms of a 5% salt solution to raise it to a 45% salt solution? (note the large increase in concentration)

These problems concern areas. All answers should be expressed properly, including units. Be sure to specify the length and depth clearly and separately.

Note to people outside western New York: food sales in this area are dominated by locally-owned chain stores which are very competitive. As a consequence, the quality of food in western New York is rather good and food prices are among the lowest in the U.S.

Problem AREA-1

The Super-Duper Market at the corner of Hopkins and Maple has a rectangular shape with the width 4/5 of the depth. Its area is 32 000 square feet. What are its dimensions?

Problem AREA-2

The Bells Klein Road Market has an area of 60 000 square feet. It is rectangular, with depth equal to 2/3 width. What are its dimensions?

Problem AREA-3

There is a small 7-11 Market on Millersport Highway. It is rectangular, and the width is 2.25 times the depth. Its area is 900 square feet. What are its width and depth?

Problem AREA-4

The huge Wegmans market on Alberta Drive is square in shape. Its area is 90 000 square feet. What are its dimensions?

Problem AREA-5

A Tops market at the corner of Maple and North Forrest is rectangular in shape. The depth is 6/10 of the width. Its area is 24 000 square feet. What are its depth and width.?

This set of problems concerns integers.

Integers are whole numbers. They may be positive, negative, or zero, such as 5,6,10 or -5, -6, -10 or just 0. Examples of successive integers are 5,6,7 or 0,1,2 or -1,0,+1.

Problem SI-1

Find three succesive integers such that the sum of the first two is 5 times the third.

Problem SI-2

Find three succesive integers such that the sum of the first two is 3 times the third.

Problem SI-3

Find three succesive integers such that the sum of the first two is the negative of the third.

Problem SI-4

Find three succesive integers such that the sum of the first two equals one-half of the third.

Problem SI-5

Find three succesive integers such that the sum of the first two is equal to the third.

Problem SI-6

Find three succesive integers such that the sum of the first two is 1.5 times the third.

Problem SI-7

Find three succesive integers such that ten times the sum of the first two is 17 times the third.

Problem SI-8

Find three succesive integers such that four times the sum of the first two is five times the third.

Problem SI-9

Find three succesive integers such that ten times the sum of the first two is 18 times the third.

Problem SI-10

Find three succesive integers such that ten times the sum of the first two is 19 times the third.

Problem SI-11

Find three succesive integers such that six times the sum of the first two is ten times the third.

The problems below are about orders of magnitude. These problems are unique to engineering. At some point in your engineering education, some professor will toss an "off-the-wall" problem at you, such as "how many pine trees must be chopped down to make the wood pulp used to make the newsprint on which last Sunday's New York Times was printed?" Or perhaps, "how many liters of gasoline are consumed in a year by all the private automobiles in the U.S.A.?" These are called "order-of-magnitude" problems because the desired answer is a reasonable estimate -- expressed as a single digit times a power of ten. For example, the answer to the gasoline problem might be 80 billion liters, or 100 billion liters, or 80 times 10**9 liters (where 10**9 is read "ten to the ninth power") How can the answer be both 80 billion and 100 billion? Because nobody really knows the exact answer. Note that private automobiles and light trucks use the same fuel, and nobody knows for sure the mixture of economical cars and gas-guzzlers on the road. Hence, while exact answers are not possible, estimates are.

Estimates of this type are usually the very first step in an engineering design.

The following facts may be useful in the next two problems. Gold and silver are sold in Troy ounces. A Troy ounce is equal to a mass of 31.1033 grams. The density of gold is 19.3 grams per cubic centimeter. The density of silver is 10.5 grams per cubic centimeter.

Safe deposit boxes are usually between 20 and 30 inches long, have widths of 5 or 10 inches, and heights of 2 or 3 inches. One inch equals 2.54 centimeters.

Problem MAG-1

In the book "Rabbit Is Rich", by John Updike, the character Harry Angstrom buys $15 000 of gold coins. The price of gold at the time was about $300 per Troy ounce. He has no trouble carrying the gold to his bank or stowing it in a safe deposit box. Explain why.

Problem MAG-2

Later, the Angstrom character and his wife trade the gold for silver and have great difficulty in carrying the silver to the bank and storing it in a safe deposit box. Explain, assuming the June 1985 price of silver (about $6 per Troy ounce).

The following facts may be useful in the next two problems. Paper money has about the same thickness as good-quality typing paper. A ream of 8 1/2 inch by 11 inch typing paper contains 500 sheets. It is about 2 inches thick, and has a mass of about 2 kilograms. All U.S. bills have the same size; refer to any dollar bill in your wallet for dimensions. Brief cases are usually about 17 inches wide, about 13 inches high, and 3 to 6 inches deep.

Problem MAG-3

In the television program "Miami Vice", payments of $100 000 are often made using twenty-dollar bills carried in a brief case. Will it fit? How heavy is it?

Problem MAG-4

In the film "Fletch", the hero leaves the country carrying three million dollars ($3 000 000) in two large brief cases. Will it fit? How heavy is it? (U.S. money comes in twenty, fifty, 100, 500 and 1000-dollar denominations).

Problem MAG-5

In the book "Hackers", Steven Levy describes the success of Roberta Williams in writing a computer game called "The Wizard and the Princess." This game sold 60 000 copies at $32.95 a copy. Ms. Williams bought a luxurious house (with a hot tub) with the profits. Was this possible? (luxurious houses in California cost about 0.5 10**6 dollars)

In these problems, let the tens digit be "t" and the units digit be "u". Thus, in 85, t=8 and u=5.

Problem DIGIT-1

The units digit of a two-digit number exceeds the tens digit by 5. For all possible values of the tens digit, the value of the number with the digits reversed exceeds the value of the original number by a constant. Find that constant. (You could try this with numbers to see how it works, then prove it with symbols)

All of the following problems should be done by setting up two equations in the two unknowns, "t" and "u".

Problem DIGIT- 2

If a two-digit number is divided by the sum of its digits, the result is 4. If the digits are reversed, the new number exceeds the original number by 18. Find the original number.

Problem DIGIT- 3

The units digit of a two-digit number exceeds the tens digit by 5. The number with the digits reversed is 4 less than twice the original number. Find the original number.

Problem DIGIT- 4

A two-digit number is 9 more than five times the sum of the digits. The tens digit is one more than the units digit. Find the number.

Problem DIGIT- 5

If a two-digit number is divided by the sum of its digits, the result is 3. If the digits are reversed, the new number exceeds the original number by 45. Find the original number.

Problem DIGIT- 6

The units digit of a two-digit number exceeds the tens digit by 5. The number with the digits reversed is 7 more than twice the original number. Find the original number.

Problem DIGIT- 7

A two-digit number is 10 more than five times the sum of the digits. The tens digit is one more than the units digit. Find the number.

Problem DIGIT- 8

If a two-digit number is divided by the sum of its digits, the result is 4. If the digits are reversed, the new number exceeds the original number by 27. Find the original number.

Problem DIGIT- 9

The units digit of a two-digit number exceeds the tens digit by 5. The number with the digits reversed is 18 more than twice the original number. Find the original number.

Problem DIGIT-10

A two-digit number is 11 more than five times the sum of the digits. The tens digit is one more than the units digit. Find the number.

Problem DIGIT-11

If a two-digit number is divided by the sum of its digits, the result is 5. If the digits are reversed, the new number exceeds the original number by 9. Find the original number.

Problem DIGIT-12

The units digit of a two-digit number exceeds the tens digit by 5. The number with the digits reversed is 29 more than twice the original number. Find the original number.

Problem DIGIT-13

A two-digit number is 12 more than five times the sum of the digits. The tens digit is one more than the units digit. Find the number.

Problem DIGIT-14

If a two-digit number is divided by the sum of its digits, the result is 4. If the digits are reversed, the new number exceeds the original number by 36. Find the original number.

Problem DIGIT-15

A two-digit number is 13 more than five times the sum of the digits. The tens digit is one more than the units digit. Find the number.

This set of problems is concerned with rate calculations and related concepts. Be careful to keep track of the direction of travel and also note that a "rate" can refer to something other than a physical thing, such as a growth rate, etc..

Problem RATE- 1

At what rate does an automobile travel if it goes 700 kilometers in 8.75 hours ?

Problem RATE- 2

Two jet fighters fly toward each other from points 1600 miles apart, one at a rate of 550 mph, and the other at a rate of 825 mph (supersonic). How long will it take for them to pass by each other if they both start at the same instant in time ?

Problem RATE- 3

A helicopter lifts off from a yacht in the Atlantic ocean at 9 AM , and begins flying away at 225 mph. At the same instant, the yacht begins to travel in the opposite direction at 25 mph. At what time will they be 750 miles apart ?

Problem RATE- 4

At 8 AM an engineer from the Really-Big Atomic Power Company leaves Gotham city in his car at 92 km/hour to meet a convoy carrying fuel rods which is 130 km away and approaching at 12 km/hour. When will the engineer meet the convoy ?

Problem RATE- 5

Ralph can run 400 meters in 54 seconds, and Norton can run the same distance in 60 seconds. How long will it take the faster runner to gain a lead of 12 meters on the slower runner if they start together in a 400-meter race ?

Problem RATE- 6

A jet leaves the flight deck of an aircraft carrier and travels south at 840 mph. The carrier travels south at 40 mph. If the radar in the carrier has a range of 600 miles, how long will it take for the jet to pass out of the carrier radar's range ?

Problem RATE- 7

On a section of the Niagara river where the current flows at a rate of 10 km/hour, a boat takes as long to travel 3 km toward the falls as it would to travel 1 km away from the falls (both distances with respect to the shore). At what rate could the boat travel in still water ?

Problem RATE- 8

When the wind velocity is 75 mph, it takes a 747 jetliner as long to travel 275 miles against the wind as it does to travel 350 miles with the wind. How fast can the 747 travel in still air ?

Problem RATE- 9

How many seasons will it take an NBA basketball player who earns $475 thousand per season to become twice as rich as an NFL football player who earns $225 thousand per season, if each starts with a $100 thousand bonus ?

Problem RATE- 10

Two jet fighters take off in opposite directions. One is travelling at a constant rate of 800 mph. The other starts travelling at 1000 mph, then after 4 hours kicks in his after-burners and travels at rate of 1800 mph for 3 hours, and then drops back down to 700 mph. Assuming that the circumference of the earth is 24,000 miles, and that neither plane will run out of fuel, how long will it take the two jets to meet each other on the other side of the planet ?

All of the following problems are solved using quadratic equations. They may be solved by factoring or by use of the quadratic formula.

Problem QUAD- 1

The Ace Electronics Corporation bought a shipment of identical integrated circuits for a total price of $806. They sold all but 5 of the integrated circuits for a unit price of $14 more than each integrated circuit cost them, and had total receipts of $1040. How many integrated circuits were in the original shipment?

Problem QUAD- 2

The members of the 1986 BEAM Summer Program decided to go on a picnic and agreed to contribute equally to form a fund of $240 to cover expenses. Three non-members asked to join the picnic, and were accepted, with the result that each person going on the picnic would have to pay $4 less than the amount originally agreed upon. How many persons had originally planned to go on the picnic? (Assume that total expenses, such a renting a bus, remained the same when the three extra people joined the group.)

Problem QUAD- 3

The length of a rectangle is 5 units more than twice the width. The number of square units in the area is 4 less than the number of units in the perimeter. What are the dimensions of the rectangle? (Identify length and width)

Problem QUAD- 4

BEAM Microchips Corporation bought a batch of identical computer chips for $896 (total). They sold all but 3 of the chips. Each chip was sold for $20 more than the chip had cost. Total receipts for this deal were $1392.

How many many chips were in the original shipment?

Problem QUAD- 5

Al's Used Computers was offered at lot of TI-33 calculators for a total price of $110. Al figured that if the vendor gave him one more calculator at the same total price, his cost per calculator would be reduced by $1.00. How many calculators were in the original offer?

Problem QUAD- 6

The length of a rectangle is 4 centimeters more than twice the width. The number of square centimeters in the area is 4 more than the number of centimeters in the perimeter. What are the length and width of the rectangle? (Watch units!)

Problem QUAD- 7

Al's Used Computers bought a shipment of identical used TI-55 calculators. The total purchase price was $945. Al's sold all but 5 of the calculators, charging each customer $12 more than each calculator had cost, and had total receipts of $1170.

How many calculators were in the original shipment?

Problem QUAD- 8

BEAM Microchips was offered at lot of 8085 CPU chips for a total price of $168. Their bookkeeper, Trixie Norton, figured that if the vendor offered them two more 8085 chips at the same total price, their cost per chip would be reduced by $2.00. How many chips were in the original offer?

Problem QUAD- 9

The length of a rectangle is 4 meters more than twice the width. The number of square meters in the area is 16 more than the number of meters in the perimeter. What are the dimensions of the rectangle? (Give length and width, with proper units!)

Problem Quad-10

The Off and On Transistor Corporation bought a shipment of identical power transistors for $682, total. They sold all but 3 of the transistors. The selling price was $17 more (per transistor) than the transistors had cost them. Total receipts on the deal were $1092.

How many transistors were in the original shipment?

Problem QUAD-11

Off and On Transistor Company was offered at lot of Power Darlington transistors for a total price of $238. Purchasing agent

Ralph Cramden figured that if the vendor sold his company just three more transistors at the same total price, his cost per transistor would be three dollars ($3.00) less. How many Power Darlingtons were in the original offer?

Problem QUAD- 12

The length of a rectangle is 5 meters more than twice the width. The number of square meters in the area is 5 more than the number of meters in the perimeter. What are the dimensions of the rectangle? (Give length and width, with proper units!)

Problem Quad-13

The Oahu Hula-Hoop Corporation bought a shipment of identical Hula Hoops. The total purchase price was $700. They sold all but 40 of the Hoops, charging $1.20 more for each hoop than they had paid for it. Total sales receipts were $992.

How many Hula Hoops were in the original shipment? (watch out for dollars and cents in this problem!)

Problem QUAD-14

Bob's Circuit City was offered at lot of portable Stereo Players for a total price of $320. Bob figured that if the seller would let him have four more stereos at the same total price, his cost per stereo would be reduced by four dollars ($4.00). How many stereos were in the original offer?

Problem QUAD-15

A computer programer is determining the dimensions of an output listing. The area of each page is to be 432 square centimeters. To allow for binding and photo-copying of the output, margins of 3 cm on each side and 4 cm on both top and bottom are required. If the printed matter is to occupy 192 square centimeters on each page, what must be the overall length and width of the paper?

These Problems are just a little more difficult and challenging than the rest of the problems in this booklet!!!!!

Problem XTRA- 1

At how many minutes after 2 PM will the minute hand of a clock overtake the hour hand ?

Problem XTRA- 2

At how many minutes after 4 PM will the hands of a clock become perpendicular for the first time ?

Problem XTRA- 3

How many kilograms of water must be evaporated from K kilograms of a 25% solution of salt in water to make a 50% solution. Or, more generally, how many kilograms of water must be evaporated from an X% solution of salt in water to double the concentration?

Problem XTRA- 4

The perimeter of a rectangle is 102 centimeters. If the diagonal of the rectangle is 39 centimeters, find the length and width of the rectangle.

This problem involves solving a quadratic and a linear equation simultaneously. You might want to try an "experimental" approach with a string 51 centimeters long before trying a purely mathematical approach.