

Word-Problem Solving: A Focus on Schemas

srpowell@utexas.edu @sarahpowellphd
www.sarahpowellphd.com

Maya has 120 caramel apples to sell. Each caramel apple is covered with one topping.

- $\frac{1}{5}$ of the caramel apples are covered with peanuts.
- $\frac{1}{3}$ are covered with chocolate chips.
- $\frac{3}{10}$ are covered with coconut.
- The rest are covered with sprinkles.

How many caramel apples are covered with sprinkles?

- A** 100
- B** 33
- C** 25
- D** 20

Solve the problem

What skills are necessary to solve this problem?

Problem-Solving Difficulties

Teaching Problem Solving

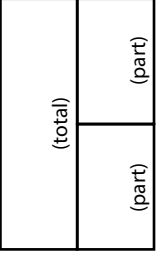
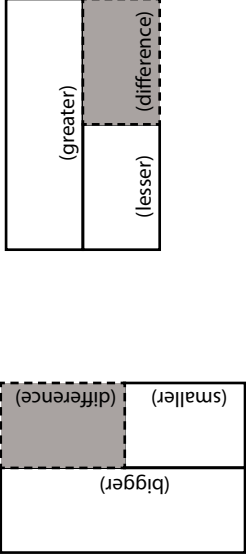
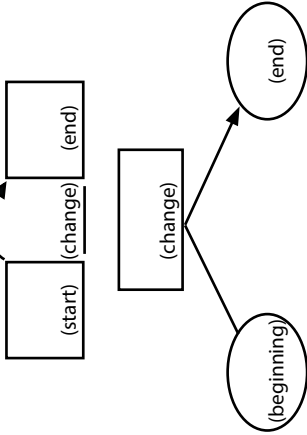
UPS✓

UNDERSTAND
Read and explain.

PLAN
How will you solve the problem?

SOLVE
Set up and do the math!

✓**C**HECK
Does your answer make sense?

Schema and Definition	Equations and Graphic Organizers	Examples	Variations
<p>Total (Combine; Part-part-whole) Parts combined for a sum</p>	<p>$P1 + P2 = T$ (part + part = total)</p> 	<p>Sum unknown: Lyle has 11 red apples and 18 green apples. How many apples does Lyle have altogether?</p> <p>Part unknown: Lyle has 29 red and green apples. If 11 of the apples are red, how many green apples does Lyle have?</p>	<p>More than two parts: Lyle has 34 apples. Of the apples, 11 are red, 18 are green, and the rest are yellow. How many yellow apples does Lyle have?</p>
<p>Difference (Compare) Sets compared for a difference</p>	<p>$B - S = D$ (bigger - smaller = difference)</p> 	<p>Difference unknown: Sasha wrote 85 words in her essay, and Tabitha wrote 110 words. How many fewer words did Sasha write than Tabitha?</p> <p>Bigger/greater unknown: Tabitha wrote 25 more words than Sasha. If Sasha wrote 85 words, how many words did Tabitha write?</p> <p>Smaller/lesser unknown: Tabitha wrote 110 words in her essay. Sasha wrote 25 words fewer than Tabitha. How many words did Sasha write?</p>	<p>(None)</p>
<p>Change (Join; Separate) An amount that increases or decreases</p>	<p>$ST + / - C = E$ (start +/- change = end)</p> 	<p>End (increase) unknown: Jorge had \$52. Then, he earned \$16 babysitting. How much money does Jorge have now?</p> <p>Change (increase) unknown: Jorge had \$52. Then, he earned some money babysitting. Now, Jorge has \$68. How much did Jorge earn babysitting?</p> <p>Start (increase) unknown: Jorge has some money, and then he earned \$16 for babysitting. Now, Jorge has \$68. How much money did he have to start with?</p> <p>End (decrease) unknown: Jorge had \$52. Then, he spent \$29 at the ballpark. How much money does Jorge have now?</p> <p>Change (decrease) unknown: Jorge had \$52 but spent some money when he went to the ballpark. Now, Jorge has \$23. How much did Jorge spend at the ballpark?</p> <p>Start (decrease) unknown: Jorge had some money. Then, he spent \$29 at the ballpark and has \$23 left. How much money did Jorge have before going to the ballpark?</p>	<p>Multiple changes: Jorge had \$78. He stopped and bought a pair of shoes for \$42 and then he spent \$12 at the grocery. How much money does Jorge have now?</p>

Additive Word Problems

A.

Megan baked 38 sugar cookies and 24 chocolate chip cookies. Enter the total number of cookies Megan baked in all.

B.

In March and April, it rained a total of 11.4 inches. If it rained 3.9 inches in March, how many inches did it rain in April?

C.

Jana has 162 wooden beads and 95 glass beads. How many more wooden beads than glass beads does Jana have?

D.

The temperature in Norfolk was 12 degrees warmer than in Roanoke where the temperature was 79 degrees. It was 86 degrees in Marion. What was the temperature in Norfolk?

Additive Word Problems

E.

A plant was $3\frac{3}{4}$ inches tall at the beginning of June. By the end of July, the plant was $9\frac{1}{8}$ inches tall. How many inches did the plant grow in 2 months?

F.

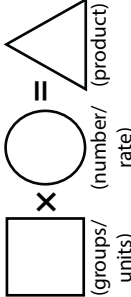
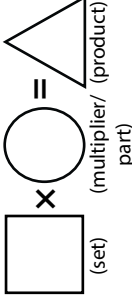
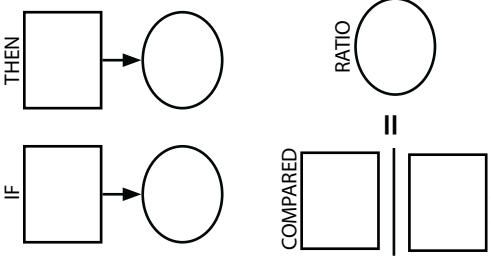
Martina has some money in her bank account. Then, she spent \$135.69 and has a balance of -\$24.80. How much money did Martina have to begin with?

G.

Sam mows lawns and made \$560 last week. She made \$95 on Monday, \$135 on Tuesday, and \$70 on Wednesday. How much did Sam make on Thursday and Friday?

H.

Hui saved \$70 in January. In February, she spent \$64 of the money she saved. She saved \$92 more in March. How much has Hui saved by the end of March?

Schema and Definition	Graphic Organizers	Examples	Variations
Equal Groups (Vary) A number of equal sets or units		<p><i>Product unknown:</i> Maria bought 5 cartons of eggs with 12 eggs in each carton. How many eggs did Maria buy?</p> <p><i>Groups unknown:</i> Maria bought 60 eggs. The eggs were sold in cartons with 12 eggs each. How many cartons of eggs did Maria buy?</p> <p><i>Number unknown:</i> Maria bought 5 cartons of eggs for a total of 60 eggs. How many eggs were in each carton?</p>	<p><i>With rate:</i> Maria bought 5 cartons of eggs. Each carton cost \$2.95. How much did Maria spend on eggs?</p>
Comparison One set as a multiple or part of another set		<p><i>Product unknown:</i> Malik picked 7 flowers. Danica picked 3 times as many flowers as Malik. If Danica picked 21 flowers, how many flowers did Danica pick?</p> <p><i>Set unknown:</i> Danica picked 3 times as many flowers as Malik. If Danica picked 21 flowers, how many flowers did Malik pick?</p> <p><i>Times unknown:</i> Malik picked 7 flowers. Danica picked 21 flowers. How many times more flowers did Danica pick?</p>	<p><i>With fraction:</i> Malik picked 25 red and yellow flowers. If 1/5 of the flowers were yellow, how many were red?</p>
Proportions (Percentages; Unit Rate) Relationships among quantities Ratio		<p><i>Subject unknown:</i> Sally typed 56 words in 2 minutes. How many words could Sally type in 7 minutes?</p> <p><i>Object unknown:</i> Sally typed 56 words in 2 minutes. How many minutes would it take Sally to type 192 words?</p> <p><i>Base unknown:</i> Justin baked cookies and brownies. The ratio of cookies to brownies was 3:5. If he baked 15 cookies, how many brownies did he bake?</p> <p><i>Compared unknown:</i> Justin baked cookies and brownies. The ratio of cookies to brownies was 3:5. If he baked 25 brownies, how many cookies did he bake?</p> <p><i>Ratio unknown:</i> Justin baked 15 cookies and 25 brownies. What's the ratio of cookies to brownies?</p>	<p><i>With percentage:</i> Watson received an 80% on his science quiz. If the test had 40 questions, how many questions did Watson answer correctly?</p> <p><i>With unit rate:</i> Paula bought 5 boxes of markers. She spent \$9.75. What is the price of one box of markers?</p>

Multiplicative Word Problems

A.

Ms. Thompson sold 6 cartons of cherries at the Farmers Market. Each carton holds 25 cherries. How many cherries did she sell?

B.

Jane bought 112 light bulbs. The light bulbs come in packs of 4. How many packs of light bulbs did Jane buy?

C.

Enrique has 2 times as many pencils as Ava. Ava has 6 pencils. How many pencils does Enrique have?

D.

Susan has 7 times as many books as Mo. Mo has 18 books. How many books Susan has?

Multiplicative Word Problems

E. The number of blueberry muffins that a baker makes each day is 40% of the total number of muffins she makes. On Monday, the baker makes 36 blueberry muffins. What is the total number of muffins that the baker makes on Monday?

F. An airplane's altitude changed -378 feet over 7 minutes. What was the mean change of altitude in feet per minute?

G. Sara buys a sweater at a department store. The sweater costs \$30. The store is having a 25% off sale on everything in the store. Enter the amount of money, in dollars, Sara saves from the sale. Do not consider the sales tax.

H. Sam's two new aquariums each hold exactly 200 gallons of water. One aquarium will hold small fish and the other will hold large fish. Now he needs new fish for his aquarium. He will buy 5 small fish for every 10 gallons of water in the aquarium. He will buy 8 large fish for every 40 gallons of water in the aquarium. What is the total number of fish Sam will have? What will be the ratio of Sam's small fish to large fish?