## Word Problems? No Problem!

# Sarahpowellphd.com <br> Evidence-based mathematics resources for educators 


 Home About Resources Presentations Videos Contact


## srpowell@austin.utexas.edu

@sarahpowellphd

8 Tickets for a play were sold on Monday, Tuesday, and Wednesday.

Tickets Sold

| Day of the Week | Number of Tickets Sold |
| :--- | :---: |
| Monday | 197 |
| Tuesday | 364 |
| Wednesday | $\boldsymbol{?}$ |

If a total of $\mathbf{9 0 0}$ tickets were sold for the play, how many tickets were sold on Wednesday?
(A) 300
(B) 339
(C) 449
(ㄷ) 461

## What do students need to know to solve this problem? What might cause difficulty for students?

## Problem Solving Difficulties



## Word Problems? No Problem!

Sarah R. Powell, Ph.D.
srpowell@austin.utexas.edu @sarahpowellphd www.sarahpowellphd.com

Three Takeaways About Word Problems


## Don't tie key words to operations

## Do have an attack strategy




8 Tickets for a play were sold on Monday, Tuesday, and Wednesday.

Tickets Sold

| Day of the Week | Number of Tickets Sold |
| :--- | :---: |
| Monday | 197 |
| Tuesday | 364 |
| Wednesday | $\boldsymbol{?}$ |

If a total of 900 tickets were sold for the play, how many tickets were soli v.. $\because$ ednesday?
(A) 300
(B) 339
(C) 449
(D) 461

Students need to understand key words. But, key words should not be directly tied to operations.


18 boxers. How many more poodles does Mrs. Smith have?

3. Mr. Kelly has 44 beagles. 26 of them are puppies. How many adult beagles does Mr. Kelly have?

5. There were 58 kittens at the pet shop on Friday. 29 of them were sold on Saturday. How many kittens were leff?

2. The kennel holds 91 dogs. Mr . Glass has 67 dogs in the kennel now. How many spaces does he have left?

4. Mrs. Green has 60 terriers. 25 of them are boys. How many terriers are girls?

6. Pat counted 22 lizards in the tank at the pet shop. 8 were sold later that day. How many lizards were left in the tank?

$$
2
$$

## Don't tie key words to operations

## Do have an attack strategy



## For every word problem

Regardless of problem type, students need an attack strategy for working through the problem

This strategy should work for any problem type

## Routine Word Problems

A library has 126 books about trees.
24. Part A

The library has 48 fewer books about rivers than about trees.
What is the number of books the library has about rivers and what is the total number of books the library has about trees and rivers?
(4) 78 and 126
(©) 48 and 204
(©) 48 and 126
(0) 78 and 204

## Instructional Word Problems



## RIDGTS

Read the problem.
I know statement.
Draw a picture.
Goal statement.
Fquation development. Solve the equation.

## RIDE

Read the problem. Identify the relevant information.
Determine the operation and unit for the answer.
Enter the correct numbers and calculate, then check the answer.

## UPS,



Read the problem.
Ask yourSelf:

- What information do I know?
- What is the question asking me to find?

Choose a strategy, a tool or an approach.

Show the math used to Solve the problem. Solve


Check your math.
Ask yourself.

- Did I answer the question asked?
- IS my answer reasonable?


## Don't tie key words to operations

## Do have an attack strategy



## Schemas

## Total

## Difference

## Change

## Equal Groups

## Comparison

| Problem <br> type | Definition | Examples |  |  | Equation | Graphic organizer |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Total |  |  | Total unknown |  |  | Part unknown |
|  |  |  |  |  |  |  |

## Total

## Parts put together into a

- Emily saw 4 cardinals and 5 blue jays. How many birds did Emily see?
- $4+5=$
- Emily saw 9 birds. If 4 of the birds were cardinals, how many were blue jays?
- 4 + ? =
- Emily saw 9 birds. 5 of the birds were blue jays, how many were cardinals?
- 5 + ? =


## Total

## "Are parts put together for a total?"

## Total

## P1 P D2 <br> C



## Total

## allphd.com <br> ators

## Total

Megan baked 28 sugar cookies and 2,4 chocolate chip cookies. Enter the total number of cookies Megan baked in all.

$$
\begin{aligned}
& P 1+P 2=T \\
& 28+24=? \\
& 28+24=52 \\
& ?=52 \text { cookies }
\end{aligned}
$$

| Problem <br> type | Definition | Examples |  |  | Equation | Graphic organizer |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Total |  |  | Total unknown |  |  | Part unknown |
|  |  |  |  |  |  |  |

## Difference

Greater and less amounts compared for a difference

- Shinead has 9 apples. Amanda has 4 apples. How many more apples does Shinead have? (How many fewer?)
- $9-4$ = ?
- Shinead has 5 more apples than Amanda. If Amanda has 4 apples, how many does Shinead have?
- ? -4 = 5
- Amanda has 5 fewer apples than Shinead. Shinead has 9 apples. How many apples does Amanda have?
- $9-$ ? = 5


## Total

## "Are parts put together for a total?"

## Difference

"Are amounts compared for a difference?"

## Difference



## Difference

## allphd.com <br> stors

## Difference

Jana has 107 wooden beads and 68 glass beads. How many more wooden beads than glass beads does Jana have?

$$
\begin{aligned}
& C-L=D \\
& 107-68=B \quad 107 \quad 68 \\
& 107-68=39 \\
& B=39 \text { more beads }
\end{aligned}
$$

| Problem <br> type | Definition | Examples |  |  | Equation | Graphic organizer |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Total |  |  | Total unknown |  |  | Part unknown |
|  |  |  |  |  |  |  |

## Change

## An amount that increases or decreases

- Shannah had \$4. Then she earned \$3 for cleaning her room. How much money does Shannah have now?
- $4+3=$ ?
- Shannah has $\$ 4$. Then she earned money for cleaning her room. Now Shannah has \$7. How much money did she earn?
- 4 + ? = 7
- Shannah had some money. Then she made $\$ 3$ for cleaning her room. Now she has $\$ 7$. How much money did Shannah start with?
- ? $+3=7$


## Change

## An amount that increases or decreases

- Reece baked 9 cookies. Then, she ate 2 of the cookies. How many cookies does Reece have now?
- $9-2$ = ?
- Reece baked 9 cookies. Then, she ate some of the cookies. Now, she has 7 cookies. How many cookies did Reece eat?
- 9- ? = 7
- Reece baked some cookies. She ate 2 of the cookies and has 7 cookies left. How many cookies did Reece bake?
- ? -2 = 7

Total
"Are parts put together for a total?"

## Difference

## "Are amounts compared for a difference?"

## Change

"Does an amount increase or decrease?"

## Change



$$
+/-
$$


(start) (change) (end)


## Change

| A. <br> Megan baked 28 sugar cookies and 24 chocolate <br> chip cookies. Enter the total number of cookies <br> Megan baked in all. | B. <br> Jana has 107 wooden beads and 68 glass beads. <br> How many more wooden beads than glass beads <br> does Jana have? |
| :--- | :--- |

## allphd.com <br> ators

## Total

## G.The animal park has 12 zebras, 25 monkeys, and some giraffes. If the total number of animals is 50 , how many giraffes are there?

$$
P 1+P 2+P 3=T
$$

## Change

## H. Mrs. Lanier saved \$617 in January. In February, she spent $\$ 249$ of the money she saved. She saved $\$ 291$ more in March. How much has Mrs. Lanier saved by the end of March?

$$
S T-C+C=E
$$

## Let's Review

What's a Total problem?
What's a Difference problem?
What's a Change problem?

## Schema Quiz Time!

## Change

Pablo goes to a stamp show where he can share, buy, and sell stamps.
26. Part A

The first day, Pablo starts with 744 stamps. He buys 27 stamps from his friend. He then sells 139 stamps.

What is the total number of stamps that Pablo has after the first day of the stamp show?

## Difference

The graph below shows the number of pounds of plastic the Keller family recycled for five months.

Recycled Plastic


Based on the graph, how many more pounds of plastic did the family recycle in July than in April?
r. Conley delivers packages. The bar graph shows the total number of packages e delivered on five days last week.

10. Part A

What is the total number of packages Mr. Conley delivered on Monday and Tuesday?
(A) 300
(B) 340
(c) 350
(D) 360

## Don't tie key words to operations

## Do have an attack strategy



| Problem type | Definition | Examples |  |  | Equation | Graphic <br> organizer |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Equal Groups |  |  |  |  |  |  |

## Equal Groups

Groups multiplied by number in each group for a product

- Scott has 2 bags of apples. There are 6 apples in each bag. How many apples does Scott have altogether?
- $2 \times 6=$ ?
- Scott has 12 apples. He wants to share them equally among his 2 friends. How many apples will each friend receive?
- $2 \times$ ? $=12$
- Scott has 12 apples. He put them into bags containing 6 apples each. How many bags did Scott use?
- ? $\times 6=12$


## Equal Groups

## "Are there groups with an equal number in each group?"

## Equal Groups

## G X <br> N

## Equal Groups



## Equal Groups

Ms. Thompson sold $6 /$ cartons of cherries at the Farmers' Market. Each carton holds $2 / 5$ cherries. How many cherries did she sell?

$$
\begin{array}{ll}
\Downarrow & G \times N=? \\
P & 6 \times 26=? \\
\forall & 6 \times 26=180 \\
W & ?=180 \text { cherries }
\end{array}
$$

| Problem type | Definition | Examples |  |  | Equation | Graphic <br> organizer |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Equal Groups |  |  |  |  |  |  |

## Comparison

## Set multiplied by a number of times for a product

- Julie picked 6 apples. Amy picked 2 times as many apples as Marcie. How many apples did Lisa pick?
- $6 \times 2=$ ?
- Amy picked 12 apples. She picked 2 times as many apples as Julie. How many apples did Julie pick?
- ? $\times 2=12$
- Amy picked 12 apples, and Julie picked 6 apples. How many times as many apples did Amy pick?
- $6 \times$ ? $=12$


## Equal Groups

"Are there groups with an equal number in each group?"

## Comparison

"Is a set compared a number of times?"

## Comparison

x


## Comparison

Susan has 3 times as many books as Mary. Mary has 18 books. Which equation can be solved to figure out how many books Susan has?


| Multiplicative Word Problems |  |  |
| :--- | :--- | :--- |
| A. <br> Ms. Thompson sold 6 cartons of cherries at the <br> Farmers' Market. Each carton holds 25 cherries. <br> How many cherries did she sell? | B. <br> Susan has 3 times as many books as Mary. Mary <br> has 18 books. Which equation can be solved to <br> figure out how many books Susan has? |  |

## Comparison

Susan has? times as many books as Mary. Mary has 18 books. Which equation can be solved to figure out how many books Susan has?

$?=54$ books

## Let's Review

What's an Equal Groups problem? What's a Comparison problem?

## Schema Quiz Time!

## Equal Groups

Ryan makes 6 backpacks. He uses $\frac{3}{4}$ yard of cloth to make each backpack. What is the total amount of cloth, in yards, Ryan uses to make all 6 backpacks?
A. $1 \frac{1}{2}$
B. $2 \frac{1}{4}$
C. $4 \frac{1}{2}$
D. $6 \frac{3}{4}$

## Comparison

Danielle's full-grown dog weighs 10 times as much as her puppy. The puppy weighs 9 pounds.

Enter the number of pounds the full-grown dog weighs.

## Schemas

## Total

## Difference

## Change

## Equal Groups

## Comparison

## Don't tie key words to operations

## Do have an attack strategy



# Sarahpowellphd.com <br> Evidence-based mathematics resources for educators 


 Home About Resources Presentations Videos Contact


## srpowell@austin.utexas.edu

@sarahpowellphd

