Make Sense of Problems and Persevere in Solving Them

I can understand a problem, devise a strategy, execute a plan and evaluate it's success.

Organize

Strategize

Change Strategies

Evaluate

SOLVE

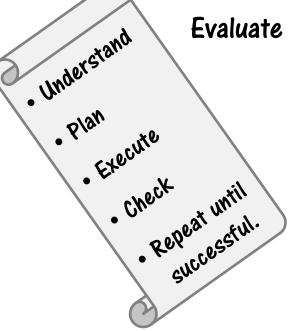What exactly is this problem asking of me?

What information do I have?

What information do I need and how do I get it?

What is the best plan?

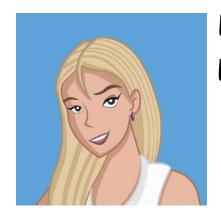Is my answer reasonable?

If not, how should I change my strategy?

- Understand
- Plan
- Execute
- Check
- Repeat until successful.

Think and don't give up.

Reason Abstractly and Quantitatively

I contextualize and decontexualize problems.

Contextualize

I put numbers and variables in a real-world context.

Given, M = 9h + 10,
I can say, 'I have $10 and earn $9 an hour. The amount of money I make depends on the number of hours that I work.'

What do these numbers and symbols represent?

What does it mean when I manipulate this equation?

What units am I dealing with?

How do these quantities relate to each other?

Contextualize

Decontextualize

Quantities

Representations

Properties

REASON

Decontextualize

I pull numbers and variables from context and work with them mathematically.

Given, 'I have $10 and earn $9 an hour. How much money will I make?'
I can write, M = 9h + 10

Think about numbers in many different ways

Construct Viable Arguments and Critique the Reasoning of Others

I make and support conjectures, and critique the mathematical thinking of others.

Justify

Prove

Support

Explain

Analyze

Instance

Counterexample

CONJECTURE

Instance

$$x \bullet x = x^2$$
$$5 \bullet 5 = 5^2$$
$$25 = 25$$

How do I defend my answer?

Can that really be correct?

How do I show him that he is wrong?

How does she know that?

Counterexample

$$x \bullet x \neq 2x$$
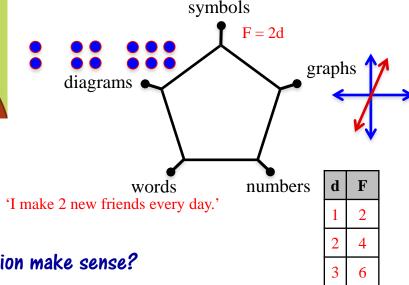$$5 \bullet 5 \neq 2 \bullet 5$$
$$25 \neq 10$$

What objects, drawings, actions or context can I use to prove my point?

Explain your thinking convincingly.

Model with Mathematics

I use math that I know to solve everyday problems.

symbols

$F = 2d$

diagrams

graphs

words

numbers

'I make 2 new friends every day.'

d	F
1	2
2	4
3	6

Represent

Equation

Graph

Data

Scenario

Drawing

MODEL

Does my representation make sense?

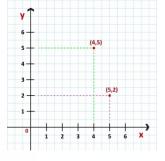**Which quantities share a relationship?**

Which representation would make this problem easier?

Think about your world in symbols, graphs, words, diagrams and numbers.

Use Appropriate Tools Strategically

I know when to use certain tools to help me understand a relationship or scenario.

TOOLS

Calculator

Computer

Ruler

Protractor

Compass

Graph

Watch

Number Line

Formula

Which tools will be most helpful?

Did my tool yield an answer close to my estimation?

What tools do I have available?

Do I need a calculator?

Think about which tools you should use.

Attend to Precision

I determine and work towards the level of accuracy needed for a problem.

$$\sqrt{2} \text{ or } 1.4$$

Do I need to round my answer?

To what place value should I round?

Is an estimate good enough, or do I need an exact value?

Did I label my answer?

Are my definitions clear?

What scale should I use on my axes?

PRECISION

Accuracy

Efficiency

Exact

Approximate

Symbols

Definitions

Units

1.4 what?

inches?

days?

dollars?

Think intentionally and thoroughly.

Look For and Make Use of Structure

I see how one concept in mathematics is connected to others.

	10	5
10	100	50
3	30	15

$(13)(15)$
$= (10 + 3)(10 + 5)$
$= 10(10) + 3(10) + 10(5) + 3(5)$
$= 100 + 30 + 50 + 15$

STRUCTURE

Dimension

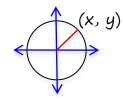Transformations

Base-10

Terms

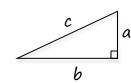Coefficients

Operations

Properties

Can I break this problem down into smaller ones?

Can I use what I know to solve new problems?

How is this concept similar to one that I already know?

(x, y)

c a b

$x^2 + y^2 = r^2$ $a^2 + b^2 = c^2$

Think about how well math fits together.

Look For and Express Regularity in Repeated Reasoning

PATTERNS

I notice when data or shapes are repeated and can use that pattern to make predictions.

Generalization

Numbers

Shapes

Structure

Case

Prediction

How do you see this pattern growing?

Is there a pattern here?

How can I generalize this pattern?

Can I predict a specific case of this pattern?

1. Up 1, over 2

2. 2 more than previous row

3. 2 more each row, and one on top

4. +5, +7, ... Keep adding consecutive odd numbers

5. Sequence of squares: 4, 9, 16 ...

Think about patterns & predictions.