

Word Problems: Algebra 1 and 2

Notes, Examples, and Practice Exercises (with detailed solutions)

After a long day, a teacher walks into a bar and orders a 10 ounce vodka and cranberry juice. The bartender prepare the drink. After one sip, the teacher says, "It's too strong!" The bartender explains, "I used 2 parts vodka and 3 parts cranberry." "Can I get one with just 15% vodka?" "Of course," the bartender answered. "A new drink? Or, can I pour out some of this one and add cranberry juice?" The teacher said, "I hate to see a drink go to waste. Just pour out some of this one and add cranberry juice."

Question: How much of the drink should the bartender pour out and replace with pure cranberry juice to produce a 15% vodka mixture?

	total amount	%	vodka quantity
Original drink	10	40%	4
pour out	$(10 - x)$	40%	$.4(10 - x)$
add	x	0%	$0x$
final drink	10	15%	1.5

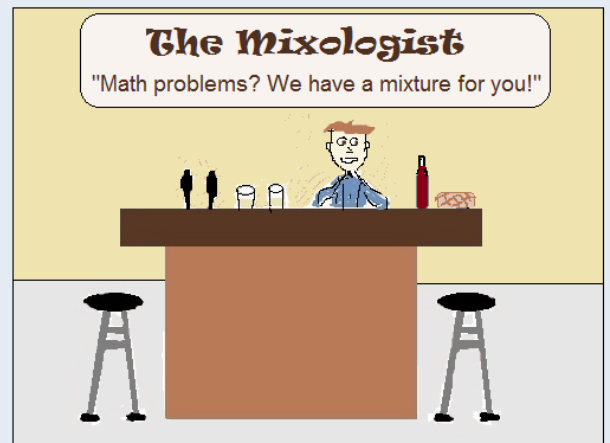
$$.4(10 - x) + 0x = 1.5$$

$$4 - .4x + 0 = 1.5$$

$$-.4x = 2.5$$

$$x = 6.25 \text{ ounces}$$

The bartender should pour out 6.25 ounces of the original drink, and then top it off with cranberry juice....



Topics include translating words to operations, linear systems, mixture, work, and rate problems, area, and more.

Basic Algebra Word Problems

1) Write each expression and solve. ("find the number")

- a) The sum of 14 and a number is 41.

- b) 8 plus the product of 21 and a number is 71

- c) The difference between 104 and a number is 79

- d) five minus the product of two and a number is 12

- e) Twelve is one-eighth of a number

2) Answer carefully.

- a) A number is eight more than another number.
If the sum of the 2 numbers is 70, what is the *smaller* number?

- b) A number is 10 less than another number.
If their sum is 26, what is the *product of the two* numbers?

3) Draw and label each figure. Then, solve.

- a) A triangle's height is half the length of its base.
If the base is 8, what is the area?

- b) The length of a rectangle is twice the width.
If the width is 6, what is the perimeter?

- c) The length of a rectangle is four times its width.
If the area is 100 square feet. What is the width?

Basic Algebra Word Problems (continued)

- 4) 50 cars and one locomotive weigh 4825 tons. (Each car is identical.)
If the locomotive weighs 225 tons, how much does each car weigh?
- 5) A car's tank holds 16 gallons of gas. At 1 gallon, you stop at the gas station to refuel. If the car uses 3 gallons per hour, when will you refuel?
- 6) A farmer has \$755. One cow costs \$500 and a flock of chicks costs \$20.
If the farmer buys one cow, how many flocks of chicks can he afford to buy?
- 7) If 9 friends take a trip, it will cost \$810. However, during the off-season, there is a discount.
If it costs the 9 friends \$729, how much was the discount *per person*?
(Bonus: What is the *percentage* discount?)
- 8) The sum of 3 *consecutive integers* is 234. What is the middle integer?
- 9) The cable company charges \$59.95 per month plus \$4 for each movie rental.
If your cable bill is \$111.95, how many movies did you rent?

1) Write each expression and solve. ("find the number")

- a) The sum of 14 and a number is 41.

$$\begin{array}{r} 14 + x = 41 \\ -14 \quad -14 \end{array} \quad \boxed{x = 17}$$

- b) 8 plus the product of 21 and a number is 71

$$\begin{array}{r} 8 + (21 \cdot n) = 71 \\ -8 \quad -8 \end{array} \quad \frac{(21 \cdot n) = 63}{21 \quad 21} \quad \boxed{n = 3}$$

- c) The difference between 104 and a number is 79

$$\begin{array}{r} 104 - y = 79 \\ -104 \quad -104 \end{array} \quad \begin{array}{r} -y = -25 \\ (-1) \quad (-1) \end{array} \quad \boxed{y = 25}$$

(also, if "the number" is larger than 104, then $z - 104 = 79$... and $\boxed{z = 183}$)

- d) five minus the product of two and a number is 12

$$\begin{array}{r} 5 - (2 \cdot d) = 12 \\ -5 \quad -5 \end{array} \quad \frac{-2d = 7}{-2 \quad -2} \quad \boxed{d = -7/2 \text{ or } -3.5}$$

- e) Twelve is one-eighth of a number

$$12 = \frac{1}{8} r \quad \boxed{r = 96}$$

(8) (8)

2) Answer carefully.

- a) A number is eight more than another number.
If the sum of the 2 numbers is 70, what is the *smaller* number?

let $n =$ the number
then, $n - 8 =$ another number

$$\begin{array}{r} n + (n - 8) = 70 \\ +8 \quad +8 \end{array} \quad \frac{2n = 78}{2 \quad 2} \quad \begin{array}{l} n = 39 \\ \text{and} \\ n - 8 = 31 \end{array}$$

$\boxed{31 \text{ is the smaller number}}$

- b) A number is 10 less than another number.
If their sum is 26, what is the *product of the two* numbers?

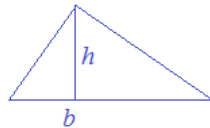
let $x =$ a number
then, $x + 10 =$ another number

$$\begin{array}{r} x + (x + 10) = 26 \\ -10 \quad -10 \end{array} \quad \frac{2x = 16}{2 \quad 2} \quad \begin{array}{l} x = 8 \\ x + 10 = 18 \end{array}$$

$\boxed{\text{the product of 8 and 18 is } 144}$

3) Draw and label each figure. Then, solve.

- a) A triangle's height is half the length of its base.
If the base is 8, what is the area?

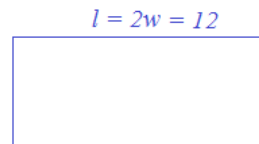


area of triangle = $1/2(bh)$

$$\begin{array}{l} b = 8 \\ h = 1/2 \cdot b = 4 \end{array}$$

$$\text{area} = 1/2(8)(4) = 16 \text{ sq. units}$$

- b) The length of a rectangle is twice the width.
If the width is 6, what is the perimeter?

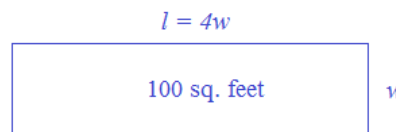


$$w = 6$$

perimeter = $2l + 2w$

$$= 2(12) + 2(6) = \boxed{36}$$

- c) The length of a rectangle is four times its width.
If the area is 100 square feet. What is the width?



area = lw

$$100 \text{ sq. feet} = 4w \cdot w$$

$$\frac{100 \text{ sq. ft}}{4} = \frac{4w^2}{4}$$

$$\sqrt{25 \text{ sq. ft}} = \sqrt{w^2}$$

$$w = \cancel{-5} \text{ or } \boxed{5 \text{ feet}}$$

(length must be positive)

Basic Algebra Word Problems (continued)

SOLUTIONS

- 4) 50 cars and one locomotive weigh 4825 tons. (Each car is identical.)
If the locomotive weighs 225 tons, how much does each car weigh?

$$\begin{array}{r} \text{Total weight} = \text{loco} + \text{cars} \\ \text{let } c = \text{number of cars} \\ \text{Weight} = 225 \text{ tons} + c(\text{wt}) \end{array} \quad \begin{array}{r} 4825 \text{ tons} = 225 \text{ tons} + 50(\text{weight of each car}) \\ -225 \text{ tons} \quad -225 \text{ tons} \end{array} \quad \begin{array}{r} \frac{4600 \text{ tons}}{50} = \frac{50(\text{weight of car})}{50} \\ 92 \text{ tons} = \text{weight of each car} \end{array}$$

- 5) A car's tank holds 16 gallons of gas. At 1 gallon, you stop at the gas station to refuel. If the car uses 3 gallons per hour, when will you refuel?

$$\begin{array}{r} \text{Fill-up} = \text{total gas} - \text{gas use} \\ \text{let } t = \text{time driving} \\ 1 \text{ gallon} = 16 \text{ gallon} - t \text{ hours}(3 \text{ gallons/hour}) \end{array} \quad \begin{array}{r} 1g = 16g - t(3g) \\ -16g \quad -16g \end{array} \quad \begin{array}{r} \frac{-15g}{-3g} = \frac{-3tg}{-3g} \\ t = 5 \text{ hours} \end{array}$$

- 6) A farmer has \$755. One cow costs \$500 and a flock of chicks costs \$20. If the farmer buys one cow, how many flocks of chicks can he afford to buy?

$$\begin{array}{r} \text{let } c = \# \text{ of cows} \\ f = \# \text{ of flocks of chicks} \\ \text{Farmer's money} \geq \$500c + \$20f \\ (\text{Farmer's money must match or exceed the cost of the cow and chicks}) \end{array} \quad \begin{array}{r} c = 1 \text{ cow} \\ \text{Farmer's money} = \$755 \\ \$755 \geq \$500(1) + \$20f \\ -\$500 \quad -\$500 \end{array} \quad \begin{array}{r} \frac{\$255}{\$20} \geq \frac{\$20f}{\$20} \\ 12.75 \geq f \\ \text{since flocks can't be divided, the farmer can afford 12 flocks of chicks} \end{array}$$

- 7) If 9 friends take a trip, it will cost \$810. However, during the off-season, there is a discount. If it costs the 9 friends \$729, how much was the discount *per person*? (Bonus: What is the *percentage* discount?)

$$\text{discount/person} = \frac{\text{total discount}}{\text{total persons}} = \frac{\$810 - \$729}{9 \text{ people}} = \frac{\$81}{9 \text{ people}} \quad \text{discount: } \$9/\text{person}$$

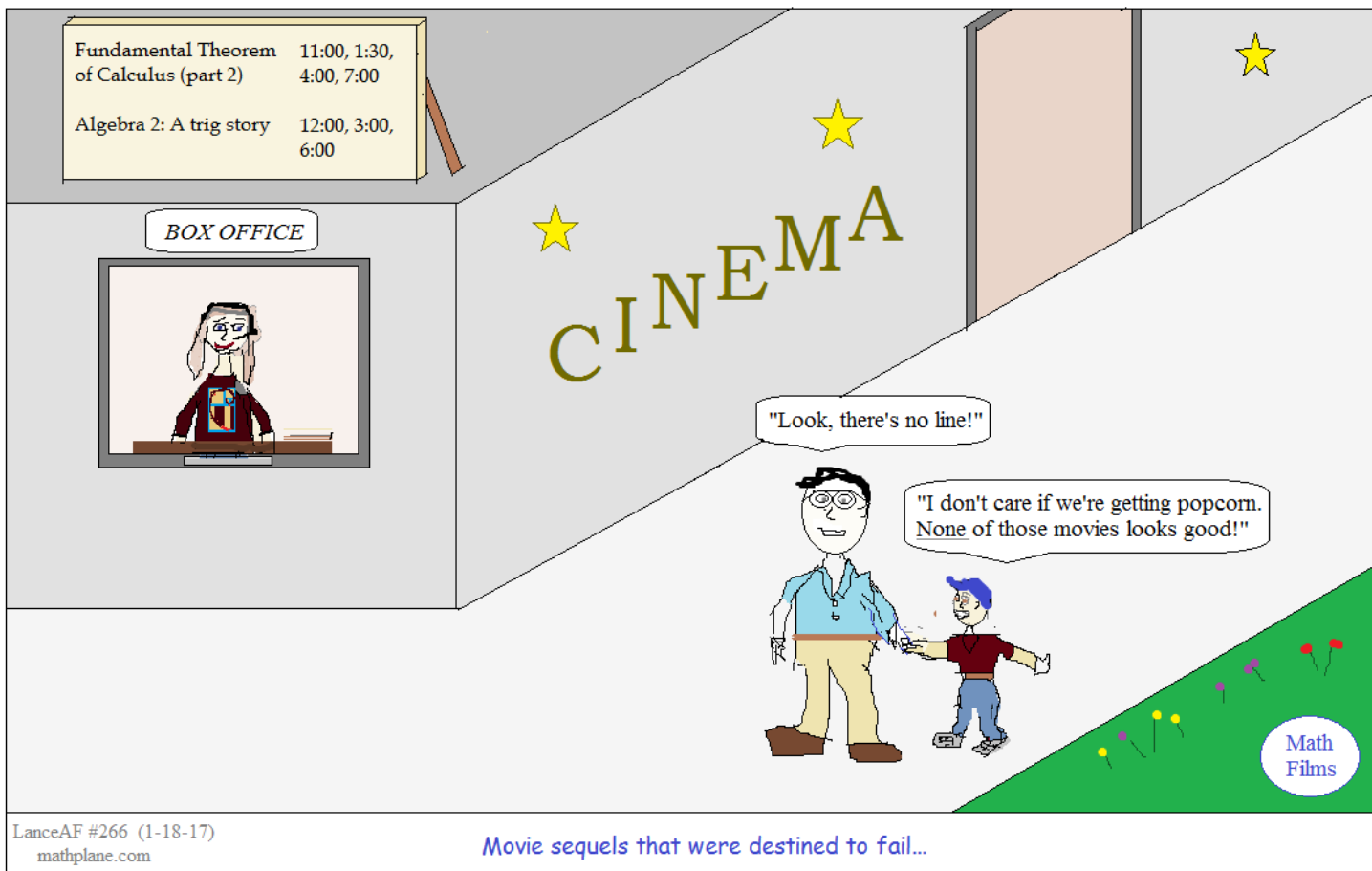
\$810 cost for 9 people... then, cost per person: \$90... If the discount is \$9, then the percentage discount is 10%

- 8) The sum of 3 *consecutive integers* is 234. What is the middle integer?

$$\begin{array}{r} \text{let } n = \text{first integer} \\ n + 1 = \text{second (consecutive) integer} \\ n + 2 = \text{third (consecutive) integer} \end{array} \quad \begin{array}{r} n + (n + 1) + (n + 2) = 234 \\ 3n + 3 = 234 \\ -3 \quad -3 \\ \frac{3n}{3} = \frac{231}{3} \end{array} \quad \begin{array}{r} n = 77 \\ \text{so, the three integers are} \\ 77, 78, 79 \\ 78 \text{ is the middle integer} \end{array}$$

- 9) The cable company charges \$59.95 per month plus \$4 for each movie rental. If your cable bill is \$111.95, how many movies did you rent?

$$\begin{array}{r} \text{cable bill} = \text{monthly fixed cost} + \$4M \\ \text{where } M = \# \text{ of movies rented} \\ \$111.95 = \$59.95 + \$4M \\ -\$59.95 \quad -\$59.95 \end{array} \quad \begin{array}{r} \frac{\$52}{\$4} = \frac{\$4M}{\$4} \\ 13 = M \\ 13 \text{ movies} \end{array}$$



More examples and practice →

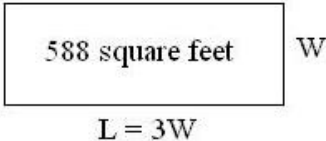
Solving Word Problems

- Basic Strategy:
- 1) "Let Statements" - Establish Variables
 - 2) Draw a Picture
 - 3) Write Relevant Formulas
 - 4) Solve (and check solutions)
 - 5) Answer the question

Example 1: The product of two consecutive whole numbers is 72.
What are the numbers?

- 1) Let X = first whole number
Let $X + 1$ = second whole number
- 3) $X \cdot (X + 1) = 72$
- 4) $X^2 + X = 72$
 $X^2 + X - 72 = 0$
 $(X + 9)(X - 8) = 0$
 $X = -9, 8$ Then, $X + 1 = -8, 9$
- 5) -9 and -8 are not whole numbers ✗
 8 and 9 are consecutive, and $8 \times 9 = 72$ ✓

Example 2: The length of a rectangular backyard is 3 times its width. If the area is 588 square feet, what is the length of the backyard?

- 1) Let L = length
Let W = width
- 2) 

A diagram of a rectangle with the text "588 square feet" inside and "L = 3W" written below it. To the right of the rectangle is the letter "W".
- 3) LW = Area of rectangle (area formula)
 $L = 3W$ (given)
Area = 588 sq. feet (given)
- 4) $LW = 588$
 $3W(W) = 588$
 $3W^2 = 588$
 $W^2 = 196$
 $W = -14, 14$ (since length/width/area cannot be negative, we eliminated -14)
- 5) Width is 14 feet
Length is $3 \times 14 = 42$ feet ($14 \times 42 = 588$) ✓

Solving Algebra Word Problems
(continued)

Basic Strategy: 1) "Let Statements" - Establish Variables
2) Draw a Picture
3) Write Relevant Formulas
4) Solve (and check solutions)
5) Answer the question

Example 3: A school play produced \$28,860 in revenue. Student tickets cost \$30; Adult tickets cost \$45. 736 total tickets were sold. How many adults attended?

1) Let S = # of student tickets
Let A = # of adult tickets

3) Revenue = ticket x price
 $28,860 = S(30) + A(45)$
Tickets sold = Adult tickets + Student tickets
 $736 = A + S$

4) (use substitution)
 $28,860 = 30S + 45A$
 $S = 736 - A$
 $28,860 = 30(736 - A) + 45A$
 $28,860 = 22,080 - 30A + 45A$
 $6,780 = 15A$
 $A = 452$ (and, $S = 284$)

5) 452 adults attended.

$452 \times \$45 = \$20,340$
 $284 \times \$30 = \$8,520$
total revenue: \$28,860
total tickets: 736

Questions for you to try!

- 1) Five times a number decreased by six is equal to the number squared.
What is the number?
- 2) As I was flying over the farm, I noticed there were only rabbits and chickens. I could only spot 18 heads and 58 feet. How many rabbits were there? How many chickens?
(assumption: rabbits have 4 feet and chickens have 2 feet)
- 3) Mr. Planter had a square garden in his backyard. He increased each side by 2 feet. After he enlarged the garden, it had an area of 196 square feet. What was the measure of the sides before he enlarged the garden? How much did the change in length increase the area?

(solutions on next page)

Solving Algebra Word Problems
(continued)

- 1) Five times a number decreased by six is equal to the number squared.
What is the number?

Let $X =$ the number	"5 times a number decreased by six"	$5X - 6$
	"number squared"	X^2
$5X - 6 = X^2$		
$X^2 - 5X + 6 = 0$		
$(X - 2)(X - 3) = 0$	$5(2) - 6 = 4 = 2^2$ ✓	
$X = 2$ or 3	$5(3) - 6 = 9 = 3^2$ ✓	

- 2) As I was flying over the farm, I noticed there were only rabbits and chickens. I could only spot 18 heads and 58 feet. How many rabbits were there? How many chickens?
(assumption: rabbits have 4 feet and chickens have 2 feet)

Let $R =$ # of rabbits	$4R =$ # of rabbit feet
$C =$ # of chickens	$2C =$ # of chicken feet

$R + C = 18$ (heads)
 $4R + 2C = 58$ (feet)

(use substitution) $R = 18 - C$
 $4(18 - C) + 2C = 58$
 $72 - 4C + 2C = 58$
 $14 = 2C$
 $C = 7$

Since $R + C = 18$,
 $R = 11$

7 Chickens	= 7 heads, 14 feet
11 Rabbits	= 11 heads, 44 feet
18 heads; 58 feet ✓	

- 3) Mr. Planter had a square garden in his backyard. He increased each side by 2 feet. After he enlarged the garden, it had an area of 196 square feet. What was the measure of the sides before he enlarged the garden? How much did the change in length increase the area?

Let $S =$ side of original garden
 $S + 2 =$ side of enlarged garden

Area of square = $S \times S = S^2$

Area of enlarged square = $196 = (S + 2)^2$

$\sqrt{(S + 2)^2} = \sqrt{196}$

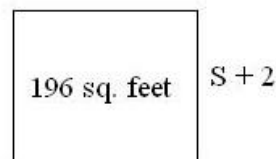
$S + 2 = 14$ (S cannot be -14 , because length of sides cannot be negative)

$S = 12$

Original side is 12 feet
 Enlarged side is 14 feet

Original area: 144 sq. ft
 Enlarged area: 196 sq. ft

Area increased by 52 square feet



Word Problems: Practice Quiz

- 1) A video store charges \$3 per rental. The store offers the following "frequent movie plan":
\$96 annual fee and movies are \$1 per rental.
 - a) Should a person use the "frequent movie plan" if he rents 2 movies per month?
 - b) What is the "break even point"? (i.e. the cost of rentals w/o plan = cost of rentals with plan)
 - c) The video store is offering the movie plan for \$50. What is the new "break even point"?

- 2) An investor lost 10% last year. What percentage increase must he have this year to end up with his original investment?

- 3) You have 14 feet of wood.
 - a) How many different types of rectangular enclosures could you make? (Each side must be a whole number)
 - b) Which will create the largest area?

**Bonus Questions

 - c) How many different types of isosceles triangles could you make? (each side must be a whole number)
 - d) Which will create the largest area?

- 4) Assume you run a 5K race in 20 minutes.
 - a) Express your speed in miles per hour.
 - b) Determine the average rate of each mile.

- 5) The length of a rectangle is twice the width. If the length is decreased by 1, and the width is increased by 3, the area is 72 square meters. Find the original length and width.

Word Problems: Practice Quiz

SOLUTIONS

- 1) A video store charges \$3 per rental. The store offers the following "frequent movie plan":
 \$96 annual fee and movies are \$1 per rental.
- Should a person use the "frequent movie plan" if he rents 2 movies per month?
 - What is the "break even point"? (i.e. the cost of rentals w/o plan = cost of rentals with plan)
 - The video store is offering the movie plan for \$50. What is the new "break even point"?

Let M = # of movies rented
 Cost w/o plan = $3M$
 Cost with plan = $96 + 1M$

- a) $M = 24$ movies per year
 Cost w/o plan = $3(24) = \$72$
 Cost with plan = $96 + 1(24) = \$120$

No, he should not use the movie plan.

- b) Break even point: Cost w/o plan = Cost with plan
 $3M = 96 + 1M$
 $2M = 96$
 $M = 48$

The "break even point" is 48 movies in a year... If he rents 47, he should go w/o the plan. If he rents 49, he would save money with the plan...

Cost of 48 movies w/o plan: $3(48) = \$144$ ✓
 Cost of 48 movies with plan: $96 + 1(48) = \$144$ ✓

- c) Cost w/o plan = $3M$
 Cost with new plan = $50 + 1M$

Break even point: $3M = 50 + 1M$
 $2M = 50$
 $M = 25$ movies

The "new break even point" is 25 movies. If he rents 24 or less, he should go w/o the new plan.. If he rents 26 or more, he would save money using the new plan..

Cost of 25 movies w/o plan: \$75 ✓
 Cost of 25 movies with plan: \$75 ✓

- 2) An investor lost 10% last year. What percentage increase must he have this year to end up with his original investment?

Let X = original investment
 Then,
 amount after first year is: $X - (.10X) = .90X$
 Now, let r = rate of return for 2nd year..

Therefore, we want $X = .90X + r(.90X)$

$$X = .90X(1 + r)$$

$$\frac{X}{.90X} = 1 + r$$

$$\frac{1}{.90} - 1 = r$$

$$r = .111$$

Therefore, the 2nd year must have an 11.11% return to end up with the original amount...

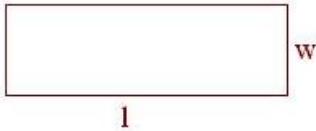
Example:
 original investment: \$100 ✓
 lose 10%
 year one total: $100 - 10 = \$90$
 gain 11.11%
 year two total: $90 + 9.99 \cong$
 \$100 ✓

Word Problems: Practice Quiz

SOLUTIONS

3) You have 14 feet of wood.

a) How many different types of rectangular enclosures could you make? (Each side must be a whole number)



$$2l + 2w = 14$$

- | | |
|---------|---------|
| $l = 1$ | $w = 6$ |
| $l = 2$ | $w = 5$ |
| $l = 3$ | $w = 4$ |
- (three types)

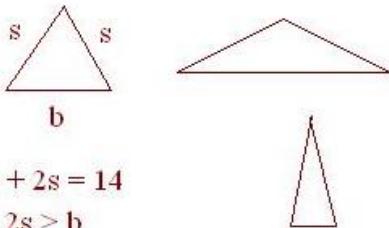
Note: $3 \times 4 = 4 \times 3$
 $2 \times 5 = 5 \times 2$
 $1 \times 6 = 6 \times 1$

b) Which will create the largest area?

- $1 \times 6 = 6$ square feet
- $2 \times 5 = 10$ square feet
- $3 \times 4 = 12$ square feet

**Bonus Questions

c) How many different types of isosceles triangles could you make? (each side must be a whole number)



$$b + 2s = 14$$

$$2s > b$$

- | | | |
|---------|----------|-----|
| $s = 1$ | $b = 12$ | no |
| $s = 2$ | $b = 10$ | no |
| $s = 3$ | $b = 8$ | no |
| $s = 4$ | $b = 6$ | yes |
| $s = 5$ | $b = 4$ | yes |
| $s = 6$ | $b = 2$ | yes |
| $s = 7$ | $b = 0$ | no |

3 different types
(with whole numbers)

d) Which will create the largest area?

$b = 6$
 $h = \sqrt{16 - 9} = \sqrt{7}$
 Area = $3\sqrt{7}$
 $\cong 7.93$

$b = 4$
 $h = \sqrt{25 - 4} = \sqrt{21}$
 Area = $2\sqrt{21}$
 $\cong 9.16$

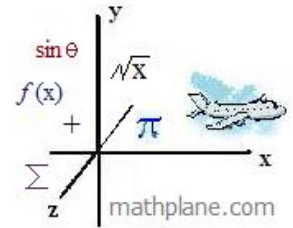
$b = 2$
 $h = \sqrt{36 - 1} = \sqrt{35}$
 Area = $\sqrt{35}$
 $\cong 5.91$

Area = $1/2 bh$

(pythagorean theorem)

Word Problems: Practice Quiz

SOLUTIONS



- 4) Assume you run a 5K race in 20 minutes.
 a) Express your speed in miles per hour.
 b) Determine the average rate of each mile.

a) 5K in 20 minutes = 15K in 1 hour
 1 Kilometer \cong .62 miles

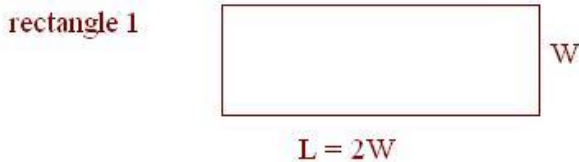
$$15K \cong 15(.62) \cong 9.3 \text{ miles/hour}$$

b) Assuming 9.3 miles/hour..
 then, 9.3 miles/60 minutes..

or, $1 \text{ mile}/6.45 \text{ minutes} \quad .45 \text{ minutes} \cdot \frac{60 \text{ seconds}}{1 \text{ minute}} = 27 \text{ seconds}$

average rate: 6 minute 27 second per mile

- 5) The length of a rectangle is twice the width. If the length is decreased by 1, and the width is increased by 3, the area is 72 square meters. Find the original length and width.



$$\text{Area} = LW$$

Area of rectangle 2 = 72 square meters

$$(2W - 1)(W + 3) = 72$$

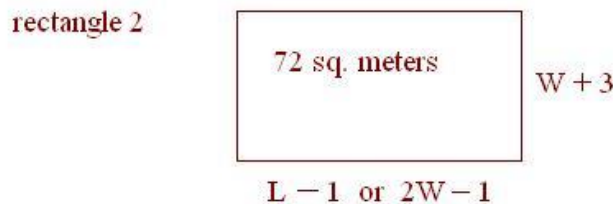
$$2W^2 - W + 6W - 3 = 72$$

$$2W^2 + 5W - 75 = 0$$

$$(2W + 15)(W - 5) = 0$$

$$W = 5 \text{ or } -15/2 \quad \text{width cannot be negative}$$

Original width: 5 meters
 Original length: 10 meters



Rectangle 2 width: 8
 length: 9
 Area = 72 ✓

"Convergence Question"

Word Problems: Distance = rate x time

Example: Joe leaves town A at noon, going 40 miles per hour toward town B.
 Bill leaves town B at 2:00 pm, going 50 miles per hour toward town A.

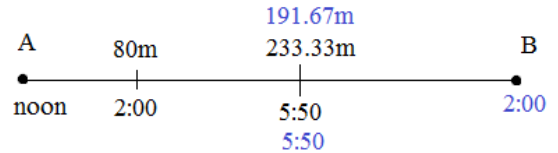
If town A and town B are 425 miles apart, when and where will Joe and Bill meet?

At 12:00 Joe leaves... At 2:00, Joe has traveled 80 miles.. (d = rt)
 so, when Bill leaves at 2:00, they are 345 miles apart...

Since Joe is going 40 mph and Bill is going 50 mph, they are gaining 90 mph...

$$345 \text{ miles} = 90 \frac{\text{miles}}{\text{hour}} \times (\text{time})$$

$$\text{time} = \frac{345}{90} = 3 \frac{5}{6} \text{ hours} \quad \text{or} \quad \boxed{3 \text{ hours, 50 minutes}}$$



"Chase Question"

Example: At 8:00am, Mike starts on a bike ride going 12 mph. Then, at 10:30am, John starts on the same road going 18 mph.
 What time will John catch up to Mike?

Approach 1: Matching the distances

$$\text{distance} = \text{rate} \times \text{time}$$

$$\text{Mike: } d = 12 \text{ mph} \times (\text{time})$$

$$\text{John: } d = 18 \text{ mph} \times (\text{time} - 2.5 \text{ hours})$$

(substitution: set d = d)

$$12t = 18(t - 2.5)$$

$$12t = 18t - 45$$

$$-6t = -45$$

$$t = 7.5$$

Mike rode for 7.5 hours
 John rode for 5 hours

Approach 2: Using related speeds

(Establish Mike's lead)

$$2.5 \text{ hours} \cdot 12 \frac{\text{miles}}{\text{hour}} = 30 \text{ miles} \quad \text{"head start"}$$

Since John (the 2nd rider) goes 6 mph faster than Mike, the gap will close at 6mph...

$$30 \text{ miles} = 6 \text{ mph} \times (\text{time}) \quad \text{time} = 5 \text{ hours}$$

John will spend 5 hours catching Mike...
 And, Mike will ride for 7.5 hours..

Can you answer this question?

Kelly leaves home at noon going 18 mph.
 At 4:00, Eric leaves home and rides at 30 mph.
 What time will Eric catch up to Kelly?

This is a "chase" question...

Kelly leaves 4 hours before Eric...

$$\text{distance} = \text{rate} \times \text{time}$$

$$= 18 \frac{\text{miles}}{\text{hour}} \times 4 \text{ hours} = 72 \text{ miles...}$$

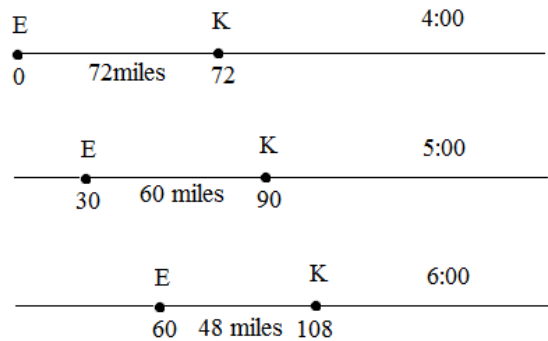
When Eric, leaves, he is 72 miles behind Kelly....

Since he rides at 30 mph, Eric gains 12 miles per hour...

$$\text{distance} = \text{rate} \times \text{time} \quad 72 \text{ miles} = 12 \frac{\text{miles}}{\text{hour}} \times \text{time}$$

$$\text{time} = 6 \text{ hours}$$

It takes Eric 6 hours, so he reaches Kelly at 10:00...



36 miles at 7:00

24 miles at 8:00

12 miles at 9:00

0 miles at 10:00

Suppose Charlie and Sam can paint a house together in 6 days. Separately, it takes Sam 5 days longer than Charlie to paint a house. How fast can each paint a house when working alone?

Step 1: Establish Variables and Formulas

Let C = Charlie's Rate
 S = Sam's Rate

$$\text{rate} \cdot \text{time} = \text{house}$$

$$\text{rate} = \frac{1 \text{ house}}{\text{time}} = \frac{1 \text{ house}}{x \text{ days}}$$

Step 2: Construct Equations and Solve

$$\text{C \& S rate (together)} = \frac{1 \text{ house}}{6 \text{ days}} \quad C = \frac{1 \text{ house}}{x \text{ days}}$$

$$S = \frac{1 \text{ house}}{(x + 5) \text{ days}}$$

$$C (\text{time}) + S (\text{time}) = (C \& S) \text{ time}$$

$$\frac{1}{x} t + \frac{1}{(x + 5)} t = \frac{1}{6} t \quad (\text{divide equation by } t)$$

$$\frac{1}{x} + \frac{1}{(x + 5)} = \frac{1}{6} \quad (\text{find least common denominator on the left side})$$

$$\frac{(x + 5)}{x(x + 5)} + \frac{x}{x(x + 5)} = \frac{1}{6} \quad (\text{add and consolidate})$$

$$\frac{2x + 5}{x^2 + 5x} = \frac{1}{6} \quad (\text{cross multiply and solve for } x)$$

$$x^2 + 5x = 6(2x + 5)$$

$$x^2 - 7x - 30 = 0$$

$$(x - 10)(x + 3) = 0$$

$$x = 10 \text{ or } -3 \rightarrow \text{Charlie can paint a house in 10 days..}$$

**We eliminate the extraneous solution: -3 because Charlie does not paint a house in -3 days (unless he is destroying the house, the rate can't be negative!)

And, if x = 10, then x + 5 = 15 → Sam can paint a house in 15 days..

Step 3: Check your answers!

It takes 6 days for them to paint a house together.. Therefore,

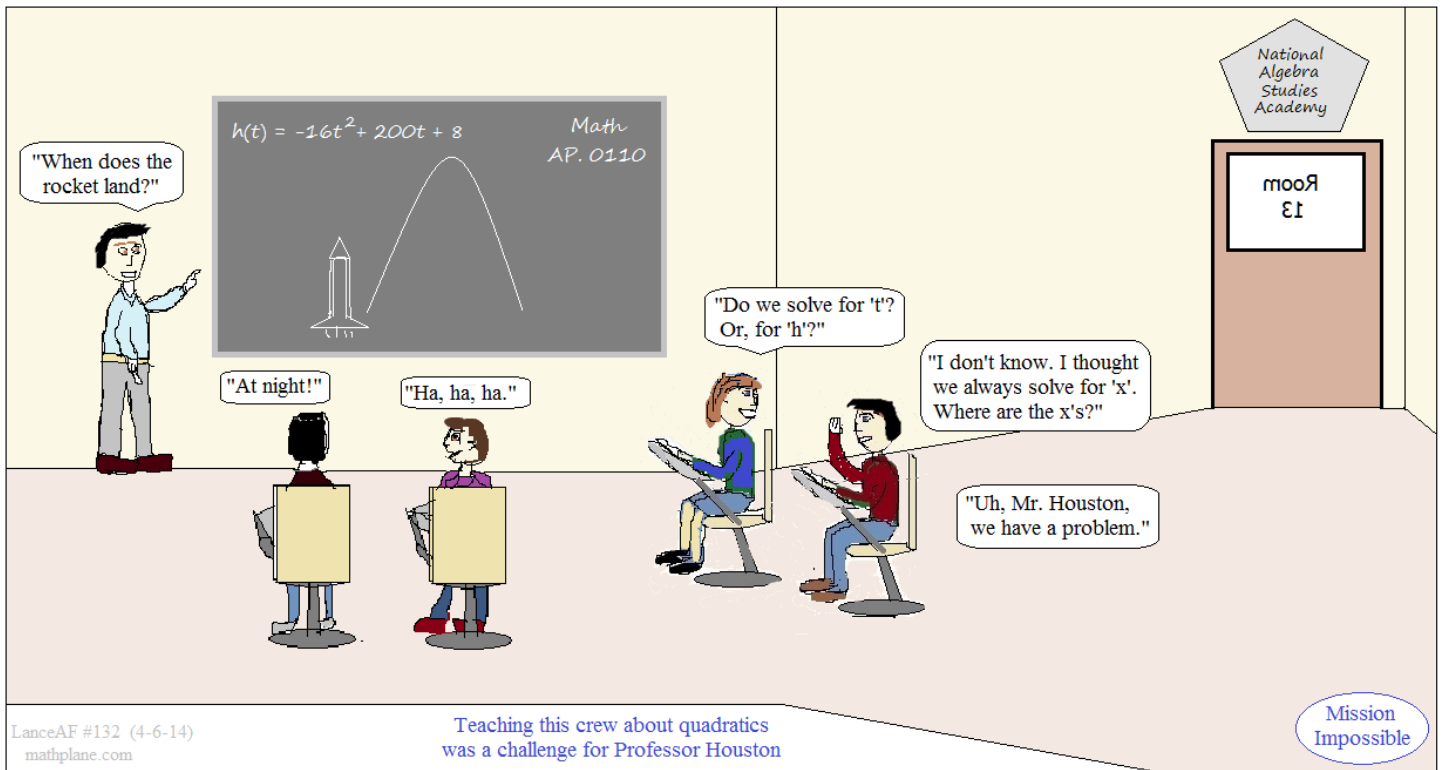
$$6 \text{ days (1 house/10 days)} + 6 \text{ days (1 house/15 days)} =$$

$$\frac{6 \text{ house}}{10} + \frac{6 \text{ house}}{15} = 1 \text{ house!}$$

If A, B, C, D, and E are integers, then what are they?

$$A^2 + B^2 + C^2 = D^2 + E^2$$

Answer on Next Page-→



$$A^2 + B^2 + C^2 = D^2 + E^2$$

If A, B, C, D, and E are consecutive integers, what are they?

Let $A = x$

Then, since they are consecutive integers,

$$x^2 + (x+1)^2 + (x+2)^2 = (x+3)^2 + (x+4)^2$$

A B C D E

Expand the terms ("FOIL")

$$x^2 + x^2 + 2x + 1 + x^2 + 4x + 4 = x^2 + 6x + 9 + x^2 + 8x + 16$$

Collect the 'like' terms

$$x^2 - 8x - 20 = 0$$

Factor

$$(x - 10)(x + 2) = 0$$

$$x = -2 \text{ or } 10$$

Therefore, 10, 11, 12, 13, 14

or

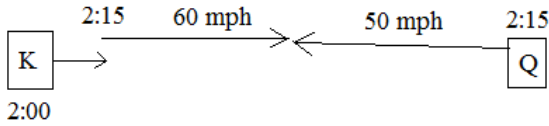
-2, -1, 0, 1, 2

Example: At 2:00, George leaves Kingstown and drives toward Queensland at 60 miles/hour.
At 2:15, Mary leaves Queensland and drives toward Kingstown at 50 miles/hour.

Rate problem

If Kingstown and Queensland are 240 miles apart, what time will they meet?

Step 1: Draw a sketch and describe the sequence



From 2:00 to 2:15, George drives 15 miles.

$$15 \text{ minutes} \cdot \frac{1 \text{ hour}}{60 \text{ minutes}} \cdot \frac{60 \text{ miles}}{1 \text{ hour}} = 15 \text{ miles}$$

Step 2: Solve

At 2:15, Mary and George are 225 miles apart.

$$\text{distance} = \text{rate} \cdot \text{time}$$

$$225 \text{ miles} = 110 \frac{\text{miles}}{\text{hour}} (\text{time})$$

since they are going toward each other, the rates are added.
(i.e. they are approaching each other at 110 miles/hour)

$$\text{time} = 2.04545 \text{ hours}$$

$$= 2 \text{ hours } 2 \text{ minutes } 44 \text{ seconds}$$

Step 3: Answer the question

At 2:00, George leaves and goes 15 miles.
Then, at 2:15, Mary begins driving...
Then, 2 hrs, 2 minutes, 44 seconds later, they meet.

4:17

Example: At the Nuthouse, nuts cost \$2.40 per pound and raisins cost \$3.20 per pound
If you spend \$129.60 for 50 pounds of a mixture, how many pounds of each did you buy?

Mixture Problem

Step 1: Establish variables and relevant equations

Let R = # of raisins (pounds)

N = # of nuts (pounds)

$$R + N = 50$$

then, $3.2R = \text{cost per pound of raisins (dollars)}$

$2.4N = \text{cost per pound of nuts (dollars)}$

$$3.2R + 2.4N = 129.60$$

Step 2: Solve

$$R + N = 50$$

$$3.2R + 2.4N = 129.60$$

Using combination/elimination method

$$3.2R + 2.4N = 129.60$$

$$- 2.4R + 2.4N = 120$$

$$\hline .8R = 9.60$$

$$R = 12$$

if R = 12, then N = 38

Step 3: Answer question and check

The 50 pound mixture consisted of 12 pounds of Raisins
and 38 pounds of Nuts

12 pounds of raisins cost $12 \times 3.2 = 38.40$

38 pounds of nuts cost $38 \times 2.4 = 91.20$

total cost: 129.60 ✓

Algebra Word Problems

Example: A speeding car goes 80 miles per hour for 1 hour and 12 minutes.
Then, it exits the highway, and drives the last fifteen minutes at 30 miles per hour.

What was the average speed for the entire trip?

$$\text{distance} = (\text{rate})(\text{time})$$

$$\text{total distance} = \text{distance at 80 mph} + \text{distance at 30 mph}$$

$$\text{total time} = 1.2 \text{ hours} + .25 \text{ hours}$$

$$80 \text{ mph} \times 1.2 \text{ hours} = 96 \text{ miles}$$

$$30 \text{ mph} \times .25 \text{ hours} = 7.5 \text{ miles}$$

$$103.5 \text{ miles} = (\text{total rate})(1.45 \text{ hours})$$

$$\text{approx. } 71.38 \text{ miles per hour}$$

Example: At the gas station, I paid \$42.51 to fill my car's gas tank.
The gas station charged \$2.63 per gallon.
Two days later, the price of gas fell to \$2.52 per gallon.

If I had waited (to fill up the gas tank), how much could I have saved?

First, let's find out the size of the gas tank.

$$\text{total} = (\text{size of tank})(\text{cost per gallon})$$

$$\$42.51 = (\text{tank}) \frac{\$2.63}{1 \text{ gallon}}$$

$$\text{tank} = 16.16 \text{ gallons}$$

Second, find the cost of the cheaper fill-up.

$$\text{total} = (16.16 \text{ gallon}) \frac{\$2.52}{1 \text{ gallon}}$$

$$\text{total} = \$40.72$$

Finally, compare the costs...

$$\$42.51 - \$40.72 = \$1.79 \text{ savings}$$

Example: Albert invests \$4000 @ 3.5% annual interest.
 If he wants to earn 5% on all his investments,
 how much *more* does he need to invest at an 8% annual interest rate?

interest - mixture
 problem

There are 2 components: *percentage* and *amount* that form the *total* portions/mixtures.

4000 3.5%	+	x 8%	=	4000 + x 5%
<i>interest earned at 3.5%</i>		<i>interest earned at 8%</i>		<i>total interest earned</i>
4000(.035)	+	x(.08)	=	(4000 + x)(.05)
mixture 1		mixture 2		total together
		140 + .08x		= 200 + .05x
				.03x = 60
				x = 2000

Quick check: If he earns 8% on 2000 dollars, Albert gets 160 dollars in interest.
 And, he earns 140 dollars from the 3.5% investment...

Total invested: \$6000
 Total interest: \$300
 Investment rate: 5% ✓

Example: A 50 ounce bottle of detergent contains 5% chlorine.
 If you want to wash your clothes with a 2% chlorine content,
 how much non-chlorine solution should you add?

Dilution Mixture
 problem

There are 2 components: *percentage* and *amount* that form the portions/mixtures

95% 50 oz	+	100% x	=	98% (50 + x) oz
bottle and non-chlorine content		added amount		desired bottle and quantity
50(.95)	+	x(1.00)	=	(50 + x)(.98)
original bottle		dilution amount		combined amount at desired ratio
		47.5 + x		= 49 + .98x
				.02x = 1.5
				x = 75 ounces

Quick check: "diluted bottle"
 amount: 50 + 75 = 125 ounces
 chlorine amount: .02 x 125 = 2.5 ounces...
 (and, 5% of a 50 ounce bottle is .05 x 50 = 2.5 ounces...) ✓

Example: A homeowner wishes to enclose/fence in 3 plots of land, 80 square feet each.
If he has 88 feet of fence, what are the dimensions of each lot?

<i>Area/Perimeter Problem</i>

Step 1: Draw a picture and label parts

Step 2: Develop the equations

Let x = width
Let y = length

There is 88 feet of fence, so $88 \text{ feet} = 4x + 2y$

Each plot is 80 sq. feet, so $80 \text{ sq. feet} = x \cdot (1/3)y$

Step 3: Solve

Since we have 2 equations and 2 unknowns, we can solve!

$$88 \text{ feet} = 4x + 2y \quad \longrightarrow \quad 44 \text{ ft} = 2x + y$$

$$80 \text{ sq. feet} = x \cdot (1/3)y \quad \longleftarrow \quad y = 44 \text{ ft} - 2x$$

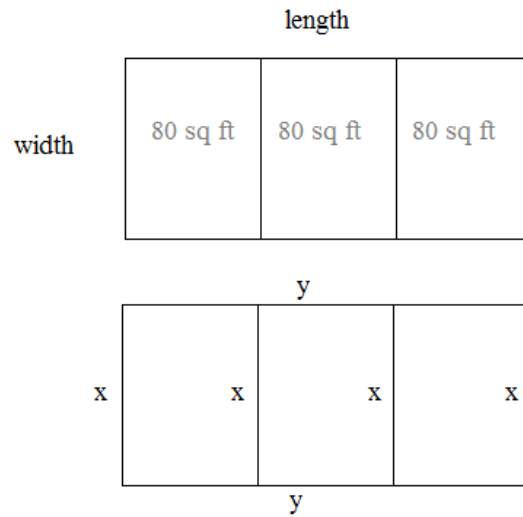
$$80 \text{ sq. ft} = x \cdot (1/3)(44 \text{ ft} - 2x)$$

$$240 \text{ sq. ft} = x(44 \text{ ft} - 2x)$$

$$2x^2 - 44x + 240 = 0$$

$$2(x - 10)(x - 12) = 0$$

$$x = 10 \text{ or } 12$$



Step 4: Answer the question and check

If $x = 10$, then $y = 24$
and $(1/3)y = 8$

10×8

area of each plot: 80
total fencing: 88

If $x = 12$, then $y = 20$
 $12 \times 20/3$ and $(1/3)y = 20/3$

area of each plot: $12 \times (20/3) = 80$
total fencing: $4(12) + 2(20) = 88$

Algebra Word Problems: "Work Problem Example"

Example: During a one-hour workout at the gym, a woman cycles 4 miles and runs 2 1/2 miles.
If she cycles 8 miles/hour *faster* than she runs, how fast is her running rate?

SOLUTION:

$$\begin{array}{l} \text{distance} = (\text{rate}) \times (\text{time}) \\ d = rt \end{array} \quad r = \frac{d}{t} \quad t = \frac{d}{r}$$

Step 1: Establish variables and formulas

running rate: $r_{\text{running}} = \frac{x \text{ miles}}{\text{hour}}$

cycling rate: $r_{\text{cycling}} = \frac{(x + 8) \text{ miles}}{\text{hour}}$

time: $t_{\text{running}} + t_{\text{cycling}} = 1 \text{ hour}$

distance: $d_{\text{running}} = 2 \frac{1}{2} \text{ miles}$

$d_{\text{cycling}} = 4 \text{ miles}$

Step 2: Set up equation and solve

substitution $t_{\text{running}} + t_{\text{cycling}} = 1 \text{ hour}$

$$\frac{d_{\text{running}}}{r_{\text{running}}} + \frac{d_{\text{cycling}}}{r_{\text{cycling}}} = 1 \text{ hour}$$

simplify units
(the miles and hours will cancel)

$$\frac{2.5 \text{ miles}}{\frac{x \text{ miles}}{\text{hour}}} + \frac{4 \text{ miles}}{\frac{(x + 8) \text{ miles}}{\text{hour}}} = 1 \text{ hour}$$

$$\frac{2.5}{x} + \frac{4}{x + 8} = 1$$

$$2.5(x + 8) + 4(x) = 1(x)(x + 8)$$

$$2.5x + 20 + 4x = x^2 + 8x$$

$$x^2 + 1.5x - 20 = 0 \quad x = -5.28 \text{ or } 3.78$$

use quadratic formula

**since miles can't be negative, -5.28 is extraneous and eliminated

Step 3: Answer question and check

Since $x = 3.78$,

the running rate is $\frac{3.78 \text{ miles}}{1 \text{ hour}}$

and cycling rate is $\frac{11.78 \text{ miles}}{1 \text{ hour}}$

Check: cycling 4 miles @ rate of 11.78 miles/hour
4 miles = (11.78 miles/hour)(time)
time = .34 hours

running 2.5 miles @ rate of 3.78 miles/hour
2.5 miles = (3.78 miles/hour)(time)
time = .66 hours

Total time: 1 hour!

A math center charges \$400 for a course, and they get 750 students.
 For every \$25 increase in price, they lose 30 students.
 What price would maximize revenue?
 What is the domain and range?

*Quadratic vertex example
 (finding maximum)*

$$(400 + 25x)(750 - 30x) = y$$

price quantity revenue

(where x is the number of \$25 increases)

method 1: use midpoint of zeros

$$400 + 25x = 0 \quad x = -16$$

$$750 - 30x = 0 \quad x = 25$$

axis of symmetry of 4.5

method 2: $-b/2a$

change to standard form and find $(-b/2a, f(-b/2a))$

$$300000 + 6750x - 750x^2$$

$$\frac{-6750}{2(-750)} = 4.5$$

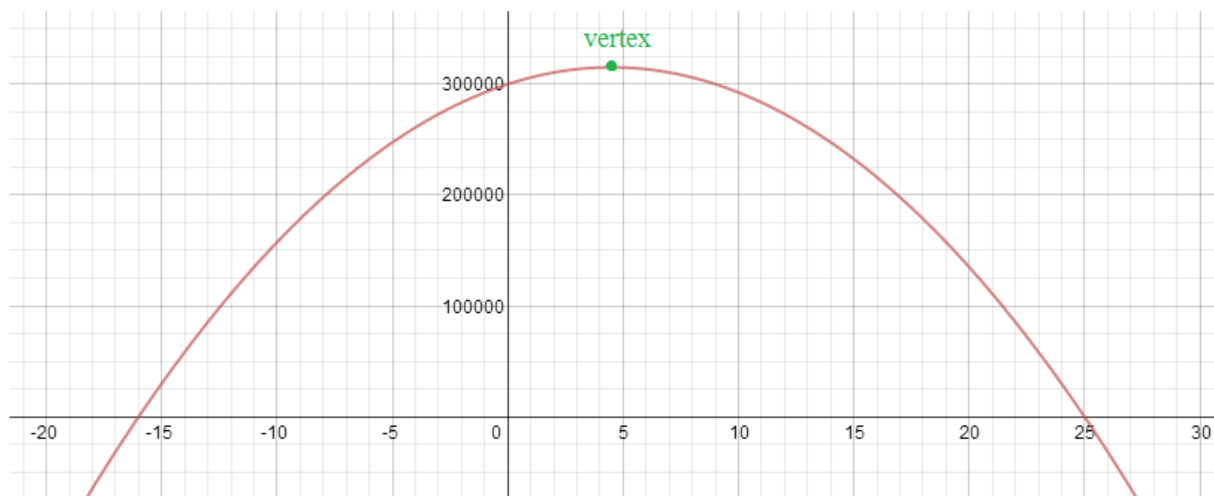
4.5 increases would lead to a price of

$$(400 + 25(4.5)) = 512.50$$

4.5 increases would lead to a quantity of

$$(750 + 30(4.5)) = 615$$

revenue = \$315,187.5



domain: $-16 < x < 25$

After 16 price decreases, the price would be 0... (Free items don't have revenue!)
 After 25 price increases, there will be no sales...

range: $0 < y < 315,187.5$

Word Problems Practice Quiz 2

SOLUTIONS

1) A bag containing only dimes and nickels holds 800 coins. If the bag contains \$49.70, how many dimes are in the bag?

(list variables)

Let $d = \#$ of dimes
 $n = \#$ of nickels

so, $.10d =$ value of the dimes
 $.05n =$ value of the nickels

(set up equations)

$$d + n = 800$$

$$.10d + .05n = 49.70$$

(2 equations, 2 unknowns;
solve using substitution)

(solve)

$$d = 800 - n$$

$$.10(800 - n) + .05n = 49.7$$

$$80 - .10n + .05n = 49.7$$

$$-.05n = -30.3$$

$$n = 606$$

if $n = 606$, then $d = 194$

(check answer)

194 dimes: \$19.40
606 nickels: \$30.30

800 coins: \$49.70 ✓

2) The tortoise leaves home at 1:00pm, traveling east at 2 miles per hour. The hare leaves 10 hours later and travels east at 9 miles per hour. What time does the hare catch the tortoise?

(list variables)

distance = rate x time

tortoise: $d = 2\text{miles/hour} \times \text{time}$

hare: $d = 9\text{miles/hour} \times \text{time}$

let $t =$ time (in hours)

(set up equations)

Since hare leaves 10 hours later, its travel time is 10 hours less than the tortoise.

The distances will be the same when they meet.

$$\frac{2 \text{ miles (t)}}{\text{hour}} = \frac{9 \text{ miles (t - 10)}}{\text{hour}}$$

(solve)

$$2t \text{ miles} = 9t \text{ miles} - 90$$

$$90 = 7t$$

$$t = 12.86 \text{ hours}$$

(approx. 12 hours, 51 minutes)

Since tortoise left at 1:00pm, the hare catches him at 1:51AM

(check answer)

12.86 hours x 2 miles/hr
 $\approx 25.72 \text{ miles}$ ✓

2.86 hours x 9 miles/hr
 $\approx 25.74 \text{ miles}$ ✓

3) Tom can paint a fence in 5 hours. Huck can paint a fence in 8 hours. If they work together, how long would it take for them to paint three fences?

(list variables/formulas)

work = rate x time

Tom: 1 fence = rate x 5 hours

$$\text{Tom's rate} = \frac{1 \text{ fence}}{5 \text{ hours}}$$

Huck: 1 fence = rate x 8 hours

$$\text{Huck's rate} = \frac{1 \text{ fence}}{8 \text{ hours}}$$

(set up equations)

To paint one fence together:

$$\frac{1 \text{ fence}}{5 \text{ hours}} t + \frac{1 \text{ fence}}{8 \text{ hours}} t = 3 \text{ fences}$$

(Tom) (Huck)

(solve)

(multiply by 40 hours)

$$8 \text{ fences}(t) + 5 \text{ fences}(t) = 120 \text{ fences}(\text{hours})$$

$$13\text{fences}(t) = 120\text{fences}(\text{hours})$$

$$t = 9.23 \text{ hours}$$

9 hours 14 minutes

(check)

Tom: 9.23 hours paints 1.846 fences

Huck: 9.23 hours paints 1.15 fences

together: 3 fences! ✓

4) Caramel popcorn costs \$1.50 per pound. Butter popcorn costs \$1.10 per pound.

A customer purchases 20 pounds of a mixture, paying \$27.70

How much of each flavor of popcorn did he buy?

	rate	(pounds) amount	cost
caramel	\$1.50	x	\$1.50x
butter	\$1.10	(20 - x)	\$1.10(20 - x)
mixture	?	20	\$27.70

$$\text{The mixture rate} = \frac{\$27.70}{20} = \$1.385 \text{ per pound}$$

(cost)

$$\$1.50x + \$1.10(20 - x) = \$27.70$$

$$\$1.50x + \$22 - \$1.10x = \$27.70$$

$$\$0.40x = \$5.70$$

$$x = 14.25 \text{ pounds}$$

caramel: 14.25 pounds

\$21.375

butter: 5.75 pounds

\$6.325

20 total pounds; \$27.70 ✓

5) Sal has 20 ounces of a 25% salt water solution. How many ounces of water must he add to dilute the solution to a 15% salt water solution?

	(ounces) amount	rate	salt
salt 25%	20	.25/ounce	5
water	x	0/ounce	0
salt 15%	20 + x	.15/ounce	3 + .15x

$$\text{salt amount: } 5 + 0 = 3 + .15x$$

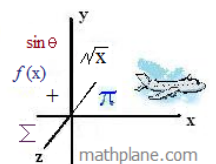
$$(25\% + \text{water} = 15\%)$$

$$2 = .15x$$

$$x = 13.333 \text{ ounces of water}$$

33.33 ounces of mixture ---

15% of 33.333 is 5 ounces of salt ✓



The volume of a metal box is 30 cubic feet. If the length is 5 feet *greater than the height* and the width is 2 feet *less than the height*, what are the dimensions of the box?

Volume = length x width x height

$$30 \text{ ft}^3 = (h + 5) \text{ feet} \cdot (h - 2) \text{ feet} \cdot (h) \text{ feet}$$

$$h(h + 5)(h - 2) = 30$$

combine 1st and 2nd terms

$$(h^2 + 5h)(h - 2) = 30$$

FOIL

$$h^3 + 3h^2 - 10h = 30$$

Set equal to zero

$$h^3 + 3h^2 - 10h - 30 = 0$$

solve for h (by grouping)

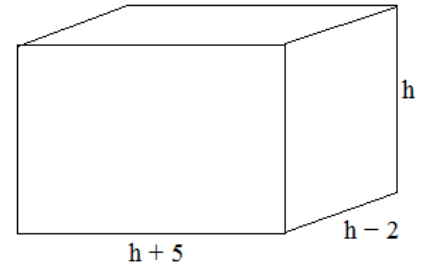
$$h^2(h + 3) - 10(h + 3) = 0$$

$$h + 3 = 0 \quad h = -3$$

$$(h + 3)(h^2 - 10) = 0$$

$$h^2 - 10 = 0 \quad h = \sqrt{10}$$

$$h = -\sqrt{10}$$



Since height cannot be negative, our solution is $h =$

the solution is $h = \sqrt{10}$ (approximately 3.16)

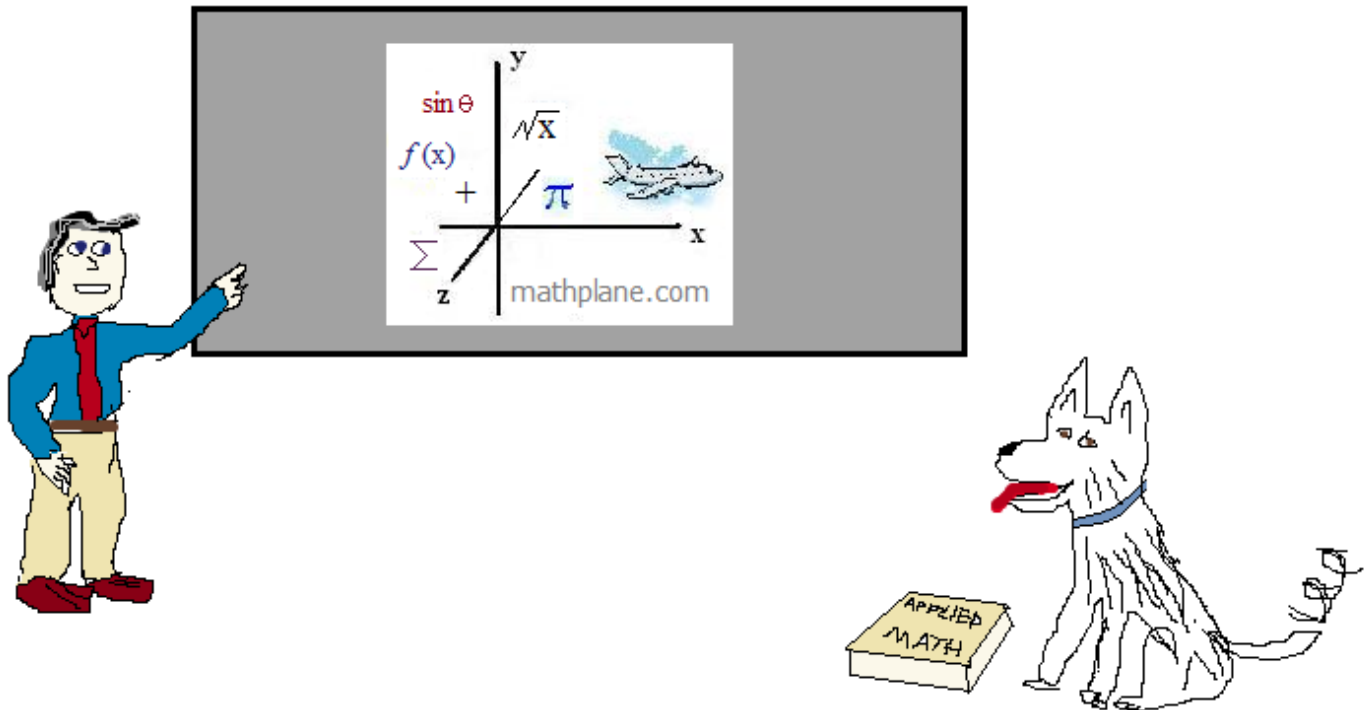
so, the dimensions of the box are approximately 8.16 x 1.16 x 3.16

The illustration shows a movie theater lobby. On the left, a sign reads "Math Generated Motion Pictures" with a camera icon. Below it is a "Gate A Entrance" sign. In the center, two characters are talking. The character on the left says, "Train operator going 300 miles per hour. Colliding at 2 1/2 hours." The character on the right asks, "What's your assignment?" and the other replies, "'Projectile motion' jump out of a window. It's routine: initial velocity of 32 ft./second. Parabolic arc. Hit the x-intercept at t=6." On the right, a large sign says "Coming Soon ALGEBRA II: THE SEQUEL" with a graph of a parabola and a train. A "Post-Productions" sign lists "Signs", "Pi", and "The Matrix". At the bottom, a sign reads "Word Problem Stuntmen".

Thanks for visiting. (Hope it helps!)

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

Cheers



Also, Mathplane *Express* for mobile and tablets at Mathplane.ORG

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Hidden Message

Answer the ten word problems below. Then, convert numbers to letters to reveal the hidden answer!

Number/Letter Key

1 2 3 4 5 6 7 8 9 0
A C D E M O P R S W

Clue: Where you may find x and y in 2 squares?

- 1) The sum of 2 consecutive even integers is 86.
What is the difference of the *digits* of the smaller integer? → _____
- 2) If the area of a square backyard is 64 feet, how long is each side? → _____
- 3) A tortoise leaves home at 1:00 and travels east at 4mph... A hare leaves the same home at 4:00 and travels east at 6mph. How many hours will it take the hare to catch the tortoise? → _____
- 4) Find the number of a's and o's in the (green) directions above. → _____
- 5) Liz has an appointment at 3:15pm.
If she appears at 2:36pm, how many minutes early is she? 3 → _____
- 6) Mark drinks a gallon of milk each week.
How many quarts does he consume each year? 2 8 → _____
- 7) The lengths of a rectangle are twice the widths.
If the perimeter is 372 feet, what is the area of the rectangle? 7 88 → _____
- 8) How many 175 pound people can fit into an elevator with capacity of 3/4 ton? → _____
- 9) A taxi cost \$1.25 per person plus \$0.20 per quarter mile.
If it cost you and your friend \$4.90 for a cab ride downtown, how many miles did you travel? → _____
- 10) A farmer is raising chickens and cows. If he has 23 total animals which have a total of 74 legs, how many chickens does he have? → _____

ANSWERS-→

Hidden Message

Answer the ten word problems below. Then, convert numbers to letters to reveal the hidden answer!

Number/Letter Key

1 2 3 4 5 6 7 8 9 0
A C D E M O P R S W

Clue: Where you may find x and y in 2 squares?

SOLUTIONS

- 1) The sum of 2 consecutive even integers is 86.

What is the difference of the *digits* of the smaller integer?

let $x = 1\text{st integer}$

$x + 2 = 2\text{nd integer}$

$$x + (x + 2) = 86$$

$$2x + 2 = 86$$

$$x = 42$$

$$x + 2 = 44$$

the digits of the smaller integer are 4 and 2. Their difference is 2.

2 → C

- 2) If the area of a square backyard is 64 feet, how long is each side?

$$s \begin{array}{|c|} \hline 64 \\ \hline \end{array} \quad \sqrt{64} = 8$$

8 → R

- 3) A tortoise leaves home at 1:00 and travels east at 4mph... A hare leaves the same home at 4:00 and travels east at 6mph. How many hours will it take the hare to catch the tortoise?

When the hare leaves home, the tortoise will have traveled 12 miles (4mph x 3 hours)..

At 6mph vs. 4mph, the hare will gain 2 miles/hour on the tortoise.. so, it will take 6 hours to catch the tortoise.

6 → O

- 4) Find the number of a's and o's in the (green) directions above.

9 total: 3 a's and 6 o's (see above)

$$4\text{mph}(t + 3) = 6\text{mph}(t)$$

9 → S

- 5) Liz has an appointment at 3:15pm.

If she appears at 2:36pm, how many minutes early is she?

2:36 is 24 minutes before 3:00... And, 3:15 is 15 minutes after 3:00.. 39 total minutes early

3 9 → S

- 6) Mark drinks a gallon of milk each week.

How many quarts does he consume each year?

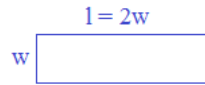
Mark drinks 1 gallon/week... 1 gallon = 4 quarts, so he drinks 4 quarts/week..

Since there are 52 weeks/year, he drinks 208 quarts per year

2 0 8 → W

- 7) The lengths of a rectangle are twice the widths.

If the perimeter is 372 feet, what is the area of the rectangle?



$$2w + 2w + w + w = 372 \text{ ft}$$

$$w = 62 \text{ ft}$$

$$2w = l = 124 \text{ ft}$$

$$\text{Area} = lw$$

$$= 124 \times 62$$

$$= 7688$$

7 6 88 → O

- 8) How many 175 pound people can fit into an elevator with capacity of 3/4 ton?

3/4 ton = 1500 pounds

$$1500 \div 175 = 8.57$$

8 people can fit...

(the 9th would be too much)

$$175p < 1500$$

8 → R

- 9) A taxi cost \$1.25 per person plus \$0.20 per quarter mile.

If it cost you and your friend \$4.90 for a cab ride downtown, how many miles did you travel?

If you and your friend take a cab, the fixed cost is \$2.50... therefore, you spent \$2.40 for x quarter miles..

At \$0.20 per quarter mile, you traveled 12 quarter miles...

12 quarter miles = 3 miles...

3 → D

- 10) A farmer is raising chickens and cows. If he has 23 total animals which have a total of 74 legs, how many chickens does he have?

let $k = \# \text{ of cows}$
 $c = \# \text{ of chickens}$

$$k + c = 23$$

$$4k + 2c = 74$$

$$4(23 - c) + 2c = 74$$

$$92 - 4c + 2c = 74$$

$$-2c = -18$$

$$c = 9$$

9 chickens and 14 cows

9 → S

$4k = \# \text{ of cow legs}$
 $2c = \# \text{ of chicken legs}$

(using substitution)

$$k = 23 - c$$

You may find x and y in the square boxes of a crossword puzzle!

Hidden Messages II

MATH PUZZLES

Constructed by

Lance
Friedman

Letter Key:

0	1	2	3	4	5	6	7	8	9
A	D	E	I	N	O	P	R	S	T

Mission?

2 =

3 - 1 =

$6^2 \div 3^2 =$

$\frac{-4 + 1)(6 + 4 - 1)}{3} =$

$[9 - 2^3] =$

10 empty boxes with arrows pointing to lines for answers.

Available at Mathplane.com

Or, the Mathplane Store at TeachersPayTeachers