4 TIPS for Teachers

Grades 7, 8, and 9 Applied
**TIP 1**  
**Multiple Representations – Pattern Building**

When the concept of variable is introduced in this way, students are more likely to connect the “representativeness” of $n$ to their own way of describing pattern building. There will be repeated opportunities throughout this program to work with patterns and represent them algebraically and by using words. When students are comfortable, they need to move from words to letters to represent variables. Students should not be rushed into using variables, but rather should see the efficiency and power of this notation and move to it themselves. Descriptions at this stage are equally powerful.

**Representing Concrete Patterns with Algebra**

For any concrete pattern, there are usually different ways to describe the building of a term. If we let $n$ represent the term number, then each description yields a different-looking algebraic representation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Visualization</th>
<th>Description</th>
<th>Understanding</th>
<th>Representation</th>
</tr>
</thead>
</table>
| 1   | ![Visualization](image1) | Start with 4 toothpicks for the first term, then add 3 toothpicks for each subsequent term. | 4  
4 + 3  
4 + 3 + 3 | • 4 plus 3 multiplied by one less than the term number  
• 4 + 3(n - 1) |
| 2   | ![Visualization](image2) | Two horizontal toothpicks and one vertical toothpick for each term number plus one more vertical toothpick than the number of the term. | 2 + 1 + 1  
2 × 2 + 2 × 1 + 1  
2 × 3 + 3 × 1 + 1 | • 2 times the term number plus one more than the term number  
• 2n + n + 1 |
| 3   | ![Visualization](image3) | Four toothpicks times the number of the term, take away the extra vertical toothpicks in the interior. | 4  
4 + 4 – 1  
4 + 4 + 4 - 1 - 1 | • 4 multiplied by the term number subtract one less than the term number  
• 4n - (n - 1) |
| 4   | ![Visualization](image4) | Think of there being one vertical toothpick there before starting to build the squares, and add three toothpicks for each term | 1 + 3  
1 + 3 + 3  
1 + 3 + 3 + 3 | • 1 plus 3 multiplied by the term number  
• 1 + 3n |
Social Skills Anchor Charts

Anchor Charts are developed together with the class to make thinking permanent and visible. They allow the class to clarify thinking, make connections, and/or remember a specific skill, strategy, or concept. These skills will be used throughout the year while doing group work/cooperative activities. The charts can be kept and reviewed periodically, as needed.

**Encouraging Others**

*Why is it important to encourage others?*

- All ideas and students are respected.
- People feel good when others encourage them.
- Students feel like a team and enjoy working together.
- It is safe to take risks.
- So students want to participate in group activities.

<table>
<thead>
<tr>
<th>Looks like …</th>
<th>Sounds like …</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Watching the speaker ♦ Nodding the head ♦ Smiling</td>
<td>♦ That is interesting. ♦ Tell me more. ♦ That is a great movie.</td>
</tr>
</tbody>
</table>

**Taking Turns**

*Why do we take turns?*

- Each person has a chance to speak.
- Everyone knows their thinking is important.
- The group benefits from everyone’s ideas.

<table>
<thead>
<tr>
<th>Looks like …</th>
<th>Sounds like …</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Only one person speaks at a time. ♦ Group members watch the speaker. ♦ Group members are smiling.</td>
<td>♦ It is your turn next. ♦ Who is next? ♦ Tell us your thinking. ♦ I like your idea.</td>
</tr>
</tbody>
</table>

**Active Listening and Summarizing**

*Why do we summarize?*

- It encourages active listening when hearing each other’s ideas.
- It clarifies and helps check for understanding.
- It encourages students to pick out key information, give examples, organize their thinking, and draw conclusions.
- Students learn to summarize their thinking and consider other strategies for solving problems.
- It encourages participation.

<table>
<thead>
<tr>
<th>Looks like …</th>
<th>Sounds like …</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Making eye contact, nodding head ♦ Taking turns ♦ Encouraging others ♦ Listening carefully to everyone's ideas</td>
<td>♦ Is there anything I missed? ♦ I think this is the main idea of what you were saying … ♦ You seem to be saying … ♦ The strategy you used was … and your conclusion is…</td>
</tr>
</tbody>
</table>

*Be sensitive to the fact that in some cultures it is considered disrespectful to maintain direct eye contact with another person.*
TIP 2  

Social Skills Anchor Charts

Including All Participants

Why do we include all participants?

- Everyone feels valued and important.
- People want to participate if they are included.
- Everyone is willing to take risks when solving problems.
- People enjoy working together as a team.

<table>
<thead>
<tr>
<th>Looks like …</th>
<th>Sounds like …</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ All group members are focused.</td>
<td>♦ It is your turn now.</td>
</tr>
<tr>
<td>♦ Eyes are on the speaker.</td>
<td>♦ Do you have an idea to share?</td>
</tr>
<tr>
<td>♦ Smiles on everyone’s faces.</td>
<td>♦ What do you think about this idea?</td>
</tr>
<tr>
<td>♦ Each person takes a turn speaking.</td>
<td>♦ Does this make sense to you?</td>
</tr>
<tr>
<td>♦ Do you mean … ?</td>
<td>♦</td>
</tr>
</tbody>
</table>

Be sensitive to the fact that in some cultures it is considered disrespectful to maintain direct eye contact with another person.

Disagreeing in an Agreeable Way

Why do we disagree in an agreeable way?

- Everyone feels their ideas are being considered even if there are differences of opinion.
- It is important to hear everyone’s ideas because a combination of ideas often produces the best idea.
- People want to participate if they are treated with respect.
- Everyone is willing to take risks when solving problems.
- People enjoy working together as a team.
- Calm, quiet, controlled voices contribute to a positive classroom climate.

<table>
<thead>
<tr>
<th>Looks like …</th>
<th>Sounds like …</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ Making eye contact with a slight shake of the head</td>
<td>♦ I understand what you are thinking but have you ever considered …?</td>
</tr>
<tr>
<td>♦ Listening to someone’s entire idea before speaking</td>
<td>♦ Your idea is important but have you thought about …?</td>
</tr>
<tr>
<td>♦ Smiling at the speaker</td>
<td>♦ I think I understand what you are saying but have you thought about …?</td>
</tr>
<tr>
<td>♦ Giving a puzzled or questioning look</td>
<td>♦</td>
</tr>
</tbody>
</table>

Be sensitive to the fact that in some cultures it is considered disrespectful to maintain direct eye contact with another person.
**Fermi Problems**

**What is a Fermi Problem?**
A Fermi problem is a multi-step problem that can be solved in a variety of ways, and whose solution requires the estimation of key pieces of information.

*Linking Assessment, p. 116*

**Why Start Grade 8 with Fermi Problems?**
The purpose of the first week of school is to set the tone for a positive academic environment and community of learners, which foster both mathematical processes and affective processes. The Fermi problems and social skills introduced in the first week of classes combine to “generate the kind of involvement and thinking processes that are at the root of quantitative literacy. Because important information is missing, students must ask themselves more questions about what they need to know and what they already know. Then they must construct a path of estimates that leads from the knowledge they have to the knowledge they need to acquire. The focus of this activity is on the process rather than the answer – a process that mirrors the ‘number sense’ we apply in everyday life when we make ‘ballpark’ estimates of our fuel consumption, our bank balances, or the time we’ll need to mark a class test.”

*Impact Math, Number Sense, p. 17*

**Who was Enrico Fermi?**
Fermi (1901-1954), a famous physicist, was known to mathematicians for his legendary estimation problems. He was able to answer impossible questions by mentally estimating large quantities for which there seemed to be insufficient information. “How many piano tuners are there in Chicago?” was one of his well-known problems. This seemingly unanswerable question often puzzled people. Fermi developed a series of subordinate questions leading to an estimate that was the right order of magnitude. The information in the table below is a summary of the sequence of questions, answers, and estimates listed in Impact Math, Number Sense.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the population of Chicago?</td>
<td>$3 \times 10^6$</td>
</tr>
<tr>
<td>To estimate pianos should we estimate people or households?</td>
<td>Households rather than individuals tend to own pianos.</td>
</tr>
<tr>
<td>Approximately how many households are there in Chicago?</td>
<td>There may be an average of 4 people per household in Chicago, so the number of households is about $3 \times 10^6 \div 4$.</td>
</tr>
<tr>
<td>What proportion of households in Chicago has pianos?</td>
<td>Maybe about 1 in 10 households has a piano. That would suggest that there are about $3 \times 10^6 \div 4 \div 10$ or $7.5 \times 10^4$ pianos in Chicago.</td>
</tr>
<tr>
<td>How many piano tuners are needed to tune those pianos?</td>
<td>Assuming a piano is tuned once a year, then 75 000 piano tunings are needed. If a piano tuner tunes approximately 3 pianos a day, and works 200 days a year, the number of tuners needed is about $75 000 \div 600$ or 125.</td>
</tr>
<tr>
<td>How many piano tuners are there in Chicago?</td>
<td>There are about 125 tuners in Chicago.</td>
</tr>
</tbody>
</table>

**Setting a Context for Solving Fermi Problems:**
- Fermi problems at first might appear not to have an answer. Your initial response may be “I need more information or there is not enough information.”
- There are many different ways to solve a Fermi problem. Be creative. Use any necessary tools.
- You may use a variety of estimation strategies and need to take a few risks. Don’t be afraid to piggyback on someone else’s ideas.
- You will be working as a team and sharing strategies and ideas, encouraging and supporting each other using social skills that we will reinforce each day.
**Ways to Determine a Square**

1. The amount of rotation off vertical is the same as rotation off horizontal.

2. Trace ABCD, pin the tracing at C and rotate the tracing until it lines up with horizontal and vertical grid lines.

3. Measure angles with a protractor and sides with a ruler. Since angles are $90^\circ$ and sides are all equal, it is a square.

4. Fold along diagonal PR and notice that Q falls on S, telling me that PQ = PS and QR = RS and $\angle Q = \angle S$. Fold along diagonal QS and notice that P falls on R, telling me that PQ = QR and PS = RS and $\angle P = \angle R$. This tells me that all the sides are the same length. Therefore, PQRS is a rhombus.

   To prove that PQRS is also a square, we need to establish that any one of the interior angles is $90^\circ$. To do this, we could rip $\angle PSR$ off and place it adjacent to $\angle PQR$. Observe the straight angle formed at Q by these two equal angles. Since the equal angles add to $180^\circ$, each must be $90^\circ$.

   Since we know that all four sides are equal and that $\angle PSR = 90^\circ$, we know that PQRS is a square.
TIP 5  Ways to Determine the Area of a Square on the Diagonal

1. Centre square B has an area of 1 unit².
   \[ B = 1 \]
   \[ A1 + A4 = 6 \]
   \[ A2 + A3 = 6 \]
   \text{Total Area (units²) = 13}  

2. Larger square = \[ 5 \times 5 = 25 \]
   \[ A1 + A4 = 6 \] and \[ A2 + A3 = 6 \]
   \text{Original square = 25 – 6 – 6 = 13}  

3. Rotate the square about P until the sides are horizontal and vertical. Measure side lengths using the grid and calculate approximate area as length \times width = 3.6 \times 3.6 = 12.96 or 13.

4. Use a ruler to measure side length, then multiply length \times width, e.g., \[ 3.5 \times 3.5 = 12.25 \div 12. \]
   \textbf{Note:} This is an opportunity to discuss the need for a scale drawing and the inherent approximation in measurements.
When situating mathematical concepts in a context, it is often possible to address and assess application of curriculum expectations from other disciplines. Likewise, it is possible to address and assess mathematics curriculum expectations during activities undertaken to learn concepts in another discipline.

These cross-curricular applications should in no way replace lessons needed to develop understanding of concepts. Rather, cross-curricular applications take advantage of previous learning in one discipline to facilitate new learning in another discipline, or these applications can provide an opportunity to practise skills from another discipline.

Example

Grade 7
The Cereal Box Challenge on Day 27 could be used to practise the following curriculum expectations in other disciplines:

Language
7 Media Literacy OE3 – create a variety of media texts for different purposes and audiences, using appropriate forms, conventions, and techniques;
7 Media Literacy OE2 – identify some media forms and explain how the conventions and techniques associated with them are used to create meaning;

Visual Arts
7 D1. Creating and Presenting - apply the creative process to produce art works in a variety of traditional two- and three-dimensional forms, as well as multimedia art works, that communicate feelings, ideas, and understandings, using elements, principles, and techniques of visual arts as well as current media technologies;

It is recommended that time additional to “math time” be used for non-math expectations.
TIP 7 Brainstorming

Description
Brainstorming is a group process for generating questions, ideas, and examples and is used to illustrate, expand, or explore a central idea or topic. Brainstorming involves students sharing whatever material comes to mind and recording every idea, without making judgments about the material being generated. When introducing a topic, brainstorming can be used for assessing what students already know or wish to learn and for providing direction for learning and reflection. Brainstorming stimulates fluent and flexible thinking and can also extend problem-solving and problem-finding skills.

Method
The teacher/group leader:
• poses a relevant problem or topic, or elicits one from students;
• asks students to contribute questions, ideas, or examples spontaneously;
• ensures that the material is recorded, e.g., on the board, flip charts, paper;
• intervenes if ideas are being evaluated;
• ensures that a plan is developed for the follow-up use of ideas generated in the brainstorming session.

Considerations
Brainstorming:
• can be used in whole groups or small groups;
• depends on establishing a comfort level for students to take risks and for teachers to trust students’ unevaluated responses;
• provides opportunities for teachers to stretch thinking by elaborating on suggested ideas.
TIP 8  **Think/Pair/Share**

Think/Pair/Share is a collaborative learning strategy for students working in pairs.

The process outlined is for using this strategy with single and multiple pairs.

**Step 1:**  
*Think*  individually for a few moments (3-5 minutes).  
- What information do you need to solve the problem?  
- What information do you already know?  
- What tools and strategies could you use?  
- What questions do you need to ask your group?

**Step 2:**  
*Pair:* With a partner, jot down ideas to help you get started with the problem (2-3 minutes).  
You may use any of the tools provided in the classroom, including calculators to help with estimating.

**Step 3:**  
*Share:* The person with the shortest first name from each pair takes a turn to share ideas in a group of four (3-4 minutes).

**Step 4:**  
Decide on the first strategy your group would like to apply to solve the problem. Record other possible strategies. You may want to revise your plan as you work through the problem.

**Step 5:**  
The person with __________________________ shares your favoured strategy with the class.
TIP 9  **Placemat**

**Description**
Up to 4 students work on the same piece of paper at the same time, but the student’s each have their own space in which to work. The students individually jot on their part of the placemat their ideas/information that relates to the posed question, then the teacher asks the placemat group to share among themselves and agree upon a response to be shared with the entire class. The intent is that each student answers the question, then the placemat is rotated so that each student checks another’s work.

![Placemat diagram]

**Method**
The teacher:
- identifies placemat groups of 3 or 4 students;
- poses the question they are all to consider on their part of the placemat;
- calls on one member from each placemat group to share with the entire class;
- gives appropriate time for activity;
- monitors by observing and listening;
- uses information gained throughout an activity to inform instructional decisions.

**Considerations**
Placemat:
- can be used to facilitate brainstorming among groups of 3 or 4 students before ideas are shared in the whole class;
- can be used to facilitate peer review and coaching on a particular type of problem or skill;
- can be used to engage all students simultaneously.
TIP 10  Word Wall

Description
A word wall is a visual strategy in which new vocabulary or high frequency words are posted in the classroom. Words are posted beneath the letter of the alphabet with which each word begins. Students refer to and use these words in activities. A word wall can be used to reinforce learning by providing cues to curriculum content. A word wall promotes the use of language in the classroom to enrich literacy and motivate student interest. It may be used in all subjects and may include words meeting varied criteria, e.g., most misspelled words, word-for-today, technical terms, words with etymological interest.

Method
The teacher:
• can identify initially the words to be added to the word wall;
• conducts activities to make students familiar with high-frequency words;
• connects the word wall to curriculum content;
• refers to the word wall on a regular basis.

Considerations
Word Walls:
• could contain words that are very different to avoid students confusing similar words;
• might take the form of a wall of quotations or questions.
TIP 11  Jigsaw

Description
Jigsaw is a cooperative learning strategy that provides opportunities for students to gain a variety of perspectives and insights by participating in a specialized group, and then by sharing and integrating what they learned in their “home” group. Jigsaw is used to help students acquire an overview of a range of materials or opinions. It enables students to develop, recognize, and share their expertise within a group and encourages a high level of student participation. The strategy may provide a review of previously learned material or identify questions or problems within an issue or topic. Jigsaw supports risk taking and the development of interpersonal skills and abilities.

Method
The teacher:
• allows considerable time for students to understand the process;
• organizes the learning materials in advance, sets goals, outlines steps, and sets the time frame;
• can use the jigsaw strategy in different ways:
  (a) material is divided into sections, and each of the numbered groups is assigned a section to learn, explore, and then report to the home group;
  (b) the class shares a common learning experience, and the specialized groups take different approaches in analysing or responding to this experience, e.g., by creating a drama presentation, posing a problem and presenting a possible solution for home group discussion;
• assesses student learning through continual observation and adjusts programming accordingly.

Considerations
Jigsaw:
• requires students to have experience in accurate communication of information, and requires the use of active listening skills;
• requires the topic to be simple, if used for a short time frame, e.g., 30 to 60 minutes;
• can be applied in a variety of contexts and across all curriculum areas;
• works best when students have experience and skills in working collaboratively;
• requires careful teacher monitoring and skilful intervention.
**Numbered Heads**

**Description**

Numbered heads is a structure in which students are organized into collaborative groups and numbered off, e.g., student number 1, student number 2, student number 3, student number 4. This strategy has a simple structure with a short time frame and can be used at any point in a learning experience. All participants are involved in thinking and talking as they work collectively to respond to a question and to ensure that each member of the group understands the answer. Numbered heads is used as an alternative to whole class question-and-answer and as a way to support all class members simultaneously in review or consolidation of learning.

**Method**

The teacher:
- plans the composition of small groups (selected carefully to encourage the high comfort level of students);
- sets clear expectations regarding the focus of thinking and sharing;
- poses a problem and sets a time limit for each group to investigate the problem;
- calls a number, and the student with that number in each group responds.
- gives appropriate time for activity;
- monitors by moving about and listening;
- uses information gained throughout an activity to inform instructional decisions.

**Considerations**

Numbered Heads:
- requires structured instructions that are reinforced until students can use the strategy efficiently;
- requires time for individuals to think prior to collective response;
- can increase the numbers of students responding, e.g., by asking all “Number 3s” to come to the board to write a response to a math problem;
- can be used in conjunction with specific learning materials, such as math manipulatives, e.g., “Using base ten blocks, make sure everyone in your group can build ... .”
TIP 13  **Inside Outside Circle**

**Description**
Inside Outside Circle is a kinesthetic activity that involves all students in the class and that facilitates short exchanges between students.

**Method**
The teacher:
- forms two concentric circles containing the same number of students. Students in the inside circle face a partner standing in the outside circle.
- asks students from the inside circle to share something with their partner in timed activity.
- has students reverse roles. The students on the outside circle share with their partner,
- controls the timing, e.g., “Outside circle, it’s your turn to share for one minute.”
- has the inside circle rotate and the students turn to face their new partner. Repeat steps 2 and 3.

**Considerations**
Inside Outside Circle:
- engages all students simultaneously;
- pairs students briefly with classmates with whom they may rarely work;
- allows the teacher to spontaneously increase or decrease the number of different student pairings that occur.
**TIP 14  Concept Mapping**

**Description**
Concept mapping is a visual strategy often used to teach scientific processes. It shows various relationships among concepts and indicates the order and sequence of the concepts. It is useful as an organizer to identify the key concepts presented in a lecture or a text. A concept map can be created as a tree-like structure, with the most inclusive concept at the top and the most general ones connected with lines to the first concept. A third level can be added until all the important ideas and relationships are identified. Concept maps can also contain events, objects, themes, activities, or other items related to the concepts being taught.

**Method**
The teacher:
- models how to use concept mapping;
- demonstrates that cross-linking of concepts between one section and another reveals relationships.

**Considerations**
Concept Mapping:
- can have connecting lines labelled with verbs to reinforce meanings of relationships;
- can be used by both teachers and students to identify important concepts and their relationships.
- can be used as an assessment device for students to demonstrate clear understanding.
### Questioning

#### Inquiry/Big Questions
- What if…?  
- Why do you think this problem-solving strategy works?  
- What generalizations or rules are emerging?  
- Does anyone have a different hypothesis?  
- How could we confirm or refute _________?  
- What if the dimensions were doubled?

#### Clarifying Questions
- What does this mean?  
- Do we need an accurate answer or will an estimate be sufficient?  
- What do we know about this already?  
- What are we trying to find?  
- Did anyone interpret the question another way?  
- Have we made any assumptions? Are they reasonable?

#### Teacher and Students

#### Strategic Questions/Suggestions
- What strategy works best here?  
- Would a diagram help?  
- Is this solution reasonable?  
- Is there a pattern or rule we can see emerging?  
- Is there another way to solve this problem?  
- Would a different representation be easier to work with?  
- How will you organize the information?  
- How accurate will your solution be if you use that ______?  
- Have you given ______’s idea enough consideration?  
- Take a look at Group C’s ____ and see if your group could incorporate a similar ____ in your presentation.  
- You have tackled this problem in a different way than _______. Please share your solution with ______, then he/she can share her/his solution.

#### Reflective Questions
- What do you notice?  
- What surprises you?  
- What patterns do you see?  
- Does this problem make sense to you?  
- If you were solving a problem like this again, would you use the same strategy or try a different one?  
- How confident do you feel about this estimate?  
- How does this compare to ______?  

#### Prompting Questions
- What do you need to find out?  
- Have you ever solved a question like this before?  
- Could you explain that again?  
- Tell us a little more about this.  
- How did you come to the conclusion, decide that, get that answer?  
- How can you check this to be sure it makes sense?  
- Can you tell us more about this ____ (number, explanation, operation)?  
- Does anyone have any questions for ______?  
- Is there anything you would like to ask questions about?  
- Why did you decide to solve the problem in this way?
TIP 16  Journal Writing Prompts

This list was compiled from a variety of sources and is in no way exhaustive. These are merely presented as a way to start a journal writing program.

Mathematical Concept Prompts
- The difference between undefined slope and zero slope is...
- I think a linear relation is... (I thought a linear relation was...)  
- Describe square root.
- What patterns did you notice in... (fractions, geometry, etc.)
- How do you use fractions in your life?
- Write a poem about numerators and denominators.
- List objects or figures in the room that have symmetry. How can you tell?
- Write your own definition of a polynomial.
- Write all you know about... (exponents, the Cartesian plane, triangles, etc.)
- How many squares are there on a chess board? Describe your strategy for solving this problem.
- Describe the mathematics seen in a photograph of your choice.
- Write a solve-a-word problem whose solution involves multiplying/dividing two or more fractions.
- Find a shortcut for adding the numbers between 1 and 100.
- Explain the Pythagorean theorem. How could it be used to remember the distance formula?
- Compare and contrast the terms median, altitude, perpendicular bisector of a triangle.
- Explain the difference between area and perimeter.
- How many dimensions does a pencil have? Explain your answer.
- Why can’t you divide by zero?
- How can you find a number with 13 factors?
- What is a prime number?
- How can you tell which is the larger of two fractions?
- What is scientific notation?
- Distinguish between congruent and similar triangles.
- Why do we need “proofs” in mathematics?

Process Prompts
- The most important part of solving a problem is...
- What does it mean to “solve” an equation?
- Write instructions for someone in Grade 5 to follow when... (adding fractions, finding percent, calculating averages, etc.)
- Write a lesson plan about how you would teach a specific math topic.
- Find something you learned today that is similar to something that you already knew. Write about these similarities.
- Do you use tables or diagrams when solving problems? Why/why not?
- You know several ways to... (solve an equation, factor a quadratic, etc.). Which method is your favourite? Why?
- Write a multiple choice question about... and explain how each of the wrong answers could be logical.
- How important is being neat and organized in general and when you are doing math?
- When I study for a test, I...
- Write a letter to your teacher explaining what you understand about the topic and what needs to be clarified.
- When I read a math textbook and see a word that I don’t know, I...
- The key idea of the lesson today was...
- Describe the graph of...as if you were explaining it to a friend over the phone.
- When I see a word problem, the first thing I do is...then I...
- Write a word problem using ‘OF.’ What does ‘OF’ mean as a math procedure?
- What are the benefits of journal writing for mathematics classes?
- How could journal writing be changed to be more effective?
- Do you make corrections and/or ask questions about a returned test? Why/why not?
- Describe any computational procedure that you invented.
- Write a possible test question for this unit.
- What is the most significant thing that you learned in math class today?
- What questions were still unanswered at the end of class today?
- Describe the discoveries you have made about mathematics (patterns, relationships, procedures, etc.)
- Answer questions under the headings: WHO, WHAT, WHERE, WHEN, WHY, and HOW.

Affective/Attitudinal Prompts
- My best kept secret about math is...
- Write a letter to the newspaper explaining why math education should be emphasized.
- My parents feel that math is...
- I want to become better at math so that I...
- People who are good at math...
- My best/worst experience with math was...
- When it comes to math I find it difficult to...
- When I hear someone say “Math is fun!” I...
- Draw a picture of a mathematician and describe what s/he does.
- If I were better at math, I would...
- How do you feel about showing your work on the board?
- Draw a cartoon of the “Math Monster.” What is s/he saying to you?
- Write a letter to a student who will take this class next year, giving some advice about how to be successful.
- Design two mathematical bumper stickers, one serious and one funny.
- My three personal goals in math this term are...
**TIP 17**

**Learning Skills Tracking Sheet (Grades 7 and 8)**

Recording tool that can be used daily as teacher observes students during various types of activities. Data can be used to support reporting at the end of the term.

<table>
<thead>
<tr>
<th>Learning Skills</th>
<th>Independent Work</th>
<th>Initiative</th>
<th>Homework Completion</th>
<th>Use of Information</th>
<th>Cooperation with Others</th>
<th>Conflict Resolution</th>
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Learning Skills Tracking Sheet (Grade 9)

Recording tool that can be used daily as teacher observes students during various types of activities. Data can be used to support reporting at the end of the term.

<table>
<thead>
<tr>
<th>Learning Skills</th>
<th>Works Independently</th>
<th>Teamwork</th>
<th>Organization</th>
<th>Work Habits/ Homework</th>
<th>Initiative</th>
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### Formula Sheet

<table>
<thead>
<tr>
<th>Geometric Figure</th>
<th>Perimeter</th>
<th>Area/Surface Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rectangle</strong></td>
<td>$P = 2l + 2w$&lt;br&gt;$P = 2(l + w)$</td>
<td>$A = lw$</td>
</tr>
<tr>
<td><img src="image" alt="Rectangle Diagram" /></td>
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<tr>
<td><strong>Parallelogram</strong></td>
<td>$P = b + b + c + c$&lt;br&gt;$P = 2b + 2c$</td>
<td>$A = bh$</td>
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<tr>
<td><img src="image" alt="Parallelogram Diagram" /></td>
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<tr>
<td><strong>Triangle</strong></td>
<td>$P = a + b + c$</td>
<td>$A = \frac{bh}{2}$&lt;br&gt;or&lt;br&gt;$A = \frac{1}{2}bh$</td>
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<tr>
<td><img src="image" alt="Triangle Diagram" /></td>
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<tr>
<td><strong>Trapezoid</strong></td>
<td>$P = a + b + c + d$</td>
<td>$A = \frac{(a + b)h}{2}$&lt;br&gt;or&lt;br&gt;$A = \frac{1}{2} (a + b)h$</td>
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<td><img src="image" alt="Trapezoid Diagram" /></td>
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<tr>
<td><strong>Circle</strong></td>
<td>$C = \pi d$&lt;br&gt;or&lt;br&gt;$C = 2\pi r$</td>
<td>$A = \pi r^2$</td>
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<td><img src="image" alt="Circle Diagram" /></td>
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### Formula Sheet

<table>
<thead>
<tr>
<th>Geometric Figure</th>
<th>Area/Surface Area</th>
<th>Volume</th>
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</table>
| **Cylinder**                     | $A_{\text{top}} = \pi r^2$  
                                      | $A_{\text{base}} = \pi r^2$  
                                      | $A_{\text{side}} = 2\pi rh$  
                                      | $A_{\text{total}} = 2\pi r^2 + 2\pi rh$  | $V = \pi r^2 h$ |
| **Sphere**                       | $A = 4\pi r^2$  
                                      | $V = \frac{4}{3} \pi r^3$ |
| **Cone**                         | $A_{\text{cone}} = \pi rs$  
                                      | $A_{\text{base}} = \pi r^2$  
                                      | $A_{\text{total}} = A_{\text{cone}} + A_{\text{base}}$  | $V = \frac{1}{3} \pi r^2 h$ |
| **Square-based pyramid**         | $A_{\text{triangle}} = \frac{1}{2} bs$ (for each triangle)  
                                      | $A_{\text{base}} = b^2$  
                                      | $A_{\text{total}} = A_{\text{triangles}} + A_{\text{base}}$  | $V = \frac{1}{3} b^2 h$ |
| **Rectangular prism**            | $A_{\text{total}} = wh + lh + lw + lh + lh$  
                                      | $A = 2(wh + lw + lh)$  | $V = lwh$ |
| **Isosceles triangular prism**   | $A_{\text{triangle}} = \frac{1}{2} bh$ (for each triangle)  
                                      | $A_{\text{rectangles}} = ls + lb + ls$  
                                      | $A_{\text{total}} = A_{\text{rectangles}} + A_{\text{2 triangles}}$  | $V = \frac{1}{2} (bh)l$ |