Linear Systems: Word Problems

Examples and Practice Questions (with solutions)

Topics include rate problems, integer questions, mixture, area, ticket sales, and more.

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Example: Spencer has 47 coins in his Snoopy bank.
The coins consist of nickels, dimes, and quarters. And, there are twice as many dimes as nickels.
If the bank contains $8.25, how many dimes are inside?

Solving Linear Systems Word Problems:

1) Establish variables
2) Draw diagram (if applicable)
3) Set up system of equations
4) Solve
5) Check Answers

Establish Variables
D = # of dimes
N = # of nickels
Q = # of quarters

Set up Equations
$2N = D$

$N + D + Q = 47$

$.05N + .10D + .25Q = 8.25$

Solve Using substitution:

$N + (2N) + Q = 47$

$.05N + .10(2N) + .25Q = 8.25$

Then, rewrite:

$3N + Q = 47$

$25N + 25Q = 825$

$75N + 25Q = 1175$

$25N + 25Q = 825$

$50N = 350$

$N = 7$
therefore, $D = 14$...

$7 + 14 + Q = 47$

$Q = 26$

Check Answers

7 nickels
14 dimes
26 quarters
total coins: 47 ✓

7 nickels
14 dimes
"twice as many dimes as nickels" ✓

7 nickels: 35 cents
14 dimes: $1.40
26 quarters: $6.50
$8.25 total ✓

Example A bottling plant has 2 machines.
Machine A can fill 1400 bottles per hour.
Machine B can fill 2200 bottles per hour.

Machine A begins running at 8:30.
After maintenence, Machine B is turned on at 10:00.

What time will they fill 19,200 bottles?
How many bottles did Machine A fill?

Solve the system of equations..

Rate and work problems:
Using table and system of equations:

1) Establish variables
2) Set up table
3) Set up system of equations
4) Solve
5) Check Answers

	rate (bottles/hour)	time (hours)	bottles
Machine A	1400	$t + 1.5$	B
Machine B	2200	t	$19{,}200 - B$

Set up Equations
Since distance (d) = rate x time,

$1400(t + 1.5) = B$

$2200(t) = 19{,}200 - B$

Solve

$1400t + 2100 = B$

$2200t + B = 19{,}200$

(substitution)

$2200t + (1400t + 2100) = 19{,}200$

$3600t = 17{,}100$

$t = 4.75$

then, $1400(4.75 + 1.5) = B$

$B = 8750$

Then, answer the question...

Machine A fills 8750 bottles

(Machine B fills 10,450 bottles)

$t = 4.75$ or 4 hours 45 minutes

So, the bottles will be finished at 10:00 + 4hr 45min = 2:45 pm

Linear Systems Application: Rate Problems

Here are 3 types of rate applications: "chase", "away", and "toward".

d = rt

distance = (rate)(time)

Example: Jack goes up a hill at a rate of 4 miles per hour.
Three hours later, Jill goes up the hill at a rate of 6 miles per hour.
How long will it take Jill to catch up to Jack?
How far up the hill did they go?

"Chase"

	rate (miles/hour)	time (hours)	distance
Jack	4	t	d
Jill	6	t − 3	d

since Jill will gain 2 miles/hour, it should take 6 hours to close the 12 mile gap...

$d_{jack} = 4t$

$d_{jill} = 6(t-3)$

$d_{jack} = d_{jill}$

$4t = 6(t-3)$

$4t = 6t - 18$

$t = 9$

So, Jack will spend 9 hours on the hill
Jill will spend 6 hours on the hill...

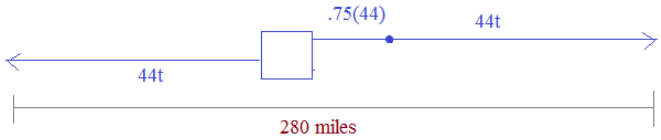
And, each of them went 36 miles up the hill!

Example: At Union Station, Train A departs southbound at 3:00pm.
At 3:45 Train B departs northbound. If each travels at
44 miles per hour, when will they be 280 miles apart?

"Away"

	rate (miles/hour)	time (hours)	distance
Train A	44	t + .75	d
Train B	44	t	280 − d

45 minutes = .75 hours



The trains will be 280 miles apart approximately
2 hours 48 minutes after Train B departs...

3:45 + 2:48 = 6:33PM

distance = rate x time

$d_A = 44(t + .75)$

$d_B = 44(t)$

together, Train A + Train B = 280

$44(t + .75) + 44(t) = 280$

$44t + 33 + 44t = 280$

$88t = 247$

t = 2.807 hours

Convert to minutes: 2 hours +

.807 hour x $60 \frac{\text{minutes}}{\text{hour}}$ = 48 minutes (approx)

Quick check: 44 x 2.807 = 123.5 miles
44 x 3.557 = 156.5 miles
280 total

Example: Tom and Jerry live 10 miles apart.
If Tom rides his bike at 12 miles per hour toward Jerry's house.
And, Jerry runs at 7 miles per hour toward Tom's house,
How long will it take them to meet?

"Toward"

	rate (miles/hour)	time (hours)	distance
Tom	12	t	d
Jerry	7	t	10 − d

Tom's distance d = (12 miles/hour)t

Jerry's distance (10 − d) = (7 miles/hour)t

Tom's distance + Jerry's distance = total distance

12t + 7t = 10 miles

(19 miles/hour)t = 10 miles

t = 10/19 hour or 31.58 minutes

or 31 minutes 35 seconds

Example: A bartender wants to make 81 ounces of a 20% cranberry drink mix.
How much pure cranberry juice should he mix with a 10% cranberry blend?

After reading the quesiton, we can see it is a 'mixture' problem.

Method 1: Using a chart

Step 1: Identify the "core item" -- in this case, it is "cranberry"

Step 2: Fill in the chart

	quantity	%	amount of cranberry
10% blend	X	.10	.10X
pure juice	Y or, 81 - X	1.00	1.00(81 - X)
20% desired mix	81	.20	.20(81) or, 16.2

Step 3: Using column 3, solve the equation....

10% blend pure 20% amount

$.10X + (81 - X) = 16.2$

$-.9X = -64.8$

$X = 72$

9 ounces of pure cranberry

72 ounces of 10% mix

Method 2: System of linear equations

Let X = amount of 10% blend
Y = amount of pure cranberry

first equation: amounts $X + Y = 81$

second equation: concentration of cranberry

$.10X + 1.00(Y) = .20(81)$

Then, solve...

$X + Y = 81$

$.10X + Y = 16.2$

Elimination method

$X + Y = 81$

$-.10X + Y = 16.2$

$.90X = 64.8$

$X = 72$ then, $Y = 9$

Example: An investor deposited $2175 into 2 investment accounts.
Account A offers a rate of 8.27%
and, Account B offers a rate of 7.74%...

If the interest received at the end of one year is $174.48, how much was deposited in each account?

The given information includes 2 variables. So, we need 2 equations to solve...

Amount deposited $A + B = 2175$

Amount of interest received $.0827A + .0774B = 174.48$

Using substitution:

$.0827(2175 - B) + .0774B = 174.48$

$179.87 - .0827B + .0774B = 174.48$

$5.39 = .0053B$

$B = 1017$

Then, $A = 1158$

More accurate solution without rounding:

$A = 1157.55$

$B = 1017.45$

Example: Dale has enough money to buy 16 gallons of gas.
If the price of gas were 25 cents less, he could buy 2 extra gallons.
How much money does Dale have?

Let's start with a formula: Total Cost = (price of gas) x (# of gallons)

Then, apply the formula with the given information: "Dale's Money" = (price of gas) x (16 gallons)

D = P x 16

We have 2 variables, so we need a second equation to solve!

"Dale's Money" = (price minus .25) x (16 + 2 extra gallons)

D = (P − .25) x (18)

Now, we have 2 equations... We can solve using a system of linear equations....

D = 16P

D = 18(P − .25)

Using Substitution: 16P = 18(P - .25)

16P = 18P − 4.5

-2P = -4.5

P = 2.25

Then, if P = 2.25,

D = 16(2.25) = 36

So, Dale has 36 dollars

Quick check:

Gas is $2.25... Dale can buy 16 gallons with $36 ✓

Gas is $2.00... Dale can buy 18 gallons with $36 ✓

Example: A bartender wants to make 81 ounces of a 20% cranberry drink mix.
How much pure cranberry juice should he mix with a 10% cranberry blend?

After reading the question, we can see it is a 'mixture' problem...

Method 1: Using a chart

Step 1: Identify the "core item" -- in this case, it is "cranberry"

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Let X = amount of 10% blend
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first equation: amounts X + Y = 81

second equation: concentration of cranberry

.10X + 1.00(Y) = .20(81)

Then, solve...

X + Y = 81

.10X + Y = 16.2

Elimination method

X + Y = 81

— .10X + Y = 16.2

.90X = 64.8

X = 72 then, Y = 9

System of 3 linear equations

Shooter had a great season, scoring 1276 points. He made twice as many free throws as 3-pointers.
Also, the number of 2-point field goals was 77 less than twice the number of free throws.

How many of each type of shot did Shooter make last season?

Step 1: (Read question and) pick out the variables...

"How many of each type of shot..." We're looking for number of free throws, field goals, and 3-pointers.

Let x = # of free throws y = # of field goals z = # of 3-pointers

Since we have 3 variables, we're seeking 3 equations....

Step 2: (Re-read question and) identify the constraints and details..

"scoring 1276 point." That can be represented by $1x + 2y + 3z = 1276$

"twice as many free throws as 3-pointers" That can be represented by $x = 2z$

"number of 2-point field goals was 77 less than twice the number of free throws" That can be represented by $y = 2x - 77$

Step 3: Solve the system of 3 equations

$1x + 2y + 3z = 1276$

$x = 2z$

$y = 2x - 77$

Using Substitution

$1x + 2y + 3z = 1276$

$x = 2z \Rightarrow z = \frac{1}{2}x$

$y = 2x - 77$

$1x + 2(2x - 77) + 3(\frac{1}{2}x) = 1276$

$x + 4x - 154 + 1.5x = 1276$

$6.5x = 1430$

$x = 220$

then, $z = 110$

and, $y = 363$

220 free throws (1 point)
363 field goals (2 points)
110 3-point field goals

Also, can be solved with a matrix:

$$\begin{vmatrix} 1 & 2 & 3 \\ 1 & 0 & -2 \\ -2 & 1 & 0 \end{vmatrix} \begin{vmatrix} 1276 \\ 0 \\ -77 \end{vmatrix} = \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} \begin{vmatrix} 220 \\ 363 \\ 110 \end{vmatrix}$$

Linear Systems Word Problems

1) The sum of two integers is 724.
If their difference is 24, what are the two integers?

2) Katie has $4 in her piggy bank, filled with nickels and dimes.
If there are 47 coins in the piggy bank, how many of them are dimes?

3) A farmer has a field full of chickens and sheep.
When viewed from above, you can see 65 heads.
And, when viewed from below, you can see 220 legs.
How many chickens are in the field?

4) An airplane flies from A-town to B-town in 6 hours.
Then, the next day, it flies from B-town to A-town in 5 hours.
If the airplane's speed is 500 miles per hour, what is the speed of the wind?
How far apart are A and B?

5) Tickets to a math performance cost $8 for adults and $3 for children.
If the show sold twice as many children's tickets as adult tickets,
and it raised $602, how many adults attended the performance?

Linear Systems Word Problems

6) A cell phone company charges $15 for the first 1000 text messages.
Then, it charges 10 cents for each addition text.

If the bill is $48.50, how many text messages were sent?

7) A tropical drink uses twice as much pineapple juice as it does coconut juice.
How much coconut juice is used in a 16 ounce drink?

8) The length of a rectangle is twice its width.
If the area is 98 square feet, what is the perimeter?

9) I have 47 quarters, dimes, and nickels in my pocket.
If I have twice as many quarters as nickels, and a total of $7.45,
how many quarters do I have?

10) The school play is charging $8 for adults, $4 for children, and $5 for seniors.
At Friday's performance, 1/2 as many seniors as adults attended.
And, twice as many children as adults attended the show.
If the show grossed $592 , how many seniors attended?

Linear Systems Word Problems

11) John paid $14.63 for three bags of chips and four sodas. At the same store, Alice paid $16.03 for two bags of chips and five sodas.
How much does a bag of chips cost?
(Note: there is no sales tax.)

12) The length of a rectangle is twice its width.
If the perimeter is 16 feet, what is the area?

13) Given a 2-digit number. The sum of the digits is 12.
If you reverse the digits, then the number decreases by 54.
What is the number?

14) Call card A costs $1.50 and 25 cents per minute. And,
call card B costs $2.75 and charges 15 cents per minute.

When is buying card B a better deal?

15) Jack currently has $75 in a bank account and saves $10 per week.
Jill has $125 in her account, and she is saving $2 per day.
When will they have the same amounts in their accounts?

Linear Systems Word Problems

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16) Lance has $100 in a savings account and adds $30 per month.
Katie has $300 in an account and withdraws $20 per month.

When will their accounts have the same amount?

17) Carnations cost $2.15 per stem. Roses cost $8.25 per stem.
If you have 90 dollars to spend and need 20 stems, how many of each can you buy?

18) Josh spilled punch on his homework!

Question 4 had a solution of (6, 3)...

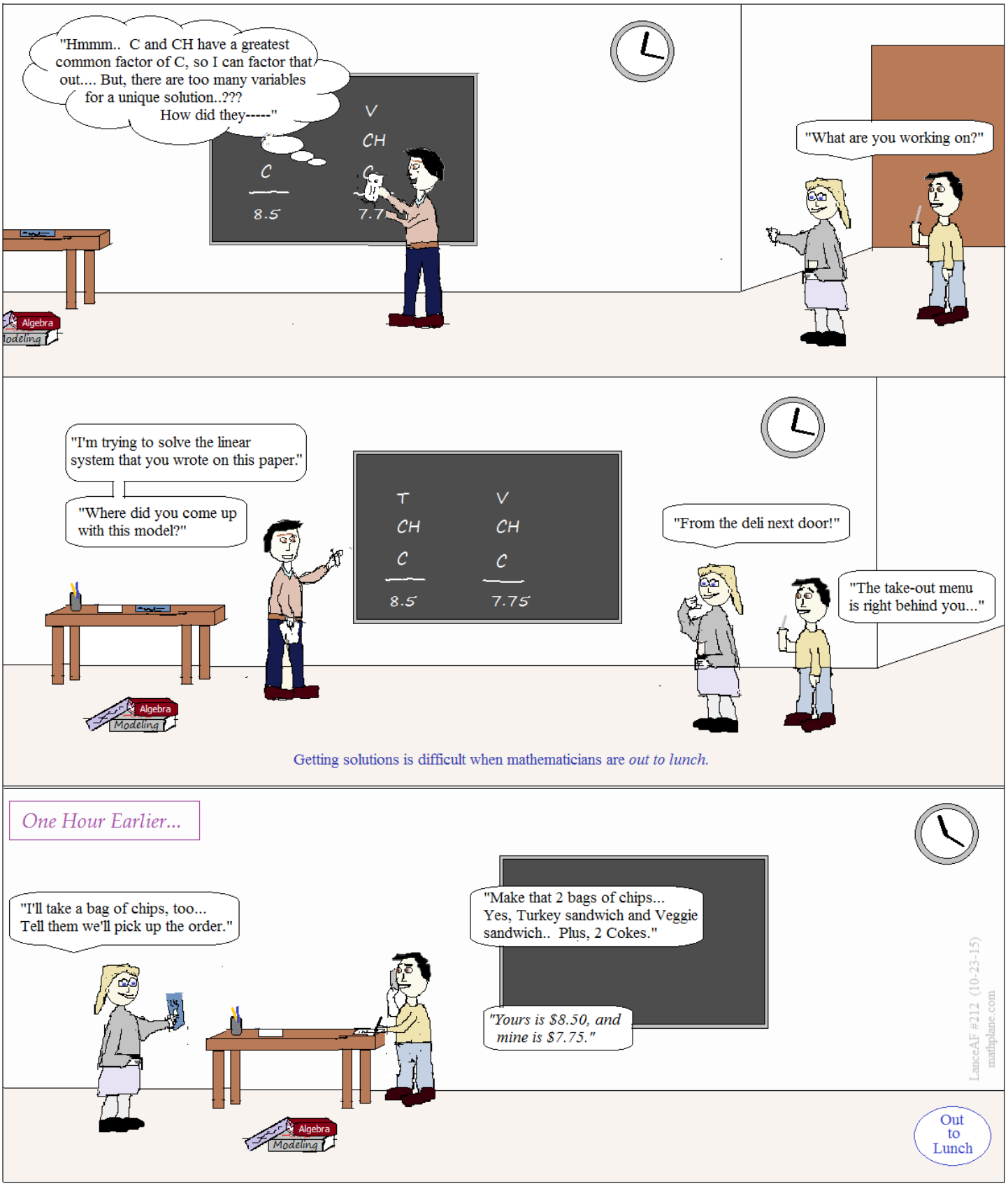
What is a possible equation in the question?

$$\begin{cases} 2x + 3y = 21 \\ 5x \end{cases}$$

19) I'm thinking of a 2-digit number. The sum of the digits is 7.
And, if you reverse the digits, the number decreases by 9.
What is the number?

20) Challenge question: solve the system *in terms of m*

$$\begin{cases} x + y = m \\ ym + x - 1 = 0 \end{cases}$$


"Hmmm.. C and CH have a greatest common factor of C, so I can factor that out.... But, there are too many variables for a unique solution..??? How did they-----"
V
CH
C
C
8.5
7.7
Algebra
Modeling
"What are you working on?"
"I'm trying to solve the linear system that you wrote on this paper."
"Where did you come up with this model?"
T
CH
C
8.5
V
CH
C
7.75
"From the deli next door!"
"The take-out menu is right behind you..."
Getting solutions is difficult when mathematicians are out to lunch.
One Hour Earlier...
"I'll take a bag of chips, too... Tell them we'll pick up the order."
"Make that 2 bags of chips... Yes, Turkey sandwich and Veggie sandwich.. Plus, 2 Cokes."
"Yours is $8.50, and mine is $7.75."
LanceAF #212 (10-23-15)
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Out to Lunch

Linear Systems Word Problems

1) The sum of two integers is 724.
If their difference is 24, what are the two integers?

"The Integer Question"

The two integers are A and B.

$A + B = 724$

$A - B = 24$

Using elimination/combination method:

$2A + 0B = 748$

$A = 374$... then, $B = 350$

350 and 374

2) Katie has $4 in her piggy bank, filled with nickels and dimes.
If there are 47 coins in the piggy bank, how many of them are dimes?

"The Coin Question"

Let D = # of dimes
N = # of nickels

$D + N = 47$

$.10(D) + .05(N) = \$4$

two equations, two unknowns

Using substitution: $D = 47 - N$

$.10(47 - N) + .05(N) = 4$

$4.7 - .10N + .05N = 4$

$-.05N = -.7$

$N = 14$

Since N = 14

and $D + N = 47$,

$D = 33$

33 Dimes

3) A farmer has a field full of chickens and sheep.
When viewed from above, you can see 65 heads.
And, when viewed from below, you can see 220 legs.
How many chickens are in the field?

"The Animal Feet and Head Question"

Let C = # of chickens

S = $ of sheep

chickens have 2 legs
sheep have 4 legs

$1(C) + 1(S) = 65$ heads

$2(C) + 4(S) = 220$ legs

Using elimination/combination:

$-1C + -1S = -65$

$2C + 4S = 220$

$-2C - 2S = -130$

$2S = 90$

$S = 45$

If there are 45 sheep,
then there are

$C + 45 = 65$

20 Chickens

4) An airplane flies from A-town to B-town in 6 hours.
Then, the next day, it flies from B-town to A-town in 5 hours.
If the airplane's speed is 500 miles per hour, what is the speed of the wind?
How far apart are A and B?

"Wind Speed"

distance = rate x time

distance A to B: $(rate_{plane} - rate_{wind})$ x 6 hours

distance B to A: $(rate_{plane} + rate_{wind})$ x 5 hours

Since the distances are the same, we set the equations equal to each other....

$(P - W) \times 6 = (P + W) \times 5$

$6(500 - W) = 5(500 + W)$

$3000 - 6W = 2500 + 5W$

$500 = 11W$

$W = 45.45$ miles/hour

Wind speed is $45\frac{5}{11}$ miles per hour

Then, since distance = rate(time),

distance = (500 m/h − 45.45 m/h)(6 hours)

A to B = 2727.27 miles...

Distance = 2727.27 miles

check: distance from B to A:

(500 m/h + 45.45 m/h)(5 hours) = 2727.27 ✓

5) Tickets to a math performance cost $8 for adults and $3 for children.
If the show sold twice as many children's tickets as adult tickets,
and it raised $602, how many adults attended the performance?

"Tickets Question"

Let A = # of adults

C = # of children

Since "twice as many children's tickets as adult tickets",

$C = 2A$ (ex: if 10 adult tickets, then 20 children's tickets...)

$\$8(adults) + \$3(children) = \$602$

$8A + 3C = 602$

Using substitution:

$8A + 3(2A) = 602$

$14A = 602$

$A = 43$

43 Adults

Quick Check:

43 adults x $8 = $344
86 children x $3 = $258

total: $602 ✓

Linear Systems Word Problems

6) A cell phone company charges $15 for the first 1000 text messages.
Then, it charges 10 cents for each addition text.

If the bill is $48.50, how many text messages were sent?

Let T = # of additional texts

$15 + $.10(T) = $48.50

$.10(T) = $33.50

T = 335

So, the total texts = first 1000 + additional texts

= 1000 + 335

= 1335

1335 total text messages

7) A tropical drink uses twice as much pineapple juice as it does coconut juice.
How much coconut juice is used in a 16 ounce drink?

P = amount of pineapple juice

C = amount of coconut juice

total juice: P + C = 16 ounces

portions: P = 2C

ex: If you used 10 oz of coconut, then you'd use 20 oz of pineapple.

C = 16 - P

P = 2C

C = 16 - (2C)

3C = 16

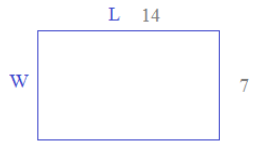
C = 16/3

and

P = 32/3

$5\frac{1}{3}$ ounces of coconut juice

8) The length of a rectangle is twice its width.
If the area is 98 square feet, what is the perimeter?



Let L = length

W = width

LW = 98 square feet

L = 2W

Using substitution:

(2W)W = 98 square feet

$2W^2 = 98$

W = 7 then, L = 14

Perimeter = 2L + 2W

theefore, perimeter is

2(14) + 2(7) = 42

perimeter is 42 feet

9) I have 47 quarters, dimes, and nickels in my pocket.
If I have twice as many quarters as nickels, and a total of $7.45,
how many quarters do I have?

Let Q = # of quarters

D = # of dimes

N = # of nickels

simce there are 3 unknown variables, we seek 3 equations...

.25Q + .10D + .05N = 7.45

Q = 2N

Q + D + N = 47

For ease, get rid of the decimals:

25Q + 10D + 5N = 745

then, use substtitution:

25(2N) + 10D + 5N = 745

(2N) + D + N = 47

55N + 10D = 745

3N + D = 47

30N + 10D = 470

then, elimination:

55N + 10D = 745

— 30N + 10D = 470

25N = 275

N = 11

22 Quarters

If N = 11, then Q = 22

Also, D = 14
because Q + D + N = 47

Quick check:

22 quarters: 5.50
11 nickels: .55
14 dimes: 1.40
total: $745 ✓

10) The school play is charging $8 for adults, $4 for children, and $5 for seniors.
At Friday's performance, 1/2 as many seniors as adults attended.
And, twice as many children as adults attended the show.
If the show grossed $592 , how many seniors attended?

Let A = # of adults

C = # of children

S = # of seniors

to find the 3 variables, we seek 3 equations...

"1/2 as many seniors as adults"

S = (1/2)A

"twice as many children as adults"

C = (2)A

"show grossed $592"

$8(A) + $4(C) + $5(S) = $592

Using Substitution:

8(A) + 4(2A) + 5(.5A) = 592

18.5A = 592

A = 32

16 Seniors attended

Since A = 32, C = 64, and S = 16

Check: $8(32) + $4(64) + $5(16) = $256 + $256 + $80 = $592 ✓

twice as many children as adults ✓

1/2 as many seiors as adults ✓

Linear Systems Word Problems

SOLUTIONS

11) John paid $14.63 for three bags of chips and four sodas. At the same store, Alice paid $16.03 for two bags of chips and five sodas.
How much does a bag of chips cost?
(Note: there is no sales tax.)

Let C = # of chips
S = # of sodas

$3C + 4S = 14.63$
$2C + 5S = 16.03$

two equations, two unknowns

(for ease, multiply by 100 to get rid of fractions)

$300C + 400S = 1463$
$200C + 500S = 1603$

$-600C - 800S = -2926$
$600C + 1500S = 4809$

$700S = 1883$

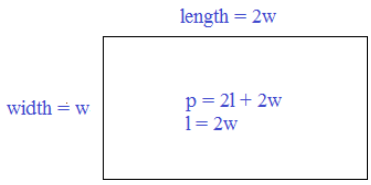
$S = 2.69$

$2C + 5(2.69) = 16.03$
$2C + 13.45 = 16.03$
$C = 1.29$

Chips cost $1.29

Sodas cost $2.69

12) The length of a rectangle is twice its width.
If the perimeter is 16 feet, what is the area?



perimeter = 2(length) + 2(width)

$16 = 2(2w) + 2w$

$16 = 6w$

$w = \frac{8}{3}$

therefore, length is $\frac{16}{3}$

the area is $\frac{128}{9}$

area is $14.2\overline{2}$ square units

13) Given a 2-digit number. The sum of the digits is 12.
If you reverse the digits, then the number decreases by 54.
What is the number?

"Integer identification question"

XY is the number...

"sum of digits is 12"

$X + Y = 12$

2-digit number reversed 2-digit number

$(10X + Y) - 54 = 10Y + X$

$X = 12 - Y$

$9X - 9Y = 54$

Using substitution:

$9(12 - Y) - 9Y = 54$

$108 - 9Y - 9Y = 54$

$Y = 3$ and $X = 9$

93

quick check:

93 and 39 (digits add up to 12)
difference between numbers: 54

14) Call card A costs $1.50 and 25 cents per minute. And,
call card B costs $2.75 and charges 15 cents per minute.

"Break even question"

When is buying card B a better deal?

$A(m) = \$1.50 + \$.25m$

cost of card A where m is minutes used..

$B(m) = \$2.75 + \$.15m$

cost of card B where m is minutes used..

If m = 0, then card A costs $1.50
card B costs $2.75
(A is a better deal....)

Set A(m) = B(m)
(the break-even point)

$1.50 + .25m = 2.75 + .15m$

$.10m = 1.25$

m = 12.5 minutes

Since 12 minutes 30 seconds is the break-even,

12 minutes: A is a better deal..
13 minutes: B is a better deal!

15) Jack currently has $75 in a bank account and saves $10 per week.
Jill has $125 in her account, and she is saving $2 per day.
When will they have the same amounts in their accounts?

Jack's account: $A(w) = \$75 + \$10w$ where w = # of weeks

Jill's account: $B(d) = \$125 + \$2d$ where d = # of days

Convert to common units: $2/day = $14/week

$A(w) = \$75 + \$10w$

$B(w) = \$125 + \$14w$

Determine when accounts are equal:

$\$75 + \$10w = \$125 + \$14w$

$-\$4w = \$50$

$w = -12.5$

But, w cannot be negative!

Jack and Jill will never have the same amounts in their accounts

Linear Systems Word Problems

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SOLUTIONS

16) Lance has $100 in a savings account and adds $30 per month.
Katie has $300 in an account and withdraws $20 per month.

When will their accounts have the same amount?

Lance's Account $B = \$100 + \$30m$

B = Balance
m = number of months

Katie's Account $B = \$300 - \$20m$

$\$200 = \$50m$

m = 4 months...

17) Carnations cost $2.15 per stem. Roses cost $8.25 per stem.
If you have 90 dollars to spend and need 20 stems, how many of each can you buy?

$C + R = 20$

$2.15C + 8.25R = 90$

$2.15C + 2.15R = 43$

$6.10R = 47$

$R = 7.70$ roses

$C + R = 20$

$C + 7.70 = 20$

$C = 12.3$ carnations..

However, since you cannot buy "partial flower stems",

we must adjust the total... If we buy 8 roses and 12 carnations,

8 x $8.25 = $66.00

12 x $2.15 = $25.80

But, $91.80 is more than I have...

If we buy 7 roses and 13 carnations,

7 x $8.25 = $57.75

13 x $2.15 = $27.95

And, I can afford $85.70

18) Josh spilled punch on his homework!

Question 4 had a solution of (6, 3)...

What is a possible equation in the question?

$2x + 3y = 21$

$5x$ [redacted]

Possible answer might be $5x - y = 27$

(or, any equation where (6, 3) fits...)

19) I'm thinking of a 2-digit number. The sum of the digits is 7.
And, if you reverse the digits, the number decreases by 9.
What is the number?

Let A = the first digit
B = the second digit

$A + B = 7$

$10A + B$ = the number

$10B + A$ = the number when the digits are reversed

$A + B = 7$

$10A + B = 10B + A + 9$

$A = 7 - B$

$9A - 9B = 9$

Using substitution: $9(7 - B) - 9B = 9$

$63 - 9B - 9B = 9$

$B = 3$ $A = 4$

the number is 43

20) Challenge question: solve the system *in terms of m*

$$\begin{cases} x + y = m \\ ym + x - 1 = 0 \end{cases}$$

$x + y = m$

$-\ x + ym = 1$

$y - ym = m - 1$

$y(1 - m) = m - 1$

$y = \dfrac{m-1}{1-m}$

$x + \dfrac{m-1}{1-m} = m$

$x = m - \dfrac{m-1}{1-m}$

check: $ym + x - 1 = 0$

$\dfrac{m-1}{1-m} \cdot m + m - \dfrac{m-1}{1-m} - 1 = 0$

$\dfrac{m^2 - m}{1-m} + \dfrac{m(1-m)}{1-m} - \dfrac{m-1}{1-m} = 1$

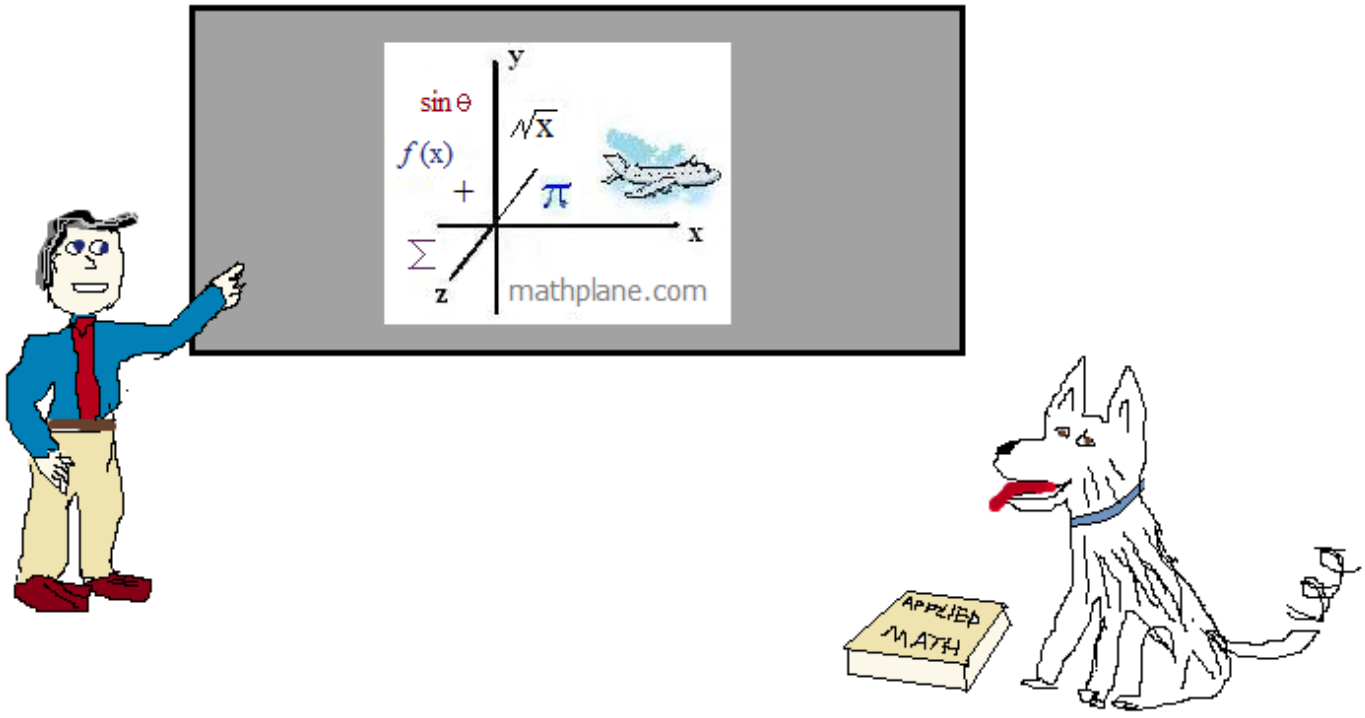
$\dfrac{-m+1}{1-m} \iff - \dfrac{m-1}{1-m} = 1$

$1 = 1$ ✓

Thanks for visiting. (Hope it helps!)

If you have questions, suggestions, or requests, let us know.

Cheers



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