

Word Problem Strategy Guide

List of different plans that can be found in the examples given.

S1. Find a Pattern

S2. Make a List

S3. Make a Table

S4. Work Backwards

S5. Guess and Check

S6. Write a Number Sentence

S7. Use Logical Reasoning

S8. Draw a Picture

S9. Act it out



PCTI Mathematics Department
45 Reinhardt Road
Wayne, NJ 07470
973-389-7238

Word Problem Strategy Guide - Directions

Read	<ul style="list-style-type: none">• Read the problem at least two times
Given	<ul style="list-style-type: none">• Important information that was found in the word problem• Using the Word Problem Survival Guide, underline/highlight any important given information
Find/Prove Unknown*	<ul style="list-style-type: none">• Write or circle the unknown information the problem is asking for• See Work Problem Survival Guide to help identify key words
Make a Plan	<ol style="list-style-type: none">1. Find a Pattern2. Make a List3. Make a Table4. Work Backwards5. Guess and Check6. Write a Number Sentence7. Use Logical Reasoning8. Draw a Picture9. Act it out
Equation	<ul style="list-style-type: none">• See formula sheet• Write out equation if needed• See Work Problem Survival Guide to help identify key words
Solve problem	<ul style="list-style-type: none">• Use logical reasoning and follow the plan developed earlier to compute the answer to the problem.
Answer / Check Answer	<ul style="list-style-type: none">• Statement or phrase, including units, that reflects what you are trying to find/prove (see above)*• Use rational reason to determine which answer is correct if more than one solution was found• Use appropriate numbers when rounding (for example, an answer of 3.6 people would read either 3 or 4 people depending on the situation)• When applicable, perform a formal check• Ask yourself, does your answer make sense logically

High School Assessment Reference Sheet

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5,280 feet	1 pound = 0.454 kilograms	1 quart = 2 pints
1 mile = 1,760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2,000 pounds	1 gallon = 3.785 liters
		1 liter = 0.264 gallons
		1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$
Parallelogram	$A = bh$
Circle	$A = \pi r^2$
Circle	$C = \pi d$ or $C = 2\pi r$
General Prisms	$V = Bh$
Cylinder	$V = \pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$
Cone	$V = \frac{1}{3}\pi r^2 h$
Pyramid	$V = \frac{1}{3}Bh$

Pythagorean Theorem	$a^2 + b^2 = c^2$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Geometric Sequence	$a_n = a_1 r^{n-1}$
Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Radians	$1 \text{ radian} = \frac{180}{\pi} \text{ degrees}$
Degrees	$1 \text{ degree} = \frac{\pi}{180} \text{ radians}$
Exponential Growth/Decay	$A = A_0 e^{k(t-t_0)} + B_0$

Name: _____ Date: _____ Per: _____

Problem:

Read	
Given	
Find/Prove Unknown*	
Make a Plan	
Equation	
Solve problem	
Answer / Check Answer	

Word Problem Strategy Guide – ALGEBRA I

Problem: Darnell got a part-time job and opens a new savings account. He is depositing money into a savings account each week. The first week he deposits \$1. The next week he deposits \$2. The third week he deposits \$4. The fourth week he deposits \$8. How much will he have in the savings account at the end of 10 weeks?



Read	Read the problem at least two times										
Given	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 15%;">Week</td> <td style="width: 15%;">1</td> <td style="width: 15%;">2</td> <td style="width: 15%;">3</td> <td style="width: 15%;">4</td> </tr> <tr> <td>Amount Deposited (\$)</td> <td>1</td> <td>2</td> <td>4</td> <td>8</td> </tr> </table>	Week	1	2	3	4	Amount Deposited (\$)	1	2	4	8
Week	1	2	3	4							
Amount Deposited (\$)	1	2	4	8							
Find/Prove Unknown*	How much will he have in the savings account at the end of 10 weeks?										
Make a Plan	1. Find a pattern.										
Equation	week 1 deposit + week 2 deposit + ... + week 10 deposit = total \$ deposited										
Solve problem	<p>Find the pattern: Each week, the amount of the deposit is doubled from the previous week.</p> $1 + 2 + 4 + 8 + 16 + 32 + 64 + 128 + 256 + 512 = 1023$										
Answer / Check Answer	Darnell will have \$1,023 in his savings account at the end of 10 weeks.										

Word Problem Strategy Guide – ALGEBRA I

Problem: Shelly is opening a lemonade stand. She will sell both lemonade and limeade and will allow customers to add one flavor to the juice for an extra 50 cents. The extra flavors she has for sale are raspberry, cherry and iced tea. How many drink options does a customer have to choose from?"



Read	Read the problem at least two times								
Given	Drink choices: lemonade, limeade Flavor choices: plain, cherry, raspberry, iced tea								
Find/Prove Unknown*	How many drink options does a customer have to choose from?								
Make a Plan	2. Make a list to organize the data.								
Equation	$2(4) = 8$ (fundamental counting principle can be used to check answer)								
Solve problem	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">plain lemonade</td> <td style="width: 50%;">plain limeade</td> </tr> <tr> <td>cherry lemonade</td> <td>cherry limeade</td> </tr> <tr> <td>raspberry lemonade</td> <td>raspberry limeade</td> </tr> <tr> <td>iced tea lemonade</td> <td>iced tea limeade</td> </tr> </table> <p><i>Count the number of options. You should end up with eight because Shelly's customer has four lemonade options and four limeade options to choose from.</i></p>	plain lemonade	plain limeade	cherry lemonade	cherry limeade	raspberry lemonade	raspberry limeade	iced tea lemonade	iced tea limeade
plain lemonade	plain limeade								
cherry lemonade	cherry limeade								
raspberry lemonade	raspberry limeade								
iced tea lemonade	iced tea limeade								
Answer / Check Answer	A customer has 8 drink choices to choose from. $2(4) = 8$ (fundamental counting principle can be used to check answer)								

Word Problem Strategy Guide – ALGEBRA I

Problem: How many hours will a car traveling at 65 miles per hour take to catch up with a car traveling at 55 miles per hour if the faster car starts one hour after the slower car?



Read	Read the problem at least two times																								
Given	Rate of car 1 = 65mph (faster car) Rate of car 2 = 55mph (slower car) Faster car starts 1 hour after slower car																								
Find/Prove Unknown*	In how many hours will the faster car pass the slower car?																								
Make a Plan	3. Make a table to organize the data.																								
Equation	$D = r(t)$																								
Solve problem	<p>Create a row for the slower car, a row for the faster car, and a column for each hour. Find the distance traveled during each hour by looking at the distances listed in each column. The distance of the faster car was more than the distance of the slower car in hour seven. The faster car traveled six hours to catch up to the slower car. Answer is the table</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Hour</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>Slower Car</td> <td>55</td> <td>110</td> <td>165</td> <td>220</td> <td>275</td> <td>330</td> <td>385</td> </tr> <tr> <td>Faster Car</td> <td>0</td> <td>65</td> <td>130</td> <td>195</td> <td>260</td> <td>325</td> <td>390</td> </tr> </tbody> </table>	Hour	1	2	3	4	5	6	7	Slower Car	55	110	165	220	275	330	385	Faster Car	0	65	130	195	260	325	390
Hour	1	2	3	4	5	6	7																		
Slower Car	55	110	165	220	275	330	385																		
Faster Car	0	65	130	195	260	325	390																		
Answer / Check Answer	<p>It took 6 hours for the car traveling at 65mph to catch up to the car traveling at 55mph.</p> <p>Read the problem again to be sure the question was answered.</p> <p>Did you find the number of hours it took for the faster car to catch up?</p> <p>Check the math to be sure it is correct.</p> <p>Sample student explanation of how to find the answer: <i>I set up a table for the miles each car had gone during each hour. I kept adding columns until the faster car caught up to the slower car. At the end of the seventh hour, the faster car had gone 390 miles, which is more than the distance traveled by the slower car, 385 miles. Because the faster car didn't start traveling in the first hour, it traveled for six hours.</i></p>																								

Word Problem Strategy Guide – ALGEBRA I

Problem: *Mike Adams walked from Met Life Stadium to Paterson City Hall. It took him 2 hours and 55 minutes to go from Met Life to IHOP. From there he took the bus to Paterson City Hall in 50 minutes. He arrived in Paterson City Hall at 3:30 p.m. What time did Mike Adams leave Met Life Stadium?*

Read	Read the problem at least two times
Given	Traveling from Met Life Stadium to Paterson City Hall Met Life to IHOP = 2 hours and 55 minutes IHOP to Paterson City Hall = 50 minutes Arrived in Paterson at 3:30 p.m.
Find/Prove Unknown*	What time did Mike Adams leave Met Life Stadium?
Make a Plan	4. Work Backwards to find when he got to IHOP and Work Backwards again to find when he left Met Life Stadium
Equation	N/A
Solve problem	Mike Adams arrived at Paterson City Hall at 3:30 pm. 50 minutes before 3:30 p.m. is 2:40 p.m. (3:30 pm – 50 minutes = 2:40 pm) Mike Adams arrived at IHOP @ 2:40 p.m. 2hrs and 55 minutes before 2:40 p.m. is 11:45 p.m. (2:40 pm – 2 hours, 55 minutes = 11:45 pm) Mike Adams left Met Life Stadium @ 11:45pm.
Answer / Check Answer	11:45 p.m. + 2hrs = 1:45 p.m. + 55min = 2:40 p.m. + 50 min = 3:30 p.m. Mike Adams left Met Life Stadium @ 11:45 p.m.

Word Problem Strategy Guide – ALGEBRA I

Problem: Jamie spent \$40 for an outfit. She paid for the items using \$10, \$5, and \$1 bills. If she gave the clerk 10 bills in all, how many of each bill did she use?

Read	Read the problem at least two times Underline/Highlight key terms				
Given	Outfit costs \$40 Paid with only \$10, \$5 and \$1 bills Total of 10 bills were used to pay				
Find/Prove Unknown*	How many of each bill was used? $x = \#$ of \$10 bills $y = \#$ of \$5 bills $z = \#$ of \$1 bills				
Make a Plan	5. Guess and check by substituting values into an equation or table				
Equation	$10x + 5y + 1z = \$40$ $x + y + z = 10$				
Solve problem	x	y	z	$10x+5y+1z = 40$	$x + y + z = 10$
	2	4	4	\$44 (no)	10 (yes)
	3	1	5	\$40 (yes)	9 (no)
	2	3	5	\$40 (yes)	10 (yes)
Answer / Check Answer	$10(2) + 5(3) + 1(5) = 20 + 15 + 5 = \40 $2 + 3 + 5 = 10$ Jaime used 2 \$10 bills, 3 \$5 bills and 5 \$1 bills to pay for her outfit.				

Word Problem Strategy Guide – ALGEBRA I

Problem: You need to get 115 cupcakes for your party. The vanilla cupcakes cost \$.50 a piece and the chocolate cost \$.75. Your parents are willing to spend \$75 on cupcakes. How many cupcakes of each kind can you get?

Read	Read the problem at least two times
Given	Cupcakes needed for party is 115 Vanilla cupcakes cost \$.50 each Chocolate cupcakes cost \$.75 each Spending total of \$75 on cupcakes
Find/Prove Unknown*	How many cupcakes of each kind can you get? $V = \#$ of vanilla cupcakes $C = \#$ of chocolate cupcakes
Make a Plan	6. Write a number sentences
Equation	$V + C = 115$ $.50V + .75C = 75$
Solve problem	$V + C = 115 \Rightarrow -.50(V + C = 115) \Rightarrow -.50V - .50C = -57.5$ $.50V + .75C = 75 \Rightarrow .50V + .75C = 75 \Rightarrow .50V + .75C = 75$ Add equations vertically to solve for variable C: $-.50V - .50C = -57.5$ <u>$.50V + .75C = 75$</u> $C = 70$ chocolate Substitute C into first equation to solve for variable V: $V = 45$ vanilla
Answer / Check Answer	$45 + 70 = 115$ $.50(45) + .75(70) = \$75$ 70 Chocolate cupcakes & 45 Vanilla cupcakes were bought

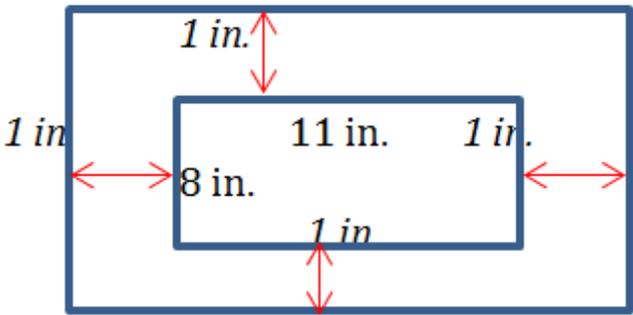
Word Problem Strategy Guide – ALGEBRA I

Problem: A bacteria doubles in population every hour. The population is modeled by the equation $y = 2^x$, where y is the population in millions and x is the time (in hours) after data was initially taken. Make a table showing the bacteria population by using the range $x=\{1,2,3,4\}$ Use logical reasoning to determine the number of bacteria when $x = 0$.

Read	Read the problem at least two times		
Given	The zero exponent property states that any number (except zero) raised to the zero power is equal to one.		
Find/Prove Unknown*	Prove the zero exponent property using logical reasoning.		
Make a Plan	7. Use logical reasoning.		
Equation	$y = 2^x$		
Solve problem	Make a table of powers. Keep 2 as the base and use whole number exponents.		
	x (hours)	Work	y (millions of bacteria)
	4	2^4	16
	3	2^3	8
	2	2^2	4
	1	2^1	2
	0	2^0	1
	Pattern: the result is halved each time the exponent reduces by one		
Answer / Check Answer	There were 1 million bacteria when the data was initially taken ($x=0$). 2^0 equals 1 because the patterns from the power dictate that.		

Word Problem Strategy Guide – ALGEBRA I

Problem: *Wally wants to frame a rectangular picture that measures 8 inches by 11 inches. The width of the frame is 1 inch. What is the area of the frame?*

Read	Read the problem at least two times
Given	The picture measures 8" by 11". The width of the frame is 1 inch.
Find/Prove Unknown*	The area of the frame
Make a Plan	8. Draw a diagram.
Equation	 <p style="text-align: center;">$A = l \cdot w$</p>
Solve problem	$[(8 + 2) * (11 + 2)] - (8 * 11)$ $(10 * 13) - (8 * 11)$ $130 - 88$
Answer / Check Answer	The area of the frame is 42 square inches

Word Problem Strategy Guide – ALGEBRA I

Problem: You are on your way to visit your Grandma, who lives at the end of the valley. It's her birthday, and you want to give her the cakes you've made.

Between your house and her house, you have to cross 7 bridges, and as it goes in the land of make believe, there is a troll under every bridge! Each troll, quite rightly, insists that you pay a troll toll. Before you can cross their bridge, you have to give them half of the cakes you are carrying, but as they are kind trolls, they each give you back a single cake.

How many cakes do you have to leave home with to make sure that you arrive at Grandma's with exactly 2 cakes?

Read	Read the problem at least two times
Given	<p>Grandma's birthday, we want to give her cakes. Have to cross 7 bridges. Each bridge you give up half of your cakes to the troll. The troll does not want any fractions of cakes so he gives those back. (If you have 5 cakes the troll will take 2) Each gives you back a single cake. Need to arrive at Grandma's with exactly 2 cakes.</p>
Find/Prove Unknown*	Need to find how many cakes I need to leave my house with to have exactly 2.
Make a Plan	<p>9. Act it out. Have 7 of your classmates act as trolls. Start your journey with a different number of cakes (pieces of paper) and follow the directions in the problem.</p>
Equation	Given $C_i = \text{Initial Cakes}$ and $C_n = \text{Final Cakes}$, then $C_n = \frac{C_i}{2} + 1$
Solve problem	$C_n = \frac{C_i}{2} + 1$ $2 = \frac{C_i}{2} + 1$ $2 - 1 = \frac{C_i}{2}$ $1 * 2 = \frac{C_i}{2} * 2$ $C_i = 2 \text{ cakes}$
Answer / Check Answer	<p>If you start with two cakes at the first bridge, you will surrender one cake, but the troll will return a cake to you, leaving you with two cakes. The same thing will then occur for all seven bridges. Therefore, if you start with 2 cakes, you will arrive at your Grandmother's house with two cakes. In addition, starting with 10 cakes initially will also produce the same final result.</p>

Word Problem Strategy Guide – ALGEBRA II

Problem: In a skydiving formation with R rings, each ring after the first has twice as many skydivers as the preceding ring. The formation for $R = 2$ is shown.

- a. Let a_n be the number of skydivers in the n th ring. Find a rule for a_n .
 b. Find the total number of skydivers if there are $R = 4$ rings.

Read	Read the problem at least two times
Given	Twice as many skydivers as the preceding ring Ring 1 (a_1) consists of 5 skydivers Ring 2 (a_2) consists of 10 skydivers
Find/Prove Unknown*	Find a rule for a_n Find the total number of skydivers if there are $R = 4$ rings
Make a Plan	1. Find a pattern
Equation	$a_n = a_1 r^{n-1}$ $S_n = a_1 \left(\frac{1 - r^n}{1 - r} \right)$
Solve problem	a. $a_1 = 5, r = 2$ $a_n = 5(2)^{n-1}$ b. $S_4 = a_1 \left(\frac{1 - r^4}{1 - r} \right)$ $S_4 = a_1 \left(\frac{2 - r^4}{1 - r} \right)$
Answer / Check Answer	Add-up the first four ring totals ($5 + 10 + 20 + 40 = 75$)

Word Problem Strategy Guide – ALGEBRA II

Problem: A marching band is arranged in 7 rows. The first row has 3 band members, and each row after the first has 2 more band members than the row before it. Make a list to find the total number of band members.

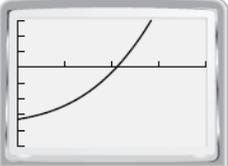
Read	Read the problem at least two times																		
Given	There are 7 rows. 1 st row = 3 band members Each row increases by 2.																		
Find/Prove Unknown*	Find the total number of band members.																		
Make a Plan	2. Make a List																		
Equation	Not needed.																		
Solve problem	<table border="1"><thead><tr><th>Row</th><th># of Band Members</th></tr></thead><tbody><tr><td>1</td><td>3</td></tr><tr><td>2</td><td>5</td></tr><tr><td>3</td><td>7</td></tr><tr><td>4</td><td>9</td></tr><tr><td>5</td><td>11</td></tr><tr><td>6</td><td>13</td></tr><tr><td>7</td><td>15</td></tr><tr><td>Total</td><td>63</td></tr></tbody></table>	Row	# of Band Members	1	3	2	5	3	7	4	9	5	11	6	13	7	15	Total	63
Row	# of Band Members																		
1	3																		
2	5																		
3	7																		
4	9																		
5	11																		
6	13																		
7	15																		
Total	63																		
Answer / Check Answer	There are 63 band members. You can check your answer by using the sum formula on your reference sheet for an arithmetic sequence.																		

Word Problem Strategy Guide – ALGEBRA II

Problem: You plan to save \$1000 each year towards buying a used car in four years. At the end of each summer, you deposit \$1000 earned from summer jobs into your bank account. The table shows the value of your deposits over the four year period. In the table, g is the growth factor $1 + r$ where r is the annual interest rate expressed as a decimal.

	Year 1	Year 2	Year 3	Year 4
Value of 1 st Deposit	1000	1000 g	1000 g^2	1000 g^3
Value of 2 nd Deposit	-	1000	?	?
Value of 3 rd Deposit	-	-	1000	?
Value of 4 th Deposit	-	-	-	1000

- Copy and Complete the table.
- Write a polynomial function that gives the value v of your account at the end of the fourth summer in terms of g .
- You want to buy a car that costs about \$4300. What growth factor do you need to obtain this amount? What annual interest rate do you need? Explain how you found your answer.

Read	Read the problem at least two times																									
Given	You save \$1000 every year for four years. Growth factor, $g, g = 1 + r$ $r =$ annual interest rate, as a decimal																									
Find/Prove Unknown*	<ul style="list-style-type: none"> growth factor What annual interest rate Polynomial function Savings per year 																									
Make a Plan	3. Make a table																									
Equation	None.																									
Solve problem	<p>a.</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>Year 1</th> <th>Year 2</th> <th>Year 3</th> <th>Year 4</th> </tr> </thead> <tbody> <tr> <td>Value of 1st Deposit</td> <td>1000</td> <td>1000g</td> <td>1000g^2</td> <td>1000g^3</td> </tr> <tr> <td>Value of 2nd Deposit</td> <td>-</td> <td>1000</td> <td>1000g</td> <td>1000g^2</td> </tr> <tr> <td>Value of 3rd Deposit</td> <td>-</td> <td>-</td> <td>1000</td> <td>1000g</td> </tr> <tr> <td>Value of 4th Deposit</td> <td>-</td> <td>-</td> <td>-</td> <td>1000</td> </tr> </tbody> </table> <p>b. $v = 1000g^3 + 1000g^2 + 1000g + 1000$ c. $4300 = 1000g^3 + 1000g^2 + 1000g + 1000$ $0 = 1000g^3 + 1000g^2 + 1000g - 3300$ The growth factor can be found by substituting 4300 for v and then solving for g; $g = 1.05$. The annual interest rate is $g - 1 = 5\%$ interest.</p>		Year 1	Year 2	Year 3	Year 4	Value of 1 st Deposit	1000	1000 g	1000 g^2	1000 g^3	Value of 2 nd Deposit	-	1000	1000 g	1000 g^2	Value of 3 rd Deposit	-	-	1000	1000 g	Value of 4 th Deposit	-	-	-	1000
	Year 1	Year 2	Year 3	Year 4																						
Value of 1 st Deposit	1000	1000 g	1000 g^2	1000 g^3																						
Value of 2 nd Deposit	-	1000	1000 g	1000 g^2																						
Value of 3 rd Deposit	-	-	1000	1000 g																						
Value of 4 th Deposit	-	-	-	1000																						
Answer / Check Answer	For parts a and b, see above. For part c, $g = 1.05, r = 5\%$ Check the answer by using a graphing calculator to graph your polynomial function. 																									

Word Problem Strategy Guide – ALGEBRA II

Problem: *At the ruins of Caesarea, archaeologists discovered a huge hydraulic concrete block with a volume of 945 cubic meters. The block's dimensions are x meters high by $12x - 15$ meters long by $12x - 21$ meters wide. What is the height of the block?*

Read	Read the problem at least two times
Given	$Volume = 945$ cubic meters $Height = x$ $Length = 12x - 15$ $Width = 12x - 21$
Find/Prove Unknown*	Find the height of the block.
Make a Plan	4. Working Backwards
Equation	$V = lwh$
Solve problem	$V = lwh$ $l = 12x - 15$ $w = 12x - 21$ $h = x$ $945 = (12x - 15)(12x - 21)(x)$ $945 = (144x^2 - 432x + 315)x$ $945 = 144x^3 - 432x^2 + 315x$ $0 = 144x^3 - 432x^2 + 315x - 945$ $0 = 16x^3 - 48x^2 + 35x - 105$ $0 = (x - 3)(16x^2 + 35)$ The only real solution is $x = 3$. The block is 3 meters high.
Answer / Check Answer	$x = 3$ meters Check your answer by substituting 3 into the length, width, and height to find a volume of 945 cubic meters.

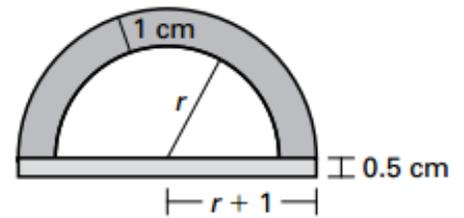
Word Problem Strategy Guide – ALGEBRA II

Problem: Tony purchased a rare 1959 Gibson Les Paul guitar in 2000 for \$12,000. Experts estimate that its value will increase by 14% per year. Find the first year when the value of the guitar will be \$60,000 or greater.

Read	Read the problem at least two times
Given	The starting price of the guitar is \$12,000. It goes up in value by 14% each year. $A = 60000; a = 12000; r = .14$
Find/Prove Unknown*	We need to find the year (t) in which the function reaches or passes 60000.
Make a Plan	5. Guess and Check Choose values for t until the equation gives near 60000 or more as a value of the guitar.
Equation	$A = a(1 + r)t$, or $60000 = 12000(1 + 0.14)t$; $60000 = 12000(1.14)t$
Solve problem	Use the formula and choose values for t. For $t = 5$: $12000 [(1.14)]^5 = 23104.97$ 5 is not large enough. For $t = 10$: $12000(1.14)^{10} = 44486.66$ 10 is still not large enough. For $t = 15$: $12000(1.14)^{15} = 85655.25$ 15 is too large, so the number must be between 10 and 15. Choose a value between 10 and 15 For $t = 12$: $12000(1.14)^{12} = 57814.86$ 12 is close, but still not enough. Try 13. For $t = 13$: $12000(1.14)^{13} = 65908.94$ 13 gives us a value above 60000, therefore 13 must be the value of t.
Answer / Check Answer	The question asks for the first year when the value of the guitar is \$60,000 or more. Since the problem starts with the year 2000, we have to add 13 years to the year 2000, giving us 2013. Therefore the answer to the question is: The guitar reaches a value of \$60,000 or more in the year 2013.

Word Problem Strategy Guide – ALGEBRA II

Problem: Assume you work for a bakery that makes mallomars and corporate wants to a formula that will allow them to calculate how much chocolate each dessert uses as a function of the radius of the desert. The CFO wants to know how much money it costs to produce a single mallomar when the radius of a mallomar is 1.1 cm. Chocolate costs \$0.02 cm³.



Read	Read the problem at least two times
Given	$r=1.1$ cm. $v=(v(r))= (LH)-(SH)$.
Find/Prove Unknown*	We need to find the volume of the chocolate in the mallowmar.
Make a Plan	6. Use /Create number sentences
Equation	$v(r) = LH - SH, \text{Volume of a hemisphere} = \frac{1}{2}(\frac{4}{3}\pi r^3)$.
Solve problem	$LH = \frac{1}{2}\left(\frac{4}{3}\pi(r+1)^3\right), SH = \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$ $v(r) = \frac{1}{2}\left(\frac{4}{3}\pi(r+1)^3\right) - \frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$ <p>Simplify and combine like terms.</p> $v(r) = \left(\frac{2}{3}\pi(r^3 + 3r^2 + 3r + 1)\right) - \frac{2}{3}\pi r^3$ $v(r) = \frac{2}{3}\pi[r^3 + 3r^2 + 3r + 1 - r^3]$ $v(r) = \frac{2}{3}\pi[3r^2 + 3r + 1]$ <p>The polynomial above will determine the volume of chocolate depending on the length of the radius. Next Substitute the length of the radius and evaluate.</p> $v(1.1) = \frac{2}{3}\pi[3(1.1)^2 + 3(1.1) + 1]$ $v(1.1) = \frac{2}{3}\pi[3.63 + 3.3 + 1]$ $v(1.1) = \frac{2}{3}\pi[10.93]$ $v(1.1) = 7.60 \text{ cm}^3$ <p>There are 7.60cm³ of chocolate in a mallomar. The chocolate cost of producing a mallomar = (the volume of chocolate per mallomar) x (the cost of chocolate per cubic centimeter of chocolate). So, Cost = 7.60 cm³ x \$0.02 cm³ Cost ≈ \$0.15</p>
Answer / Check Answer	The question asks for the volume of the chocolate in the mallowmar. We found the volume of the chocolate in cm ³ and multiplied it by the cost per cm ³ of chocolate.

Word Problem Strategy Guide – ALGEBRA II

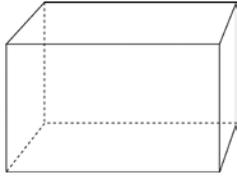
Problem: You are stacking soup cans for a display in a grocery store. Your manager wants you to stack 136 cans in layers, with each layer after the first having one less can than the layer before it. One can should be in the top layer. If you must use all 136 soup cans, how many cans should be in the first layer?

Read	Read the problem at least two times
Given	$n = 136$ (Total number of cans) $a_1 = 1$ (number of cans in the top layer) $d = 1$ (Each layer has one less can than the layer before)
Find/Prove Unknown*	Find the rule for the nth term
Make a Plan	7. Use Logical Reasoning Identify variables a_1 : <i>first number of the sequence</i> d : <i>common difference</i>
Equation	$a_n = a_1 + (n - 1)d$
Solve problem	$a_n = 1 + (n - 1)(1)$ Substitute in numbers $a_n = 1 + n - 1$ Simplify $a_n = n$ n^{th} rule of the sequence So, as the number of rows increases, number of cans increases as well. Then use the sum formula: $s_n = n \left(\frac{a_1 + a_n}{2} \right)$ Since $n = 136$ then $136 = n \left(\frac{1+n}{2} \right)$ $136 = \frac{n + n^2}{2}$ $272 = n + n^2$ $n^2 + n - 272 = 0$ $(n - 16)(n + 17) = 0$ $n = -17, n = 16$ We reject the negative answer and keep the positive one \therefore There are 16 cans in the first layer or at the bottom of stack
Answer / Check Answer	Substitute 16 in the sum formula: $s_n = n \left(\frac{a_1 + a_n}{2} \right)$ $136 = 16 \left(\frac{1 + 16}{2} \right)$ $136 = 136$

Word Problem Strategy Guide – ALGEBRA II

Problem: A manufacturer of corrugated boxes is trying to build a thousand custom boxes for a client. Unfortunately instead of sending in detailed specifications of the length, width, and height they sent in the following:

“The length must be three greater than the width, and the height must be two more than the length. The boxes should have a total volume of 840 cubic inches.

Read	Read the problem at least two times
Given	The length is three more than the width. The height is two more than the length. The volume is 840 cubic inches. It is a rectangular prism so $V = lwh$
Find/Prove Unknown*	Unknowns: Width, height, length.
Make a Plan	8. Draw a picture of the box and label:  $\begin{aligned} \text{Height} &= \text{Length} + 2 \\ \text{Height} &= (w + 3) + 2 \\ \text{Height} &= w + 5 \\ \\ \text{Width} &= w \\ \text{Length} &= w + 3 \end{aligned}$
Equation	$V = lwh$ $V = (w + 3)(w)(w + 5)$ $840 = (w + 3)(w)(w + 5)$
Solve problem	$840 = (w^2 + 3w)(w + 5)$ $840 = (w^3 + 5w^2 + 3w^2 + 15w)$ $0 = w^3 + 8w^2 + 15w - 840$ Zero analysis gives intersection at $w = 7$ and no other real zeros. Synthetic division to verify the zero and substitute. $\text{Width} = 7 \text{ inches.}$ $\text{Length} = 7 + 3 = 10 \text{ inches}$ $\text{Height} = 7 + 5 = 12 \text{ inches.}$
Answer / Check Answer	Dimensions are 7"x10"x"12" Verify the volume is 840 in ³

Word Problem Strategy Guide – ALGEBRA II

Problem: Ms. Katao, the Algebra II class teacher, is asking her 25 students to shake hands exactly once with ever other students. It has determined that each handshake takes an average of 5 seconds. How long should it take for every student to shake the other entire student’s hand exactly once? If she has allowed 1 hour for this session, will all the handshakes be completed?

Read	Read the problem at least two times
Given	25 students to shake hands exactly once with ever other students each handshake takes an average of 5 seconds
Find/Prove Unknown*	How long should it take for every student to shake the other entire student’s hand exactly once? If she has allowed 1 hour for this session, will all the handshakes be completed? Explain
Make a Plan	9. Act it out and make chart on the table: Start with 2 students, ask to shake hands each other. How many hand shake? 1 Ask 3 students to shake hand, how many handshakes? 3 Ask 4 students to shake hands, how many handshakes? 6
Equation	Total # of handshakes $T = \frac{n(n-1)}{2}$ n is # of people who are shaking hands
Solve problem	$n = 25$ $T = \frac{n(n - 1)}{2}$ $T = \frac{25(25-1)}{2} = 300 \text{ handshakes}$ Each handshakes takes average of 5 seconds $300(5) = 1500 \text{ second} = 25 \text{ minutes.}$ Yes all handshakes will be completed before the session is over.
Answer / Check Answer	

Word Problem Strategy Guide – GEOMETRY

Problem: You are constructing a regular octagonal wooden gazebo and need to find the measure of one angle to cut the pieces of wood. If you know that the sum of the measures of the interior angles of a triangle, quadrilateral and pentagon equal 180° , 360° and 540° respectively, find the measure of one angle of the regular octagon wooden gazebo.

Read	Read the problem at least two times						
Given	Regular Octagon Triangle= 180° Quadrilateral= 360° Pentagon= 540°						
Find/Prove Unknown*	Find measure of one angle of an octagon.						
Make a Plan	1. Find a Pattern / Make a Table <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Triangle (3 sides)</td> <td>180°</td> </tr> <tr> <td>Quadrilateral (4 sides)</td> <td>360°</td> </tr> <tr> <td>Pentagon (5 sides)</td> <td>540°</td> </tr> </table>	Triangle (3 sides)	180°	Quadrilateral (4 sides)	360°	Pentagon (5 sides)	540°
Triangle (3 sides)	180°						
Quadrilateral (4 sides)	360°						
Pentagon (5 sides)	540°						
Equation	One angle of an octagon = $\frac{\text{Total Sum}}{8}$						
Solve problem	According to the table above there is a pattern of adding 180° between 180° , 360° and 540° . If this pattern continues, then $540^\circ + 180^\circ = 720^\circ \text{ (6 sides)}$ $720^\circ + 180^\circ = 900^\circ \text{ (7 sides)}$ $900^\circ + 180^\circ = 1080^\circ$ Perhaps pattern of $(n - 2)180$ can be discovered. $\text{One angle of an octagon} = \frac{\text{Total Sum}}{8}$ $\text{One angle of an octagon} = \frac{1080^\circ}{8}$ $\text{One angle of an octagon} = 135^\circ$						
Answer / Check Answer	One angle of an octagon = 135° Use rational reason to determine if answer is correct and if it makes sense logically – 135° is obtuse as shown in the picture $135 * 8 = 1080$ Sum of 1080 is larger than other sums listed. Sum of 1080 is a multiple of 180° as in found pattern.						

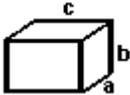
Word Problem Strategy Guide – GEOMETRY

Problem: *Juan Carlos is making a design from vinyl tiles for his rec room. The design consists of 2 different types of parallelograms. He will borrow a protractor and a ruler from his neighbor to measure the angles and sides to make sure they are parallelograms. Describe the different ways he can use the tools to confirm they are parallelograms.*

Read	Read the problem at least two times
Given	Definition of a Parallelogram: A quadrilateral with opposite sides parallel. Tools: protractor (used to measure angles), Ruler (used to measure sides)
Find/Prove Unknown*	List the different properties of parallelograms
Make a Plan	2. Make a List: The opposite sides of a parallelogram _____ The opposite sides of a parallelogram _____ The opposite angles of a parallelogram _____ The consecutive angles of a parallelogram _____ The diagonals of a parallelogram _____
Equation	For parallelogram ABCD, $m\angle A + m\angle B = 180$ and $m\angle A = m\angle C$
Solve problem	Using the list from above, describe how the two tools, the protractor and the ruler, can be used to verify the shapes are parallelograms.
Answer / Check Answer	Match the list you created using the tools to measure parts of the tiles to the list from above 1. The opposite sides of a parallelogram are congruent: Use the ruler to measure the sides of the parallelogram and confirm that they're congruent 2. The opposite sides of a parallelogram are parallel: Use the protractor to measure the consecutive angles of the parallelogram and confirm that they're supplementary (consecutive angles converse theorem) 3. The opposite angles of a parallelogram are congruent: Use the protractor to measure the opposite angles of the parallelogram and confirm that they're congruent 4. The consecutive angles of a parallelogram are supplementary: Use the protractor to measure the consecutive angles of the parallelogram and confirm that they're supplementary 5. The diagonals of a parallelogram bisect each other: Use the ruler to measure the diagonal parts of the parallelogram and confirm that they're congruent

Word Problem Strategy Guide – GEOMETRY

Problem: Two boxes with the same volume are contain soap for a fund raiser. Box A is 8 inches tall, 2 inches wide, and 6 inches deep. Box B is 9 inches tall, 3 inches wide, and 4 inches deep. Which box style has the least amount of surface area to decorate for the fundraiser?

Read	Read the problem at least two times		
Given	Box A is 8 in x 2 in x 6 in Box B is 9 in x 3 in x 4 in		
Find/Prove Unknown*	Surface area of each box Which box style has the least amount of surface area		
Make a Plan	3. Make a Table		
Equation	$\text{Surface Area of a Rectangular Prism} = 2ab + 2bc + 2ac$ 		
Solve problem		Box A	Box B
	a	6	4
	b	8	9
	c	2	3
	$2ab$	$2(6)(8) = 96$	$2(4)(9) = 72$
	$2bc$	$2(8)(2) = 32$	$2(9)(3) = 54$
	$2ac$	$2(6)(2) = 24$	$2(4)(3) = 24$
	$2ab + 2bc + 2ac$	152	150
Answer / Check Answer	Surface area of box A is 152 square inches Surface area of box B is 150 square inches Box B has the least amount of surface area and therefore would be the least amount to decorate.		

Word Problem Strategy Guide - GEOMETRY

Problem: *What is the perimeter of the square with area 64 cm²?*

Read	Read the problem twice.
Given	The figure is a square. The area of the square is 64 cm ² .
Find/Prove Unknown*	What is the perimeter of the square?
Make a Plan	4. Work backwards Draw and label the figure. Find the formula for the area and perimeter of a square.
Equation	$A = s^2$ $P = 4s$ $64 = s^2$
Solve problem	$A = s^2$ $P = 4s$ $64 = s^2$ $P = 4(8)$ $8 = s$ $P = 32 \text{ cm}$
Answer / Check Answer	$P = 32 \text{ cm}$

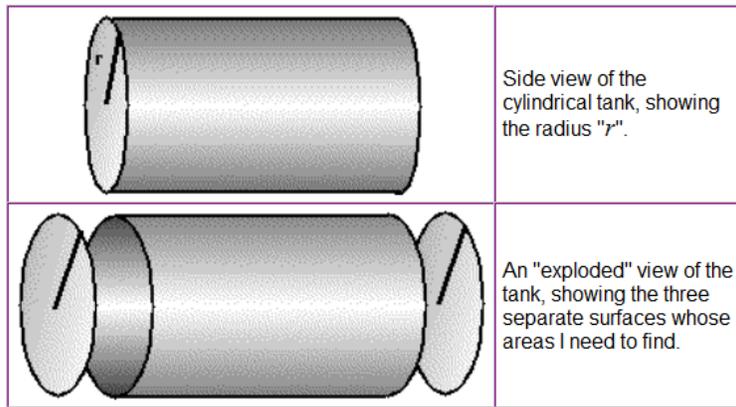
Word Problem Strategy Guide - GEOMETRY

Problem: Devin grew a rectangle on graph paper. The area of the rectangle is 810 square centimeters. The length is 3 centimeters greater than the width. Find the length and width of the rectangle.

Read	Read the problem twice.	
Given	$A = 810 \text{ cm}^2$ $l = 3\text{cm} + w$	
Find/Prove Unknown*	Find the length and width of the rectangle	
Make a Plan	5. Guess and check Make a table. A column for length, and a column for width. Make a list of factors for 810 Look through table for a pair of numbers that fit the equation	
Equation	$L = w + 3$	
Solve problem	1	810
	2	405
	3	270
	5	162
	6	135
	9	90
	10	81
	15	54
	18	45
	27	30
Answer / Check Answer	Length is 30. Width is 27 $L = w + 3$ $30 = 27 + 3$ $30 = 30$	

Word Problem Strategy Guide - GEOMETRY

Problem: Suppose a water tank in the shape of a right circular cylinder is thirty feet long and eight feet in diameter. How much sheet metal was used in its construction?



Read	Read the problem twice.
Given	$h = 30 \text{ ft}$ and $d = 8 \text{ ft}$
Find/Prove Unknown*	<ul style="list-style-type: none"> Find the surface area of the cylinder to determine the amount of sheet metal necessary.
Make a Plan	<p>6. Write a number sentence</p> <p>Write the equation for surface area. Substitute the given information into the equation Solve the equation</p>
Equation	$SA = 2\pi r^2 + 2\pi rh$
Solve problem	$SA = 2\pi r^2 + 2\pi rh \quad h = 30, \quad r = \frac{1}{2}d, \quad d = \frac{1}{2}(8) = 4$ $SA = 2\pi(4)^2 + 2\pi(4)(30)$ $SA = 2\pi(4)^2 + 2\pi(4)(30)$ $SA = 2\pi(4)^2 + 2\pi(4)(30)$ $SA = 32\pi + 240\pi$ $SA = 272\pi \approx 854.08 \text{ feet}^2$
Answer / Check Answer	$SA = 272\pi \approx 854.08 \text{ feet}^2$

Word Problem Strategy Guide - GEOMETRY

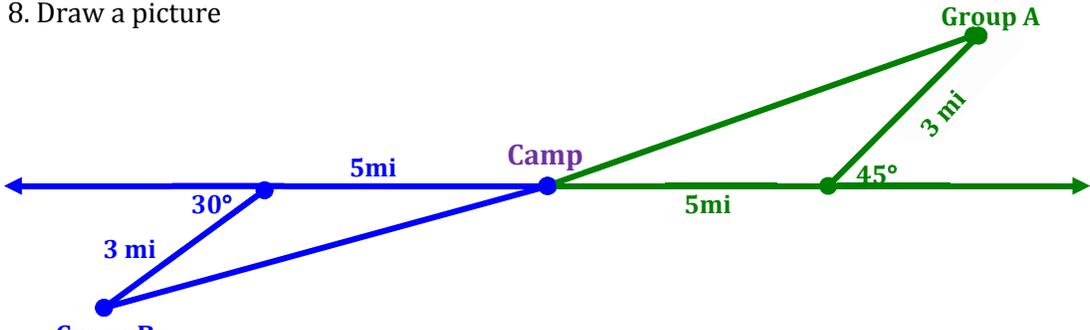
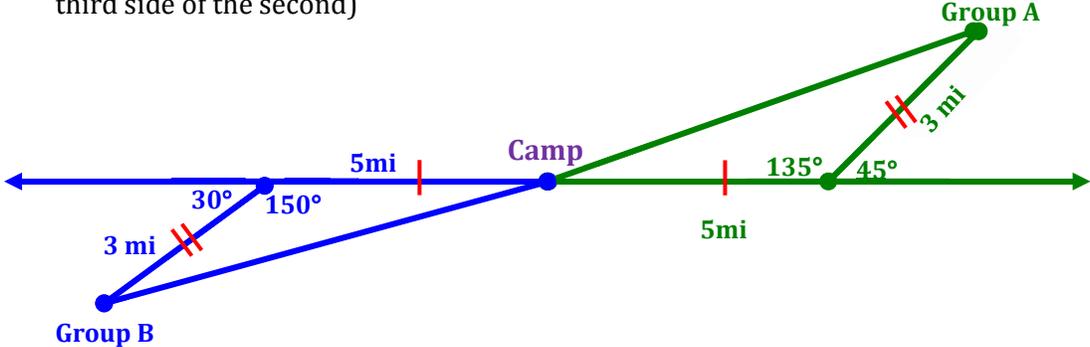
Problem: Organizers of an orienteering race are planning a course with checkpoints A, B, and C. Does the table give enough information to determine the location of the checkpoints?

	Bearing	Distance
A to B	N 55° E	7.6 km
B to C	N 26° W	?
C to A	S 20° W	?

Read	<ul style="list-style-type: none"> Read problem twice. 												
Given	<table border="1"> <thead> <tr> <th></th> <th>Bearing</th> <th>Distance</th> </tr> </thead> <tbody> <tr> <td>A to B</td> <td>N 55° E</td> <td>7.6 km</td> </tr> <tr> <td>B to C</td> <td>N 26° W</td> <td>?</td> </tr> <tr> <td>C to A</td> <td>S 20° W</td> <td>?</td> </tr> </tbody> </table>		Bearing	Distance	A to B	N 55° E	7.6 km	B to C	N 26° W	?	C to A	S 20° W	?
	Bearing	Distance											
A to B	N 55° E	7.6 km											
B to C	N 26° W	?											
C to A	S 20° W	?											
Find/Prove Unknown*	<ul style="list-style-type: none"> Does the table give enough information to determine the location of the checkpoints? 												
Make a Plan	<p>7. Use Logical Reasoning Draw the course using vertical lines to show north-south directions. Then use these parallel lines and the alternate interior angles to help find angle measures of Triangle ABC.</p>												
Equation	$m\angle CAB = 55^\circ - 20^\circ$ $m\angle CBA = 180^\circ - (26^\circ + 55^\circ)$												
Solve problem	$m\angle CAB = 55^\circ - 20^\circ = 35^\circ$ $m\angle CBA = 180^\circ - (26^\circ + 55^\circ) = 99^\circ$ You know the measures of $\angle CAB$ and $\angle CBA$ and the length of the included side segment AB. Therefore by ASA, a unique triangle ABC is determined.												
Answer / Check Answer	One and only one triangle can be made using the information in the table, so the table does give enough information to determine the location of all the checkpoints.												

Word Problem Strategy Guide - GEOMETRY

Problem: Two groups of campers leave the same camp hiking in opposite directions. Each group goes 5 miles, then changes direction and goes 3 miles. Group A starts hiking due east and then turns 45° toward north. Group B starts hiking due west and then turns 30° toward south. Which group is farther from camp? Explain your reasoning.

Read	<ul style="list-style-type: none"> Read the problem at least two times
Given	<ul style="list-style-type: none"> Each group goes 5 miles, then changes direction and goes 3 miles Group A starts hiking due east and then turns 45° toward north Group B starts hiking due west and then turns 30° toward south
Find/Prove Unknown*	Which group is farther from camp?
Make a Plan	<p>8. Draw a picture</p>  <p>Draw line segments connecting each group back to camp, creating triangles</p>
Equation	<ul style="list-style-type: none"> Find the measure of the two interior angles The angles are supplementary to the given angles so the sum of the angles equals 180°
Solve problem	<ul style="list-style-type: none"> Mark all congruent parts on the diagram $180^\circ - 30^\circ = 150^\circ$ $180^\circ - 45^\circ = 135^\circ$ Label the two interior angles with their measurements found above Use the Hinge Theorem to determine which group is farther from camp (If two sides of one triangle are congruent to two sides of another triangle, and the included angle of the first is larger than the included angle of the second, then the third side of the first is longer than the third side of the second) 
Answer / Check Answer	Because $150^\circ > 135^\circ$, Group B is farther from camp.

Word Problem Strategy Guide - GEOMETRY

Problem: Field Hockey: In a field hockey game, the goalkeeper is at point G and a player from the opposing team hits the ball from point B. The goal extends from left goalpost L to right goalpost R. Will the goalkeeper have to move farther to keep the ball from hitting L or R? Explain.

Read	<ul style="list-style-type: none">• Read the problem at least twice
Given	<ul style="list-style-type: none">• $\angle LBG \cong \angle RBG$
Find/Prove Unknown*	Will the goalkeeper have to move farther to keep the ball from hitting L or R and explain
Make a Plan	9. Acted out the problem and see how many students will you need to do it?
Equation	No equation necessary
Solve problem	No; G is on the angle bisector of $\angle LBR$, so the goalkeeper is equidistant from \overline{BL} and \overline{BR} by the angle Bisector Theorem.
Answer / Check Answer	There is no need to check